

**AN INVESTIGATIVE AND EVALUATIVE
STUDY OF FACTORS AFFECTING
QUALITY OF AGRICULTURAL AND FARM
INFORMATION SERVICES IN KERALA**

THESIS

Submitted to the University of Kerala
in partial fulfillment of
the requirement for the award of the degree of
DOCTOR OF PHILOSOPHY
in Library and Information Science

by

RAMAN NAIR, R

Research Guide

Dr. G. DEVARAJAN

DEPARTMENT OF LIBRARY AND INFORMATION SCIENCE
UNIVERSITY OF KERALA

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CERTIFICATE

Certified that the thesis entitled *An Investigative and Evaluative Study of Factors Affecting Quality of Agricultural and Farm Information Services in Kerala* submitted for the award of the Degree of Doctor of Philosophy of the University of Kerala is a record of bona fide research work done independently by Sri. Raman Nair, R under my guidance and supervision and that it has not previously formed the basis for award of any degree, diploma, fellowship or associateship.

Thiruvananthapuram
01.06.2004

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DECLARATION

I hereby declare that the thesis entitled *An Investigative and Evaluative Study of Factors Affecting Quality of Agricultural and Farm Information Services in Kerala* is a bona fide record of research work done by me during the course of research and that the thesis has not previously formed the basis for the award of any degree, diploma, fellowship or associateship or other similar title or recognition of any university or society

Thiruvananthapuram
01.06.2004

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-Raman Nair, R

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LIST OF ABBREVAIATIONS USED

<i>Acronyms</i>	<i>Full form</i>
AICRP	All India Coordinated Research Project of ICAR
ARIS	Agricultural Research Information System
ASFA	Aquatic Sciences and Fisheries Abstracts
CABI	Centre for Agriculture and Bioscience International
CAE	Kelappaji College of Agricultural Engineering and Technology, Tavanur
CAGI	Centre for Agricultural Informatics, Kannur
CBT	Computerized Training Programmes
CCBM	College of Co-operation, Banking and Management, Vellanikkara
CDIA	College of Dairy Science & Technology, Idukki
CDS	Centre for Development Studies, Thiruvananthapuram
CESS	Centre for Earth Science Studies, Thiruvananthapuram
CFISH	College of Fisheries, Panangad
CGIAR	Consultative Group on International Agricultural Research, Hague
CIFT	Central Institute of Fisheries Technology, Kochi
CMFRI	Central Marine Fisheries Research Institute, Kochi
COAP	College of Agriculture, Padannakad, Kasaragod
COAT	College of Agriculture, Vellayani, Thiruvananthapuram
COF	College of Forestry, Vellanikkara
COHV	College of Horticulture, Vellanikkara
CPCRI	Central Plantation Crops Research Institute, Kasaragod
CTCRI	Central Tuber crops Research Institute, Thiruvananthapuram
CVA	College of Veterinary and Animal Sciences, Mannuthy
CWRDM	Centre for Water Resources Devt and Management, Kozhikode
DAG	Department of Agriculture, Government of Kerala
DES	Department of Economics and Statistics, Government of Kerala
DFW	Department of Forests and Wildlife, Government of Kerala
FIB	Farm Information Bureau, Government of Kerala
GOI	Government of India
GOK	Government of Kerala

<i>Acronyms</i>	<i>Full form</i>
ICAR	Indian Council for Agricultural Research
ICT	Information and Communication Technologies
IISR	Indian Institute of Spices Research, Calicut
IM	Information Management
INFLIBNET	Information and Library Network Programme of UGC
KAU	Kerala Agricultural University
KAUC	Kerala Agricultural University Central Library
KFRI	Kerala Forest Research Institute
KSLU	Kerala State Land Use Board
KVK	Krishi Vignan Kendras
MIS	Management Information System
NAEP	National Agricultural Extension Project of ICAR
NARP	National Agricultural Research Project of ICAR
NATP	National Agricultural Technology Project of ICAR
NIC	National Informatics Centre, Government of India
PCOC	Programme for Community Organization
RGCB	Rajeev Gandhi Centre for Biotechnology, Thiruvananthapuram
SAU	State Agricultural University
SPB	State Planning Board, Thiruvananthapuram
TBGRI	Tropical Botanic Garden and Research Institute, Thiruvananthapuram
UOC	University of Calicut

ABSTRACT

RELEVANCE: Agriculture is not only the backbone of our food, livelihood and ecological security systems, but is also the very soul of our sovereignty. In Kerala population density is high and land is scarce. To achieve sustainable advancement in quality of human life in the State, meeting the domestic food requirement is to be given foremost priority in development plans. As the area of cultivation cannot be increased and growth of population cannot be controlled growth in food production is to be achieved by qualitative improvement in farming. This requires improved production technology developed by research.

Technological transformation that can boost agricultural production consists of improvements in material inputs, farming techniques, storage technology and research. Effective integration of these factors is tied closely to adequate information flow, which can be ensured only by an efficient information system for agricultural education, research, extension and development. So evaluation and improvement of existing information services is very crucial for agricultural growth.

Agricultural research conducted at various research institutions under Union and State Government, ICAR and Kerala Agricultural University at huge public expense has come out with important techniques that can improve our production tremendously. But when a farmer, an extension worker, a scientist or an administrator needs some specific information related to agriculture it is not easily available from any system near him let it be a Krishi Bhavan or a specialized institute. It is due to the lack of an agricultural information system and databank accessible to all. Library and information services of various institutes in agricultural sector of the State are independent and non-coordinated. There is no resource sharing programme or network. The agricultural sector fails to effectively bank on relevant information stored in academic and research institutions in the State or accessible there from other sources worldwide.

OBJECTIVES: Primary objectives of the study are; i) to examine the existing information resources, facilities, services, their effectiveness as well as possibilities for resource sharing in agricultural sector of the State, ii) to examine how far regional, national and international level databases in agriculture is accessible to institutions in the State and, iii) to determine the factors that affect the quality and hinder efficiency of information services. Secondary objectives are to define the aims and objectives of an Agricultural and Farm Information System and Network for Kerala and to propose a model plan for such a system and its computer communication network interlinking the agricultural institutions in the State. It can enable sharing of information resources available in the State and also ensure the smooth flow of results of research down to the grassroots level to achieve maximum productivity in agriculture.

SAMPLE: Kerala is taken as the geographical area within which the study is limited. Sample consists of information service divisions of, 30 resource rich institutions and 50 minor institutions from agricultural sector coming under, Union and State Governments, ICAR etc as well as 25 randomly selected institutions outside agricultural stream.

Randomly selected sample of users consist of 125 users from major institutions, 190 users from minor institutions, 111 users from out stream institutions and 220 from farmers and public living near the institutions covered by the survey. Data was also collected from 74 librarians.

METHODOLOGY: For obtaining data on information systems of resource rich institutions an elaborate questionnaire was used. A short questionnaire was used for minor institutions. For obtaining the assessment on libraries, their resources and services by managers, scientists and students another set of questionnaire was used. For the evaluation by farmers a short questionnaire in Malayalam was used. Interview was also conducted among selected librarians and scientists in charge of libraries by using an Interview schedule.

MAJOR FINDINGS: The mandate of agricultural libraries is to provide information support to plan, undertake, and promote education, research, extension and development in agriculture. The status of libraries, as well as duties, responsibilities and service conditions of librarians is not well defined in instruments of governance. In many institutes library is at third or fourth level of the organizational set-up and is managed by clerical staff. Managerial post is vacant in most libraries. There is lack of qualified professionals at various levels. There is lack of resource sharing programmes and leadership. Union catalogue of printed and electronic documents held by institutes in the agricultural sector is not available. There are no common standards for classification, cataloguing, subject description or database development. The sector has rich information resources. Duplication of costly resources and under utilization of the facilities is a common phenomenon. The library budget varies between 2 to 5% of institute budget. Expenditure on collection development is 73% of the total library budget. Duplicate subscriptions to Journals and databases in 15 of the institutions surveyed for this study costs an annual recurring expense of Rs. 103 lakhs. Most of the libraries in agricultural sector have not considered the requirements of farmers and the systems are not accessible to farmers and the public. Valuable information resources relevant to agriculture are found to be available also in institutes outside the stream. There is no integrated view about information systems. Information services are not always connected to the libraries

CONCLUSION: Information resources and infrastructures are very costly. Various institutions in agriculture have built up library facilities and huge collections. Considerable investments have already been made and the journals and databases cost a recurring expense of approximately two crore rupees per year. But the agricultural sector of the State fails to extract the optimum utility of these resources. The proposals made by this study if implemented will ensure accessibility to full agricultural information available in the region as well as from worldwide sources to each and every institution and user in the State. Transfer of technology from the lab to the farm will become speedy and efficient. Duplication of resources and ICT Infrastructures can also be avoided.

Chapter 1

INTRODUCTION

Information is a productive resource in agriculture, potentially influencing the efficiency of production, marketing, processing and administration; as well as education, research and extension related to these factors. So the development process in agriculture rests heavily on information available to managers, scientists and farmers. Yet this aspect of agriculture gets least consideration and inefficiencies have become obvious in managing this resource. Evaluation and improvement of the concerned systems is a matter of urgent concern and priority to protect the interest of agricultural sector in the context of increasing requirement for food grains as well as globalization. The cost of establishing information infrastructures for agriculture may be expensive, but the costs of not doing so are likely to be much higher in terms of productivity, quality and value addition.

A clear policy framework coupled with sound planning and implementation backed by generous research and development investments and efficient information support is essential to ensure sustained production of food grains and other agricultural commodities. Meeting the domestic food requirements has been the foremost social priority before India since independence. Hence thrust was given to food production beginning with First Five-Year Plan, particularly during mid-sixties¹.

India has put in unstinted and aggressive efforts towards agricultural development. This has increased 51 million tones of food grains production in 1950-51, to 191.09 million tones during 1994- 95 and to 195.92 in 2001-2002. According to the estimate of Indian Council for Agricultural Research (ICAR) India now need about 230 million tones of food grains i.e. an increase of 30-35 million tones². Further, large increase is essential in coarse cereals, pulses, oilseeds, fodder, fuel wood, fruits, vegetables, milk, meat, eggs, fish and a wide range of industrial and plantation crops. This is a formidable task.

The scenario gets further complicated when we view a rising population graph against decreasing productivity graph of major agricultural commodities. The yield per hectare of most crops is still quite low as compared to other countries. Land available for cultivation is limited, and it goes on decreasing due to the ever growing demands of industries, roads, houses, etc. Experts, especially those in the area of demography, are of the opinion that problems will become acute unless a second revolution takes place in agriculture.

We need to take measures based on research to stabilize the annual agricultural production, which fluctuate due to weather, pests and plant diseases. Many problems are there to be solved also in, animal husbandry, veterinary science and fisheries. Sustainable agricultural production on long-term basis has also become a cause of concern. Unless we strive continuously to improve present level of crop production, we may again face severe food shortage.

It has been widely held that future growth in production has to come exclusively from growth in productivity. As the area under cultivation cannot be increased and the growth of population cannot be controlled, the alternative is the qualitative improvement in farming, which requires improved agricultural production technology. For this an efficient research and development programme is needed. Quality and quantum of research by our agricultural scientists, in turn depends on efficient information support systems³. In this context Dr. M.S. Swaminathan, renowned agricultural scientist has remarked that sustainable agriculture in the 21st century will be based on the appropriate use of biotechnology, information technology and eco technology. Regulation through legislation, social mobilization through organizations and education through mass media and information shops will be needed to meet the dual demands for food and ecological security⁴.

Further, in the present economic environment, where India is getting integrated with world economy, it is imperative to develop techniques, technologies, processes and products which are competitive in terms of cost and quality at local, regional and global levels. All these suggest for a strong, vibrant, effective and dedicated agricultural research supported by efficient information systems at regional and national levels.

Traditionally agricultural libraries have played a vital role in knowledge communication and in keeping the scientists, administrators, planners and farmers posted with latest knowledge and advancement in their area of work and respective fields of specialization. But extension and intension of the field of agriculture and emerging specializations under it has made management of information resource very complicated. The present trends of development in agricultural research and the nature and quantum of information generated by it have brought in various challenges to traditional systems.

1.1. Definitions and Scope of Agricultural Science

An agricultural Information System is to be concerned with all the subject areas the term agricultural sciences cover. Hence a discussion on the scope, extension and intention of the discipline do not go out of place here.

Agriculture, an oldest practical art of the world is now recognized as one of the youngest professions in applied sciences. Like medicine scientific agriculture rests on the principles of basic sciences. However agriculture must draw not only from botany, zoology, chemistry, physics and mathematics but also from geology, ecology, meteorology, engineering, economics, sociology and statistics. The profession of agriculture includes a wide diversity of practices and specializations because it is closely knitted with the production of the fundamental elements of man's food, shelter and clothing, which are derived from plants and animals. Most broadly agriculture must also be concerned with the production, conservation and improvement of the plants and animals and the natural environment in which they grow as well as with their marketing and distribution⁵.

The subject covered by the term agricultural sciences can be listed as follows based on the sub disciplines of agriculture specified by Encyclopedia of Agricultural Science⁶, Agripedia⁷, as well as subject divisions to agriculture specified by Centre for Agricultural and Bioscience International (CABI)⁸ specializing in agriculture and bioscience information.

Table 1.1: Disciplines Under Agricultural Science

Broad Discipline	Sub Discipline
Crop Sciences	Plant Breeding, Crop Production and Horticulture Crop Protection
Forestry and Related Sciences	Forestry, Forest Products and Agro forestry Soil Science, Land/Water Management and Fertilizer Technology
Animal Sciences	Natural Resources and Environmental Issues Animal Production Veterinary Medicine Medical and Veterinary Parasitology Dairy Science and Technology Fisheries and Aquatic Sciences
Food Sciences	Food Technology Human Nutrition
Engineering, Economics etc	Biotechnology Biodeterioration and Biodegradation Agricultural Engineering Agricultural and Environmental Economics Rural Development Agriculture Related aspects in other Biosciences

1.1.1. Crop Sciences

Plant Breeding, crop production and horticulture, crop protection etc are the major subdivisions of crop sciences. But as no discipline under agriculture can stand in a watertight compartment there will be overlapping and many other subjects may seem to have a place under this heading in various contexts.

a) Plant Breeding, Crop Production and Horticulture

All aspects of crop production and management in relation to yield and quality are dealt in this subject area. Major aspects covered by the discipline include taxonomy and systematics, physiology, botany and biochemistry, on-farm processes, plant breeding and genetics, environmental issues related to crop production, propagation including seed production and testing as well as grazing behavior and its effects⁹. Aspects of forest trees with regard to agro forestry systems involving the growing of trees with agricultural and horticultural crops and the breeding, genetics and taxonomy of timber trees, all crops of nutritional and economic importance etc

are also dealt by this field. The major groups covered include; food crops, fodder crops, industrial crops and ornamental crops.

b) Crop Protection

The aspects related to the control and management of pests and pathogens are dealt in this discipline. The coverage include; chemical, biological, physical as well as integrated pest management, control of weeds or pathogens by the integrated methods, use of repellents and attractants in the control, trapping and monitoring of pests, resistance of plants to pests and pathogens normally injurious to them, control measures including sterile male release, trapping, genetic control, irradiation, plant quarantine, extension as well as legislative and economic aspects¹⁰. For pests, pathogens, natural enemies and other beneficial organisms the coverage include; taxonomy, genetics/sterility, morphology/anatomy, physiology/biochemistry, biology/behavior, reproduction/ development, ecology/ conservation, geographical distribution and techniques/equipments.

1.1.2. Forestry and Related Areas

Forestry comes under agricultural sciences from the point of planting and propagation through management and harvesting, to the processing of timber and the various wood and non-wood forest products. The management of forestland, in the widest sense, and agro forestry, an area of increasing importance also comes under this discipline¹¹.

a) Forestry, Forest Products and Agro forestry

Forestry is concerned mainly with the silviculture and management of forests for the production of wood and other purposes. Broadly speaking the aspects covered by forestry can be divided into four main areas: core forestry, tree biology, forest pests and control and forest land use.

Agro forestry includes all land use systems and practices in which woody perennials including forest trees, multipurpose trees, plantation crops, shrubs etc are

deliberately grown on the same land management units as crops in either spatial or temporal arrangements, and where there are significant economic or ecological interactions between the woody and non-woody components¹².

b) Soil Science, Land/Water Management and Fertilizer Technology

Coverage of this area includes all aspects related to the properties of soils and the management of land and water resources. Aspects of coverage are; soil properties and their determination, soil management, land assessment and management, erosion, conservation and reclamation of soil, water management and fertilizer technology.

c) Natural Resources and Environmental Issues

Natural resources, as a topic, is extremely broad but can be broken down into four major categories - air, land, water and biological resources. Environmental issues covers agricultural and forest production as well as human and animal health.

1.1.3. Animal Sciences

This discipline covers veterinary and animal sciences, their medical aspects, dairying, poultry, and fisheries and all areas related to them.

a) Animal Production

This field deals with all aspects related to the rearing of animals of domestic or economic importance. Major areas under this discipline include breeds and breeding, genetics and genetic engineering, immunogenetics, nutritive value, composition and digestibility of feeds, digestion, nutrition physiology, production responses to dietary manipulation, nutritional disorders, livestock industry and behavior¹³. Animals covered by this field are farmed mammals, hybrids of domesticated animals with wild animals; other mammals of economic importance, poultry, fish etc.

b) Medical and Veterinary Parasitology

As a natural progression from man's production of animals for economic or domestic purposes the coverage of this field extends to their diseases and disorders as well as parasitic diseases in man, particularly the major tropical diseases affecting rural, agricultural communities. The host organisms including man plus all animals of domestic or economic importance, wild mammals, birds, reptiles, amphibia, fish and invertebrates are covered where; infected with helminths, protozoa, fungi or arthropods, and especially when they act as intermediate or reservoir hosts. Disease organisms covered by this area are helminths of man and animals, nematodes, protozoa parasitic in man and animals, fungi, arthropods, vector-borne pathogens, pathogens and parasites of medical and veterinary importance. Aspects of coverage of this discipline are; taxonomy, control of pathogens, infection and disease.

c) Veterinary Medicine

This field deals with animal diseases and disorders including their diagnosis, prevention and treatment. It also includes animal health; the state of productivity, in particular those parameters that can be used as a guide to an animal's or group's state of health such as food intake, faecal output, body weight, milk yield, racing performance, egg yield, wool quality etc. Veterinary public health is also dealt in this subject area. Diseases and disorders due to direct or indirect action of biological, chemical or physical agent are dealt here. Disease aspects like aetiology, pathology, epidemiology, pathogenesis, control, and prevention are covered. For parasitic disease organism, coverage includes work on taxonomy, biology, life cycles etc. as well as other aspects like diagnosis, pharmacology, veterinary drugs, physiology, immunology, hematology anatomy, hygiene, animal behavior, surgery and food inspection. The field covers infectious diseases, chemical agents and compounds and physical agents.

d) Dairy Science and Technology

The field deals with mammary gland, milk, milk constituents, milk products, milk processing and aspects of dairy farming covering all mammalian species.

Specific aspects studied under this discipline are; husbandry, technology, economics, legislation and standards, milk and public health, physiology and biochemistry as well as microbiology.

1.1.4. Food Science and Human Nutrition

This field deals with food and nutrition for both man and animals. In addition, policy on malnutrition, food aid and food supply are covered. Aspects of human nutrition covered by the field are; analysis and techniques for the determination of nutritive value of foods, nutrients, anti-nutritional factors, toxic substances and toxins in foods, whole range of foodstuffs, physiology and biochemistry related to food intake, and nutritional disorders.

1.1.5. Biotechnology, Engineering, Economics and Other Areas

As agricultural sciences covers work on all animals and plants of economic or domestic importance and related wild species as well as their management, production and protection issues no area that can be considered, as coming under biosciences is alien to agriculture. In addition the sub fields of economics, engineering, Information Technology, medicine, newly emerging areas like biotechnology and a host of such subjects are highly relevant to agriculture and have sub disciplines specializing in agriculture.

a) Biotechnology

Biotechnology covers the application of molecular genetics, genetic engineering and in vitro culture to organisms of agricultural importance including pathogens and beneficial microorganisms¹⁴. Methodology is a key focus, as are studies of agriculturally useful traits. This field covers applications of biotechnology for traditional animal and plant breeding. The economic, planning and policy aspects of biotechnology are also dealt here as well as the biosafety, legal and social issues.

b) Biodeterioration and Biodegradation

The field covers organisms including those active in biodeterioration or biodegradation like microorganisms, viruses, bacteria, actinomycetes, fungi, algae and lichens, higher plants, invertebrates, protozoa, mollusca, insects, mites, birds, rodents etc. Techniques involved with organism identification, enumeration, as well as deterioration of foods, feeds and non-foodstuffs by living organisms and by microbially derived toxins are dealt in this area. Biodegradation deals with biologically based treatment of industrial, municipal and agricultural pollutants and wastes and their constituent parts.

c) Agricultural Engineering

Agricultural engineering includes agricultural and horticultural machinery, implements, equipment and buildings. Aspects like design, construction, selection and operation and control as well as effects on crops, livestock and soil are covered by this discipline. Coverage of this field can be divided into the major areas like control, robotics and computer vision, mechanical power, land improvement machineries and equipments, crop production and protection machineries and equipments, protected cultivation, crop harvesting and threshing equipment and machinery, livestock buildings and associated equipments, and energy relating to the use of buildings and equipment.

d) Agricultural and Environmental Economics

Economics is the practical and theoretical science of the production and distribution of wealth. The discipline of agricultural economics is concerned with a wide range of issues from policy formation, through development programmes, the economics of the food industry, natural resource utilization, farm management, aspects of education and research and rural sociology. Agricultural information services have to cover all aspects of interest to managers and economists working in agricultural sector. The discipline also covers the production of food and agricultural products from the input industries to the distribution of the final product. The

economics of pest control and fisheries, and the areas like forest and environmental economics are dealt in this field.

e) Rural Development

Rural development is defined as the process whereby rural communities progress from given situations to more desirable situations in terms of their quality of life. It depends upon the utilization of local physical and human resources, supplemented by investment, technology and services with full participation of the local people in decision making. Agricultural development is closely connected to rural development.

f) Biosciences

Explaining the subject coverage of agricultural information is not an easy task. Inevitably there are areas in biosciences, which are difficult to place outside agriculture. There are many areas relevant to agriculture in various disciplines under biosciences traditionally not grouped under agricultural science. Hence studies on various disciplines coming under biosciences are highly relevant to agricultural sciences also. .

1.2. Nature and Use of Agricultural Information

The discussion in the above section on nature and scope of agricultural sciences reveals that information services to agricultural sector have to deal with published literature on research and development related to the fields of agriculture, animal rearing, fisheries, forestry, human health, human nutrition, animal health and the management and conservation of natural resources as well as various disciplines and sub disciplines coming under the broad area known as biosciences.

1.2.1. Literature Output in Agriculture Sciences

The rate of accumulation of knowledge in the above areas is a hundred times more than it was at the beginning of the last century. We have progressed from a low

productive agricultural society to an information society of high productivity. At a moderate estimate we have over forty million documents for use annually in the world in different languages and are doubling every six to eight years¹⁵. No other single discipline has shown so much growth of published material as in agriculture today. In agriculture we have 2 to 2.5 lakh primary documents annually. Of the world's approximately 85000 journals and bulletins the biggest contribution is from agriculture i.e. a thousand research papers per day¹⁶. About 9000 periodicals and more than a lakh books are published annually related to agriculture along with innumerable number of other documents in different languages of the world.

The published documents in agriculture mentioned above consist of research reports, books, journal articles, CDROMs, magnetic tapes, videotapes, etc. From the documents resulting from agricultural research worldwide since 1973, items that have relevance to all countries and agro climatic systems selected by CABI for its database itself, comes to over four million documents. Approximately 180,000 documents of high relevance get added to that at CABI each year.

These documents related to agriculture selected by CABI are published in more than 50 languages. The breakdown of the documents included in CABI database by country of publication for the period 1998-2001 is presented in Table 1.2.

Table 1.2: Country wise Published Documents on Agriculture During 1998-2001

Country of Publication	Percentage
Europe	45.0%
North America	26.0%
Far East Asia	09.0%
Indian Subcontinent	08.0%
Central and South America	04.0%
Australia	02.0%
Russia	02.0%
Africa	02.0%
South East Asia	01.0%
Middle East	01.0%

Source: Data from Centre for Agriculture and Biosciences International (CABI).

The items of the above table include research papers published in over 9,000 learned, professional and trade journals specializing in agriculture and related areas from all over the world. They also consist of serials including irregularly issued reports, bulletins and monographs, proceedings of conferences, symposia, workshops, etc. books, doctoral dissertations, annual reports, project reports and other papers, patents and standards related to agriculture and allied fields.

Approximately thirty percent of the specialized publications that cover latest developments are presently available in digital form only. Various lectures and awareness and training programs meant for extension workers as well as farmers were available now as video films and interactive multimedia programmes. Accessibility to all these are important for our agricultural sector for supporting the scientists to update their knowledge as well as to help the farmers for applying what has been invented by the scientists.

Information output is measurable in many braches of knowledge. For instance the estimates have been that if a chemist researches and studies 60 minutes an hour, 24 hours a day throughout his life, he would have by end of his life, just read only 1/10th of the total literature output on his specialized area of research. This may be less than that with the agricultural scientists because the extent of agricultural research information is vaster¹⁷. Due to information explosion, retrieval of required information has also become a serious problem. A scientist will need a long time to find out and read all the literature relevant to his work from three lakhs and more articles on agriculture published annually which will steal away his time for applying what he has learned. Repackaging and transferring research information to the farm also has become a specialized function.

1.2.2. Information Flow and Users in Agriculture

People as individuals or groups communicate information in agricultural sector. It can be information they have generated or received from another source, to others who have interest in that specific topic. By doing so the original information is usually transformed and adopted to enhance understanding and to add to the already existing knowledge pool of the receiver. The flow of information in an agricultural

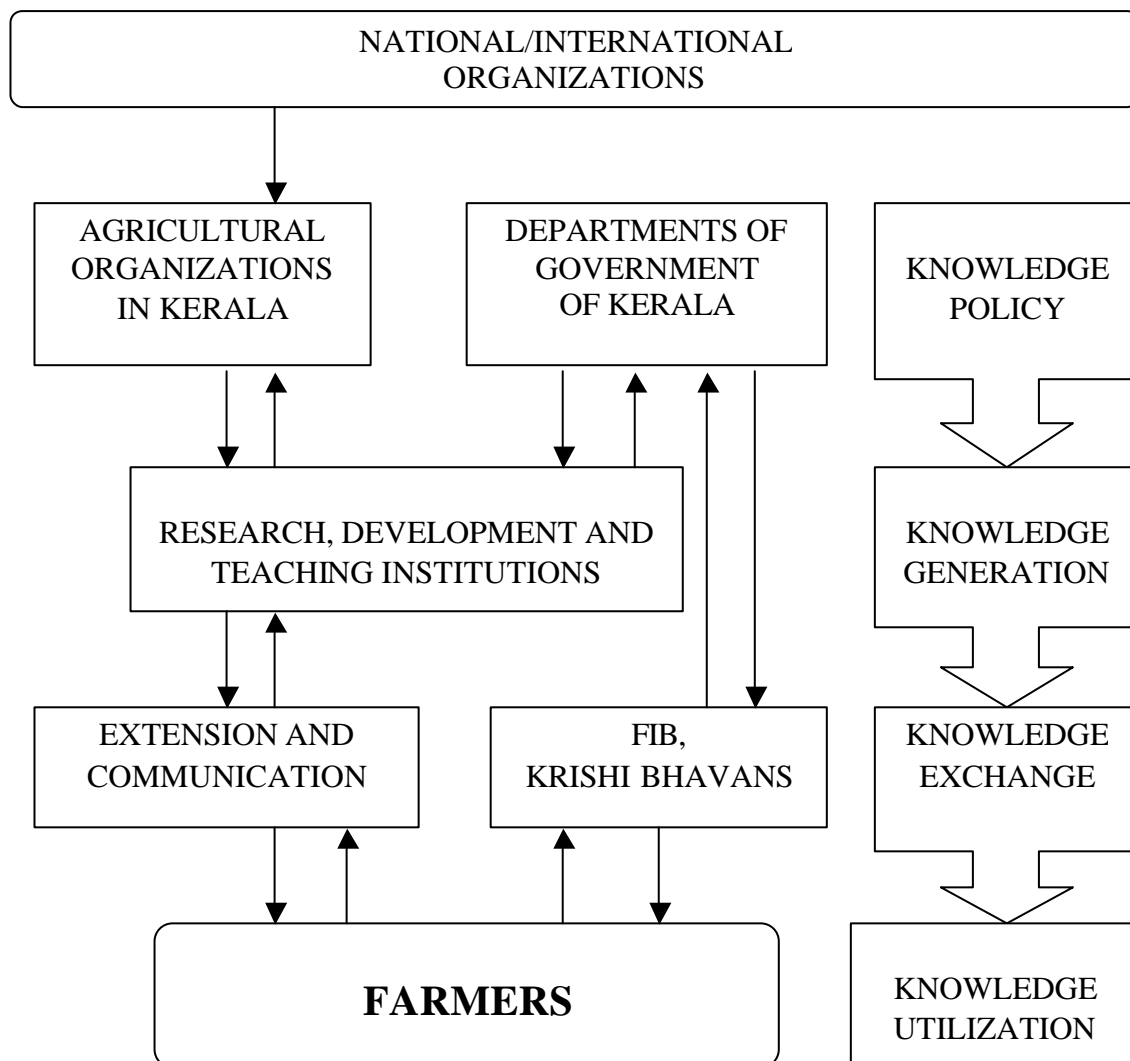


Figure 1.1: Flow of Information in Agricultural Sector

sector is grouped into four levels by Abraham Blum¹⁸ according to their place in the continuum from knowledge policy making to knowledge generation, knowledge exchange and finally to knowledge utilization (Figure 1.1).

The users of information in agricultural sector can be generally classified into three the managers, scientists and farmers.

a) Managers: This category of users in Kerala include Vice Chancellor, Directors, Secretaries and other decision making authorities of Kerala Agricultural University (KAU), ICAR Institutes, Government Departments of Agriculture, Animal Husbandry, Poultry, Fisheries, Dairy Science, Food and Rural Development of the State as well as those from NGO's and private groups. They will require the following information for effective decision-making:

- ?? human and physical resources
- ?? research, extension and development projects
- ?? budgeting
- ?? physical targets

b) Scientists: This category of users will include personnel working in research systems of the State coming under KAU, ICAR etc as well as various research and extension units of the Departments of the Government of Kerala related to agriculture. Their information requirement can be listed as follows:

- ?? research and extension trends in agriculture and related disciplines
- ?? plant animal and fisheries genetic resources, soil profiles, and natural resources
- ?? agro climatic factors
- ?? economic and social indicators
- ?? feedback from fields
- ?? results of previous research at both national and international levels

c) Farmers: The farmers and the public form the most important category of users. They may require information on aspects like the following:

- ?? input/output prices
- ?? market information
- ?? location specific improved varieties, farm machinery, cattle breed, fish etc.
- ?? improved techniques and methods
- ?? complete package of practices
- ?? post harvest value additions
- ?? information about input supply system

1.2.3. Agricultural Information Related to the Region

The agricultural information generated in Kerala, the areas in which research is going on in the region, and the requirement of managers, extension activists and farmers discussed above are related to the crops and animals reared in the region. The crops cultivated in Kerala and a detail of institutions where research extension and development related to them is going on is presented in Table 1.3. These institutions generate information on the crops cultivated in Kerala, They also acquire and store information generated elsewhere on these crops. In addition they require information on those crops generated and stored in other institutions in Kerala.

Data presented in Table 1.2 shows that representation of information on agricultural research conducted in India in international information systems and databases is good. But even than we cannot fully rely on such systems for our activities at grass roots level. When agricultural development at the regional level like within Kerala is considered unrecorded indigenous knowledge held by the farmers, literature generated in the region, in the regional language and specific to the region and our farmers like extension literature, farmers' literature, product literature, newspaper, radio and television reports, audio-visual materials etc are also important. We cannot expect such resources to be covered by international or even national information systems.

Table 1. 3 Cultivated Crops and Reared Animals of Kerala and Related Research

	Group	Common Name	Concerned Institutions
1	Cereals	Chama, Kodomillet, Maize, Rice, Ragi,	KAU, ICAR, GOK
2	Pulses	Black gram, Cowpea, Green Gram, Horse gram, Red gram	KAU, ICAR, GOK
3	Tubers	Colocasia, Carrot, Elephant foot Yam, Potato, Turnip, Tapioca, Yam	KAU, CTCRI, GOK
4	Vegetables	Brinjal, Tomato, Chilly, Amaranthus, Okra, Bitter gourd, Bottle gourd, Snake gourd, Ridge gourd, Ash gourd, Little gourd, Sword bean, French bean, Beet root, Cabbage, Carrot, Cauliflower, Indian bean, Drumstick, Musk melon, Onion, Pumpkin, Red pumpkin	KAU, ICAR Institutes, GOK
5	Fruits	Banana, Bread fruit, Bullocks heart, Cashew, Sweet-sop, Grapes, Guava, Jack, Jujube, Lemon, Lime, Mango, Mangosteen, Papaya, Pineapple, Pomegranate, Sapota, Mandarin, Pomelo	KAU, ICAR Institutes, GOK
6	Condiments & Spices	Chilly, Turmeric, Coriander, Indian Mustard, Cumin, pepper, garlic, Ginger, Cardamom, long pepper, Nutmeg, Cinnamon, Clove, Cinchona, Allspice, Fennel	KAU, IISR, GOK
7	Oil Seeds	Coconut, Sesamum, Groundnut, Indian Mustard, Castor, Oil Palm	KAU, CPCRI
8	Beverages	Coffee, Tea, Cocoa,	KAU, CPCRI, ICAR
9	Green Manure Crops	Glyrcidia, Crotalaria, Sun hemp, Carpogonium's	KAU, CPCRI, ICAR
10	Fodder Crops	Bermuda, Napier, Guinea, Para, Tropical kudzu	KAU, CPCRI, ICAR
11	Other Crops	Tobacco, Betel Vine, Arecunut, Rubber, Sugarcane	KAU, CPCRI, ICAR
12	Trees	Teak, ebony, Jungle jack, Poon, Tree of Heaven, Sain, Kindal, Gurjun, Iron wood tree, Venteak, Siris, Yellow teak, Dita bark, Ekadania, Mahogany, Indian rosewood, Jack, Bead tree	KAU, CPCRI, ICAR, KFRI, TBGRI, COF
13	Medicinal Plants	Black catch, Asparagus, Brahmi, Aparajit, Indian borage, Nut grass, Sadovani, Sarivn, Indian sarsaparilla, Pennywort, Kachura, Neem, Holy basil, Jaramala, Long pepper, Rauwolfia, Garden Rue, Sida, Gulancha, anatamul, Khas-khas, Niragandi, Asgand, Baloonvie	KAU, CPCRI, ICAR, KFRI, TBGRI, COF, GOK
14	Animals	Cattle, Buffaloes, Goats, Pigs, Rabbits	GOK, CVA
15	Birds	Fowls, Ducks	GOK, CVA
16	Fishes	Tiger prawn, Naran chemmeen, Thelli chemmeen, Yetta, Paral, Irumeen, Crabs etc	GOK, CIFT, CMFRI, CFIS

The details of information generated and required revealed by Table 1.3 points out that the State can not refrain from modernizing the information support systems which is very important for achieving quality and efficiency in managing the crops and animals. This necessitates improving the existing information management facilities on a priority basis so as to offer appropriately tailored and well defined services required for different crops and categories of users.

1.2.4. Information for Agricultural Research

As in all other spheres of human activity, in agriculture also information is an important constituent that contributes to quality and speed of development. Agriculture being the major determinant of livelihood destiny of the majority of people of India, development of this sector will determine the country's economic and political future. Synthesis of technology, public policy and farmers cooperative action is essential to shape this future in a desirable direction¹⁹. If we can achieve that our country will be one of the major nations of the world with farm power. If we fail due to in appropriate public policies and research priorities that result from lack of right information at right time the country will collapse. This stresses the importance of information services for agricultural research.

The main function of agricultural research is to seek information and knowledge. If the information does not exist or is not available in the researcher's institutions, it can be generated by experiment. If experimentation is ruled out due to resource limitations or other factors, researchers will scan knowledge sources outside the institution, hoping to identify information, ideas, and technologies that can be borrowed and adopted for local use²⁰.

Even a large research system cannot generate all the technologies it requires. So an effective national or State agricultural research system must have the capacity to borrow both knowledge and materials from the entire world²¹. In advanced countries this capacity to borrow from outside is desirable and complements the capacity of the country to generate technology. In countries like India and its constituent States, where sources for technology generation are scarce, it is essential

to be able to borrow. Borrowing technology is mainly acquiring knowledge or information for application as it is or adoption for further development.

Getting knowledge and information generated elsewhere or in-house for the use of researchers is a critical management function. This only can ensure that past investments in research and information are adequately assessed, evaluated, and utilized before experiments begin. This limits duplication of previous efforts and ensures that current activities use, and benefit from, existing knowledge.

1.2.5. Information and Agricultural Education

Digitized information combined productively with creative potential and knowledge embodied in people, which are presently known as knowledge societies are now propagated by national and international organizations²². In this context perception of the scope of education also is changing as societies come to recognize that time to learn now is the whole lifetime and not just during the period of childhood and youth.²³ This is of high relevance to agricultural education, training and extension. The impact of ICT on education is candidly described in the documents of the World Conference on Education for All²⁴. New possibilities are emerging which already show a powerful impact on meeting basic learning needs, and it is clear that the educational potential of these new possibilities has rarely been tapped in agricultural sector of our country. These new possibilities exist largely as a result of two converging forces, both recent byproducts of the general development process. First the quantity of information available in the world – much of irrelevant to survival and basic well being – is exponentially greater than that available only a few years ago and the rate of its growth is accelerating. A synergic effect occurs when important information is coupled with a second modern advance – the new capacity to communicate among the people of the world. The opportunity exists to harness this force and use it positively, consciously and with design, in order to contribute to meeting defined learning needs.

The agricultural educationists and extension activists of advanced countries are long since using computers having multimedia capacity with links to digital libraries which store text, animations, audio and video files, to create interactive

learning environment as well as effective extension activities. There, librarians and extension activists work in close cooperation. Any one from any remote location with a computer, a modem and a telephone can access virtual libraries with such training materials mixing, text, animation and video. Digital library technology combined with communication systems of State Information Infrastructure can materialize high-tech teaching learning environment for agriculture as well as training and extension facilities at Krishi Bhavans, veterinary hospitals, or village libraries at low cost.

1.2.6. Information and Agricultural Extension

The demands made upon the transfer of technology for accelerating production are enormous and most formidable. This is a complex task – interdisciplinary and multi-institutional in approach and content. Integrated functioning of research, education, information and extension has been the cardinal principles of agricultural development in advanced countries. The extension system in the country and State involves research institutions, educational institutions, training centers, marketing system, extension organizations, input agencies, village institutions and farming communities. But the involvement of institutions or units, which have to undertake the most important function - information dissemination is lacking at national and State level. Information in various media, repacked for various categories is the main tool and resource for extension activity. The major institutions dealing with this resource is libraries and information units. Hence as a strategy of development an integrated systems view of information and extension agencies is needed. Functional linkages of library, information and extension are to be created. Our State's extension system has to deal with millions of farmers including farmwomen, and agricultural laborers. An extension system however vast cannot reach them quickly or acquire organize and manage the information and documents meant for them. What is required is developing and maintaining strong functional relationship with library and information service units at higher levels in production of information materials and programmes for extension as well as use of existing village library networks and facilities near the farm to transfer the technology. Utilizing the resources at the command of specialist's areas of information science together with village library services is essential for success of transfer of technology programmes covering the whole State. Detailed studies on these aspects have revealed

that unless systems are redesigned with such an integrated view we cannot reach the unreached and make the extension systems sustainable.²⁵.

1.2.7. Information and Agricultural Marketing

Our country's economic and financial policies have undergone dramatic transformation in the last few years and many structural changes have been brought into the traditional system, so that the country can integrate itself into the new and reemerging world economic order. Liberalization and globalization have become the keywords in the present policies. With the signing of the Marrakech Accord (WTO) in 1994 largest increase in global trade is expected in clothing, agriculture, forestry and fishery products and processed food and beverages – areas where India has a competitive advantage.²⁶ The new Export and Import Policy (EXIM) announced by government seeks to complete the process of India's integration with global economy by removal of various restrictions. It seeks to provide fresh directions to setting up Agricultural Export Zones and providing them special benefits. Agro exports would be reorganized on the basis of specific products and specific geographic areas. Focusing specially on areas where there is a convergence of these two factors would make a beginning. Such zones will be made as Regional Rural Motors of Indian Export Economy. The more will be the end-to-end development of export specific products.

Kerala and many agricultural regions of the country will have constraints in fully participating in International Trade. It will be because of various critical gaps including availability of information on prices, demands, quality, standards etc. Efficient information systems will be essential to fill these gaps by transmitting international signals to the farmers. They need to be encouraged and enabled to respond to these signals through the State.

Internationalization of our agriculture will have several implications. It can give great opportunities to our farmers. The terms of trade, which have, for long been in favor of industry is expected to shift in favor of agriculture. Huge investments will be diverted to agriculture. If our farmers are equipped to rise to the occasion, we will

be able to make a mark in the international trade in agriculture with this farm to port approach. Information systems have a crucial role to play in equipping the farmers.

Kerala's agricultural sector is heavily dependent on foreign trade and approximately 80% of agricultural produce in the State is in one way or other affected by foreign trade. This necessitates an efficient information system to enable the stakeholders to evolve appropriate strategies and plans for minimization of negative impacts of the new multilateral trade regimes on specific crops, products and sub sectors. Good understanding about the different aspects of the WTO Regime by all stakeholders in the field of agriculture including cultivators, traders, exporters, scientists, breeders, plant protection personnel, staff of the development departments, and media persons is very important.

To fulfill the above needs an information system, which can enable the farmers to achieve higher income and prosperity through productivity improvement, quality enhancement, value addition, and farmer friendly marketing of agricultural products is important. Such an information system should generate and disseminate technical and marketing information to farmers and other stakeholders to take maximum advantage of the emerging worlds trade regime in agriculture. It should also act as a decision support system to the government for planning appropriate strategies to take advantage of the dynamic market situation and minimize adverse impact of market fluctuations on the one side and competition from other countries on the other.

The information required for the above processes and the source of the generation and availability of relevant data and information existing in Kerala is presented in Table 1.4.

1.2.8. Agricultural Libraries

Because of the multidisciplinary nature of the subject of agriculture, in an organization concerned with it the role of library becomes very important. The discipline agriculture unlike most other disciplines as discussed in Para 1.1 is very vast and complex. Diverse subjects are studied and researched under Agriculture in

Table 1.4: Items of Information Required for Agricultural Production and Marketing and Source Organizations

Data Requirement	Types of Information required	Level of Desegregation	Agency/Source for Data Generation
1	Crop Forecast	location wise and area wise (based on major growing areas)	Commodity Boards, Directorate of Economics and Statistics(GOK) KAU, Directorate of Agriculture (GOK)
2	Production Data	crop wise and area wise productivity (variety wise and area wise)	Commodity Boards, Directorate of Economics and Statistics, Directorate of Agriculture (GOK), Trade Organizations
3	Market Information	stock of non perishable commodities estimated season wise market arrivals (product wise and variety wise - major production centers wise) international changes in product preferences and standards domestic demand and export demand (quality wise and product wise) price trends and Seasonal variation (Quality wise variation (grades), market wise variation, domestic, international, spot and future prices)	Commodity Boards Export Development Agencies Export Organizations Directorate of Agriculture (GOK) Institutions like KAU collecting field data on a daily basis from important markets
4	Consumption Data	product wise consumption data (direct consumption (quality/quantity wise/centers of processing), individual consumption, consumption for processing /value addition as well as sources domestic and imported)	Department of Economics and Statistics Commodity Boards Trade Associations Processing Industry Associations
5	Market Intelligence	supply and demand forecasts (product wise and quality wise) domestic and International demand projected supply from competing centers international price movements future prices export potential (product /quality – timing, season and period – price expectations; projected – direction of export) import prospects (product wise: quantity and price – courtiers of origin)	Commodity Boards Export Organizations Export promotion council/Development Authorities Directorate of Economics and Statistics (GOK)

Data Requirement	Types of Information required	Level of Desegregation	Agency/Source for Data Generation	
6	Marine Products	<p>?? species wise quantity, centers of origin wise (weekly)</p> <p>?? variety wise export, country wise(month wise)</p> <p>?? price movements internal and external (weekly)</p> <p>?? change in quantity exported and price of competing countries</p> <p>?? disease surveillance data, special quarantines</p> <p>?? trends in domestic consumption, variety wise</p> <p>?? trends in fish processing and their exports</p> <p>?? species wise export of meat and meat products</p> <p>?? species wise price trends domestic and international (weekly position)</p> <p>?? international changes in product preferences, export shares of competing countries, price movements etc</p> <p>?? disease surveillance data, foot and mouth disease and other major diseases (area wise)</p>	<p>according to production centers</p>	<p>MPEDA</p> <p>Marine Exporters</p> <p>Department of Fisheries (GOK)</p> <p>Department of Economics and Statistics</p> <p>Cochin Port Trust</p>
7	Meat Products	<p>?? identification of disease free zones</p> <p>?? preference pattern for organic products -international scenario changes</p> <p>?? price trends in different importing countries</p> <p>?? consumption pattern of organic products</p> <p>?? quality standards for organic products</p> <p>?? certification requirements</p> <p>?? emerging opportunities</p> <p>?? area, production, productivity</p> <p>?? pharmacological application, product development</p> <p>?? export in primary form and processed form</p> <p>?? variety, quantity, price and direction of trade</p> <p>?? price and quantity trends</p> <p>?? information on herbal drugs and exports</p> <p>?? emerging markets, competition etc</p> <p>?? rainfall, humidity, diurnal variations in temperature, weather forecasts, crop planning advisories.</p>	<p>according to production centers</p>	<p>Export institutions</p> <p>Department of Animal Husbandry (GOK)</p> <p>Port Trust</p> <p>Directorate of Economics and Statistics (GOK)</p>
8	Organic Products	<p>?? identification of disease free zones</p> <p>?? preference pattern for organic products -international scenario changes</p> <p>?? price trends in different importing countries</p> <p>?? consumption pattern of organic products</p> <p>?? quality standards for organic products</p> <p>?? certification requirements</p> <p>?? emerging opportunities</p> <p>?? area, production, productivity</p> <p>?? pharmacological application, product development</p> <p>?? export in primary form and processed form</p> <p>?? variety, quantity, price and direction of trade</p> <p>?? price and quantity trends</p> <p>?? information on herbal drugs and exports</p> <p>?? emerging markets, competition etc</p> <p>?? rainfall, humidity, diurnal variations in temperature, weather forecasts, crop planning advisories.</p>	<p>crop wise product wise production center oriented potential to be estimated</p>	<p>APEDA</p> <p>Commodity boards</p> <p>Agencies for Organic Farming</p> <p>Export organizations</p>
9	Medicinal Plants	<p>?? area, production, productivity</p> <p>?? pharmacological application, product development</p> <p>?? export in primary form and processed form</p> <p>?? variety, quantity, price and direction of trade</p> <p>?? price and quantity trends</p> <p>?? information on herbal drugs and exports</p> <p>?? emerging markets, competition etc</p> <p>?? rainfall, humidity, diurnal variations in temperature, weather forecasts, crop planning advisories.</p>		<p>Directorate of Economics and Statistics (GOK)</p> <p>Directorate of Ayurveda</p> <p>Drug manufacturers associations</p> <p>Exporters,</p> <p>Association of Ayurvedic drug manufacturers etc</p>
10	Meteorological Data	<p>?? rainfall, humidity, diurnal variations in temperature, weather forecasts, crop planning advisories.</p>		<p>ISRO(Metsat) KAU, CWRDM etc</p>

one context or other. Such a phenomena has a direct bearing on the agricultural library, its users and managers.²⁷ It is almost impossible to quantify the information output in the field of agriculture and related sciences. Hence the role of the libraries in acquiring, organizing and disseminating required information to their patrons could not be over estimated.

Agricultural library and information systems have to discharge a multiplicity of functions, catering to a wide clientele having divergent interests, and representing varying states of intellectual development. Their modernization is very important for agricultural development. They can no longer exist as those old institutions charged with preservation and conservation of books. They are now saddled with the task of collecting, organizing, managing, repacking and communicating information and knowledge of a colossal magnitude and variety with speed and efficiency²⁸.

The current developments in agricultural sector necessitate creation of library and information service units in all agricultural institutions, which are not presently having them. Information service outlets are to be established at different levels up to villages. It is also important that information systems existing in the institutions in the sector be vitalized to meet the challenges in terms of quality, efficiency and cost effectiveness. The method of working of most of the libraries coming under various agricultural organizations in the State needs thorough restructuring and overhauling, keeping in mind requirements of the agricultural sector. The libraries of the organizations around which agricultural, education, research, extension and development activities are centered should be capable to provide effectively the knowledge and information support required for those activities. All these indicate the important role that the library and information systems have to play in agricultural development.

The systems, which bridge the gap of information downpour on the one hand, and the information needs of the users on the other are libraries. In Kerala the libraries attached to KAU and its constituent colleges and Research centers as well as ICAR institutes, and Agricultural Department of State Government are responsible to fulfill the information needs of the agricultural sector in the State. They offer various traditional and modern library and information services to the users. But their efforts

are presently individual and isolated²⁹. So the scope, comprehensiveness, coverage and cost effectiveness of their services is limited. In addition to them there are also many other libraries of organizations coming under government, private organizations, and NGOs which are struggling hard to cope up with the problems of expanding agricultural research information, increasing information needs of their clientele, complexity of the ways of acquiring information and ever declining financial resources. Facing all these problems they have to provide the information support required for education, research, extension and development programmes of their parent organizations.

Estimates about the amount spent on agricultural research and also the annual production of publications in agriculture reveal that we have sufficient recorded knowledge in agriculture, which can be used as input for improving production. But the existing knowledge is not reaching the users. This gap is to be reduced. Sharing the resources can narrow this gap. Generation of technology and its application are two different issues. A country may not generate technology but can use it skillfully if it has good information network. It has been said that there are advanced countries because they take advantage of the work of other countries. Therefore creation of basic information infrastructure, support and services is crucial in agricultural development.

1.2.9. Harnessing Possibilities of ICT

Harnessing the possibilities of Information and Communication Technology (ICT) can help us to improve in the right direction with speed and efficiency. Capability in areas of science and technology, like biotechnology, information and communication, give hitherto unavailable opportunities. They can help the country for achieving sustainable agricultural development based on knowledge and biological inputs in the place of chemical and capital-intensive production methods that can harm. Integrated attention to regulation, education and social mobilization has become very important for sustainable development. Research strategies need to be restructured so as to make possible strategic, anticipatory and participatory research. Extension services are to be decentralized and should be capable of converting generic into location specific knowledge essential for taking to precision farming

methods. The farmers themselves should maintain the rural knowledge centers. They should act as service outlets of, and form part of national and State level agricultural information systems. They should be able to use State level information infrastructures, public library networks and village library facilities for information access, management and dissemination. They should provide computer aided and Internet connected information access and processing facilities so that farmers have timely and relevant technical as well as methodological management and marketing information. Hence national and state level information infrastructures extending to the villages catering to the needs of agricultural sector has become the need of the time.

In the above contexts a study of the resources, facilities and services of library and information units of agricultural organizations in the State as well as the feasibility for establishing resource-sharing programme among them becomes very important.

1. 3. Title of the Study and Definition of Key Terms

The title of the study is ‘An investigative and evaluative study of factors affecting the quality of agricultural and farm information services in Kerala’. The main concepts in the title of the study are ‘*agriculture and farming*’, ‘*information services*’, ‘*quality*’ and ‘*investigation and evaluation*’.

Webster's Dictionary defines *agriculture* as the science or art of cultivating the soil, harvesting crops and raising livestock and in varying degrees the preparation of these products for man's use and their distribution.³⁰ *Farm* or farming is growing crops and rearing animals.

In the context of this study ‘*information*’ is considered to be synonymous with the scientific knowledge irrespective of its manifestation. In terms of manifestations information includes oral and written, documentary and non-documentary, audio and video, in their traditional or digital forms from formal or informal sources.

'Information services' here means acquiring, organizing and managing relevant information, processing and repackaging it if essential and delivering or making the same available to the user community in agricultural sector as per their requirement at the right time.

'Quality' here is the totality of features and characteristics of a product or service (here information systems consisting of collections, staff, services, physical facilities, equipments and information and communication infrastructures available, their accessibility etc.) that bear on its ability to meet the stated or the implied needs (here of the information users from agricultural sector)³¹. This is usually referred to as meeting requirements, conforming to specification or fitness for the purpose.

'Investigation' is finding out detailed facts by questioning or observation and *'evaluation'* is finding out or forming an idea of the amount or value of assess and in this context *'investigation and evaluation'* is finding out detailed facts about the agricultural and farm information service in Kerala using questionnaires, observation etc to form an idea of the quality and utility of the systems and services.

1.4. Objectives of the Study

This study consists of a systematic investigation and evaluation of the resources, facilities and services of the library and information units of the organizations engaged in agricultural education, research, extension and development in the State of Kerala. The existing resources, facilities, their accessibility and utilization are assessed with an objective to ascertain the need and possibilities for further improvement, effective resource sharing, networking and extension of services to all concerned. Examining the factors of subject specialization of institutions, standardization and the status of automation for determining various areas for ICT application and resource sharing are other aims of this study. The investigation and evaluation have the following primary and secondary objectives.

1.4.1. Primary Objectives

The primary objectives are:

- a. to examine the existing facilities for resource sharing among the information systems in agricultural sector in Kerala;
- b. to examine how far access to international and national databases in agricultural sciences is available to the research institutes in the State;
- c. to assess the effectiveness of the existing systems and methods; and
- d. to determine the factors that affect efficiency and extension of information services.

1.4.2. Secondary Objectives

The secondary objectives of the study are:

- a. to define the aims and objectives of an agricultural and farm information system;
- b. to ascertain the feasibility of resource sharing and networking as also to determine areas where resource sharing can be resorted to with advantage;
- c. to propose a plan for establishing an agricultural and farm information system – computer communication network interlinking the agricultural research institutions in Kerala that can allow agricultural scientists in the State, access to up-to-date information; and
- d. to suggest the measures that can enable flow of results of research down to the grass root level to improve productivity in agriculture.

1. 5. Methodology

The sources from where the investigator first sought information about the organizations in the agricultural sector are Kerala Agricultural University, Farm Information Bureau and State Departments of Agriculture, Animal Husbandry, and Fisheries. More institutions were identified during further enquiry at the field.

The sample institutions are divided into three categories for the convenience of the study; major, minor and out steam institutions based on their resources, infrastructures and funding agencies. Minor institutions were further divided into two one coming under ICAR and KAU and the other group under various other organizations. Under minor institutions data on systems of the first group only is discussed. The coverage of second group is limited to interview of staff in charge of those organizations to extract information on accessibility of information required for their work, their ICT literacy and views

The study was conducted with mixed methodologies and instruments as presented in Table 1.5 to extract data from systems, managers and users.

Table 1.5: Methods and Instruments

Method	Respondents	Instrument	Mode	Sample Selection
Survey	Librarians of major institutions	Questionnaire-I on system resources and facilities	Post, Institution visit	30 randomly selected institutions from response to Q-I
Survey	Librarians of minor institutions	Questionnaire-II on system resources and facilities	Post, Institution visit	30 randomly selected from Q-II respondents
Interview	Scientists/staff in charge of institutions /divisions	Interview Schedule on Information accessibility, skills, and views.	Institution visit	Scientists randomly selected based on response to Q-I and II
Survey	Information users: scientists, students, extension workers	Questionnaire -III on accessibility, relevance and quality of services	Post, Institutions visit	All respondents to Q-III
Survey	Agriculturists/farmers	Questionnaire -IV in Malayalam, on accessibility, aptness etc	Home Local functions visit	All respondents to Q-IV

Basic data regarding the resources, facilities and services of the libraries of agricultural organizations were collected through a) a detailed questionnaire which is

appended as Appendix -1 for major institutions, b) a short questionnaire appended as Appendix -2 for minor and out stream institutions c) visits to these institutions, d) interview with librarians and or staff in charge of institutions and services, e) interview with members of the staff who were connected with the collection development, automation and services. The websites, annual reports and budget estimates of the institutes were also scanned.

Data relating to user's assessment of the library and information services from scientists, students, managers, extension workers etc were collected through a questionnaire appended as Appendix -3. The responses from farmers and the public were collected through a questionnaire in regional language appended as Appendix -4. Interviews with select groups of users and managers from the major institutions as well as scientists and staff in charge of Krishi Bhavans, Veterinary Hospitals, Cooperatives and other small organizations functioning at grass roots level were also conducted using Interview Schedule appended as Appendix -5. The samples used for the study, constitute 77 librarians and officers in charge of information systems (Questionnaire I and II) 437 users that include scientists, students, and extension workers (Questionnaire -III), 220 farmers and the public (Questionnaire -IV), and 300 scientists and staff in charge of organizations at grass roots level interviewed for the purpose.

1. 5.1. Constraints

The information required for the evaluation was not available in any organized way at most of the institutes. The information, provided by many libraries were incomplete and had to be supplemented as well as updated from the Annual Reports of their parent institutions as well as from handbooks, brochures etc related to those institutions. A good deal of data had to be collected from the librarians and the staff of the libraries concerned through formal and informal communications and personal interviews. The study being a qualitative evaluation of the systems the librarians or officers in charge of information services were normally found disinclined to provide details thinking about the observations and comments the study may make about the systems managed by them. Many visits have become essential to get the confidence of the officers. As the libraries do not maintain records related to aspects like daily visits

of users etc, the data provided by the librarians is only approximate. The librarians and staff who provided the information from concerned institutions have to collect required data from various records that are in-house publications with limited copies, mimeographed reports and files, registers and papers from different divisions. This was time consuming. This support, which required tedious work from, the part of the staff from selected institutions helped to extract information sought through the system questionnaire up to some extent. Various visits to these institutions helped in getting the responses to the remaining questions as well as enabled the interviews with scientists at the managerial level for the study.

1. 6. Hypothesis

The following hypotheses are formulated.

- a) the agricultural information and extension services in Kerala fail to utilize the available resources for providing need based services to various categories of users in the agricultural sector;
- b) there is lack of efficient infrastructures for information management, access and dissemination as well as effective programmes for coordination of the information services in the agricultural sector of Kerala.

1. 7. Region and Scope

Kerala is taken as the geographical area within which the study is limited. Kerala is situated between the Western Ghats and the Arabian Sea. It was formed on November 1, 1956 as per the State Re-organization Act 1956. It comprises the earlier princely States of Travancore and Cochin except four taluks left to Madras State and Malabar province of the erstwhile Madras Presidency. It stretches from Manjeswaram in the north to Parassala in the south. It is 576 Kms in length and 32 to 125 km in width.³² The region is bounded by Western Ghats in the east, the Arabian Sea in the west, Tamil Nadu in the south and Karnataka in the north. The topography of the State is highly undulating starting from the hill tops covered with thick forests of the Western Ghats on the east along with the Nilagiri hills, from where it gradually slopes

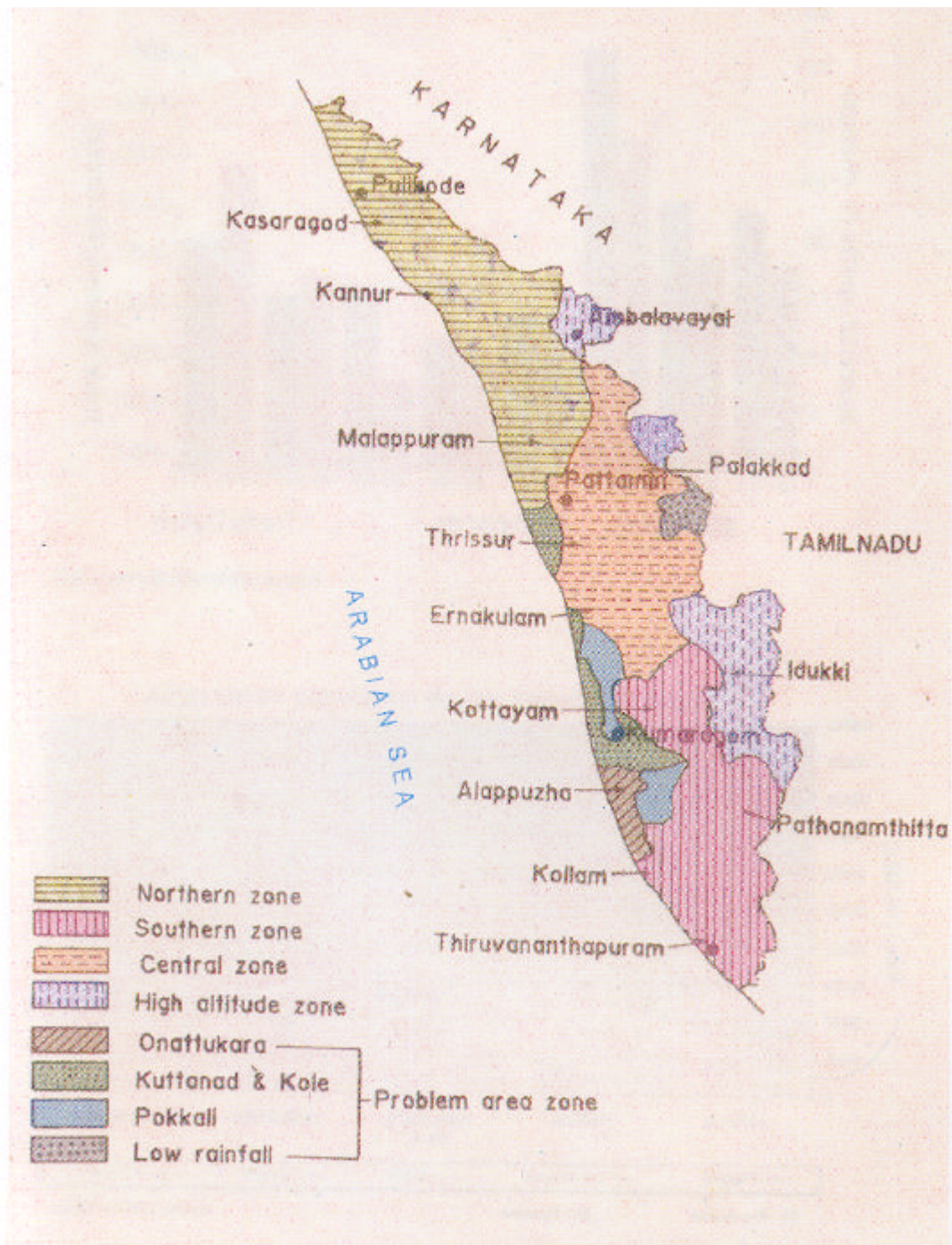


Figure 1.2: Agro Climatic Zones of Kerala (Source: Kerala State Land Use Board)

down to the valley, the small hillocks and back waters before finally ending on the sandy beaches of the Arabian Sea in the West.

Physiographically Kerala can be divided into three natural regions – highland, mid-land, and coastal low – land. These divisions form parallel belts running across the length of the State. The high land consists of the Western Ghats and high mountain peaks, long spurs, extensive ravines and dense and evergreen forests. The mid land consists of undulating terrain, rivers, valleys and plains and lies between high land and low land. The low land runs along the 576 Kms coastal belt of the Arabian Sea, charactering beach ridges, beaches, lagoons and sandy coastal belt³³.

For agricultural purposes these regions are technically divided into five agro climatic zones. They are Northern, High range, Central, Special and Southern Zones. There are some problem related zones also. Research institutions and stations dealing with a specific agro climatic region are normally established in the concerned region. The agro climatic zones of Kerala are presented in Figure 1.2

Northern Zone comprises the districts of Kasaragod, Kannur, Kozikode and Malappuram. The High range zone is a sub region of Western Ghats lying at an elevation of 750 meters above sea level. The region comprises of the hill districts of Wayanad, Idukki, Nelliampathy and Attappady range of Palakkad, Thannithodu and Seethathodu Panchayats of Kollam as well as Peringammala, Aryankavu, Vithura, Amboori and Kallikadu Panchayats of Thiruvananthapuram districts. The zone is mainly agrarian with a predominance of high value perennial crops. The major crops are coffee, paddy, pepper, cardamom, rubber, tea, ginger, tapioca etc. The climate prevailing in the zone is by and large mild subtropical, which is conducive for growing both tropical and subtropical fruits. The three revenue districts located in Central Kerala viz Palakkad, Thrissur and Ernakulam constitutes the Central Zone. Majority of the soils in the zone are laterite in nature, coastal alluvium, riverine alluvium and brown hydromorphic soils and acid saline soils are found in the coastal tracts and black soils in Chittoor Taluk. The Southern Zone comprises of the districts of Thiruvananthapuram, Kollam, Alappuzha, Kottayam and Patthanamthitta except problem areas of Alappuzha and Kottayam districts. The special and problem areas

are regions demarcated as areas where agriculture is hazardous and exposed to vagaries of nature in all the above zones.

The State gets rains from the southwest and northeast monsoons. So the rainfall is almost spread throughout the year. This continuous rainfall and the undulating nature of the land bless the State with about 44 rivers³⁴. The State has also ample ground water potential. It also has many backwaters, which includes lakes and ocean inlets. All these aspects are favorable to agriculture

The State measuring 38, 863 Sq.Kms comprises only 1.8 percent of the total geographical area of the country and is one of the smallest of the Indian States. The state sustains 2.9 crore population. The forest area account for 28.63 percent of the total geographical area. The records of land use reveal that the net sown area is around 59 percent³⁵. Selected indicators³⁶ of progress in agricultural sector of Kerala are presented in Table 1.6.

1.7.1. Present Agricultural Scenario of the Region

Kerala cultivates a large variety of vegetations of food crops and non-food crops. The food crops include cereals, pulses and tuber crops. The non-food crops are diversified in nature namely, oilseeds, cash crops, perennial cash crops, spices and plantations, rice, jowar, ragi and other millets. The rice is the predominant food crop. Tuber crops; tapioca a near substitute for rice and sweet potato are extensively cultivated. Coconut and areca nut constitute the perennial tree crops. Kerala's spices are pepper, chilies, ginger, turmeric, cardamom and cocoa. The plantation crops are tea, coffee, rubber and cashew nuts. Coconut is the major oilseed of the State. Besides coconut, other oilseeds are groundnut and sesamum. The State has widespread tobacco cultivation. In addition to these, horticultural crops like banana, mango, jackfruit, and pineapple are grown in different parts of the State. Vegetable cultivation is also on the rise.

Since the British Raj Kerala has inherited a unique crop pattern that lays stress on cash crops. The agro-climatic condition of the State is biased in favor of cash crops. In the colonial period, the Europeans initiated plantations in the highland to

Table 1.6 Selected Indicators of Progress in Agricultural Sector of Kerala

SN	Item	Unit	Kerala	India
1	Geographical area	000 Sq Kms	38.58	3287.00
2	Population	Lakhs	318.00	10270.00
3	Density of population/Sq.Km	No	819.00	324.00
4	Sex Ratio – Female/1000 male	No	1058.00	933.00
5	Growth rate of population	%	09.40	21.35
6	Literacy rate	%	90.92	65.38
7	Per capita income at current prices	Rs	21046.00	16487.00
8	Percentage share of State income from agriculture (2000-2001)	%	21.38	34.00
9	Gross cropped area	Lakh ha	30.22	1908.00
10	Net area sown	Lakh ha	20.06	1420.00
11	Net area sown as percentage to geographical area (2000-2001)	%	56.78	43.45
12	Area under food grains	Lakh ha	03.59	NA
13	Percentage of area under food crops to total cropped area	%	11.88	38.13
14	Percentage of area under non food crops to total cropped area	%	88.12	61.87
15	Annual growth rate of food grain	%	NA	05.51
16	Per capita food grain production	Kg. annum	21.60	210.00
17	Production of rice	Lakh Tonns	07.51	895.00
18	Productivity of rice		2162.00	1930.00
19	Gross irrigated area	Lakh ha	04.58	732.75
20	Gross irrigated area as percentage to gross cropped area	%	15.15	38.65
21	Net irrigated area	Lakh ha	03.81	551.43
22	Net area as irrigated as percentage to net area sown	%	17.27	37.63
23	Fertilizer consumption per ha	Kg	76.25	87.18
24	Value of forest product per ha of forest area	Rs	1343.00	56.00
25	Number of livestock	Lakh No	55.77	4708.24
26	Production of milk	Lakh Tonnes	165.50	NA
27	Production of eggs	Million Nos	2002.00	30150.00
28	Production of meat	1000 Tonns	165.50	NA
29	Production of fish	Lakh Tonns	06.68	56.60
31	Membership of primary agricultural credit societies	000 Nos	11421	96476

exploit the agro-climatic condition of the State. The Rajas of Travancore also promoted the cultivation of cash crops to tap the benefits of European capital, technology and expertise.

The State has a high intensity of cropping and has already utilized about 58.31 per cent of its total geographical area for cultivation and an increase in this will be at the cost of other development purposes³⁷. For the last few decades, the net area sown has shown steady but marginal increase.

Predominantly, a cash crop economy, Kerala grows a large variety of high value cash crops to earn valuable foreign exchange. Of these, the cultivation of some crops like coconut, pepper, rubber, cardamom, ginger, etc. enjoy a higher concentration. In pepper, Kerala's contribution is 97 per cent of India's production, rubber claims 85 per cent, and cardamom enjoys 70 per cent, ginger 60 per cent, and coconut 43 per cent. There was a rapid improvement in the area under different cash crops since 1972. During the period area under coconut cultivation increased from 7.45lakh ha to 9.14lakh ha and rubber from 0.62 lakh ha to 4.43lakh ha, pepper from 1.16lakh ha to 1.88lakh and coffee from 0.34lakh ha to 0.82lakh ha.³⁸ In addition to the extension of the area, the production and productivity of majority of the cash crops have gone up sufficiently to attract more attention over the years. But productivity of important food crops has declined. Year wise production of important crops in Kerala is presented in Table 1.7.

Table 1.7: Year- wise Production of Important Crops in Kerala

Crops	1991-92	1993-94	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01
Rice	1060.35	1003.94	871.36	764.61	764.61	726.74	770.69	751.33
Tapioca	2670.55	2602.20	2500.11	2691.12	2741.70	2810.93	2531.75	2586.90
Coconut*	4641.00	5197.00	5155.00	5274.00	5209.00	6672.00	5680.00	5536.00
Arecunut*	13116.00	13643.00	17429.00	17175	87.03	92.48	83.34	87.95
Pepper	50.31	49.85	68.57	56.55	56.55	64.34	47.54	60.93
Ginger	50.27	37.68	46.45	46.37	43.62	49.93	41.34	42.70
Cardamom	03.45	04.43	05.38	05.38	05.29	05.30	06.59	07.58
Cashew nut	104.60	87.51	82.76	68.95	56.89	56.55	65.54	66.18
Rubber	343.11	408.31	474.56	474.58	541.94	559.10	572.80	579.87
Coffee	20.04	46.24	45.00	45.00	50.66	61.15	60.47	70.55
Tea	66.08	61.49	64.80	64.80	65.23	68.37	61.96	69.13

*Production in 000 tonns. * million nuts*

Since the 1970's the area under food crops in general and rice in particular has been declining at an alarming proportion due to a host of reasons. The area under rice, the staple food of the State, declined from 8.74lakh ha to 5.03lakh ha between 1991-92 and 1998-99. The production of rice came down from 10.60 lakh tonns in 1991-92 to 7.51 lakh tonns in 2000-01³⁹. The cultivation of rice is not a relatively profitable affair due to its high cost of cultivation, including the wage cost. The occupational mobility has taken place in favor of the tertiary sector among the second generation of farmer tenant families. This has restricted the mobility of family labor for the continuation of cultivation. The implementation of land reforms since the 1970s by covering paddy field under the provisions of ceilings on land holdings has adversely affected the food crop cultivation in the State. Sub-division and fragmentation of paddy lands through generations have discouraged the intensification of food crop cultivation and encouraged the pattern of fallowing of the paddy lands.

Given lucrative profits, paddy growers are turning to cultivation of cash crops like rubber, coconut, areca nut and other garden crops. The wages of laborers have risen due to the intervention of militant trade unionism. In addition, the cost of other inputs has also increased. The shortage of labor is another important reason for this change in crop pattern. Non-availability of information and inputs, including high yielding varieties of seeds, are other factors that force paddy growers turn to cash crops.

Since the 1980s Kerala has witnessed another trend, the conversion of paddy farms for non-agricultural purposes due to the high value offered for paddy land. The processes of cash crop orientation and conversion of paddy land for coconut gardening have undergone a serious set back since 1996-97 due to a sharp decline in the prices of coconut. The area under coconut cultivation has shown a downward trend from 9.14lakh ha to 8.82lakh ha from 1995-96 to 1998-99. This has adversely affected our agricultural sector.⁴⁰

The homestead cultivation is the unique feature of Kerala crop pattern, which is the result of the settlement pattern of the people that exists in the State. Due to successful implementation of land reforms and subdivision and fragmentation of

holdings, a majority of the land holdings are small, being less than one hectare. The number and area of operational holdings in Kerala is presented in Table 1.8.

Table 1.8: Number and Area of Operational Holdings in Kerala 1995-96

SN	Class and Size of Holdings	Number (Lakhs)	%	Area (Lakhs ha)	%
1	Marginal Less than 1 ha	59.16	93.96	09.11	53.24
2	Small 1-2 ha	02.62	04.16	03.50	20.46
3	Semi medium 2-4 ha	00.95	01.51	02.43	14.20
4	Medium 4-10 ha	00.20	00.31	01.04	06.08
5	Large Above 10 ha	00.03	00.04	01.03	06.02

With such smallholdings, the growers prefer cultivation of a number of horticultural and perennial tree crops like coconut, areca nut, mango, jack tree, banana tree, etc. to a single crop. The agro-climatic and social conditions of the State are highly suitable for the cultivation of horticultural crops and have led to the shift away from food crops.

1.7.2. Organizations in the Region Covered

Kerala has one State Agricultural University (SAU) with ten constituent colleges and about 40 research stations spread over the length and breadth of the State. Then there are also many agricultural research/development organizations under State Government, Central Government, ICAR and other agencies. State Government also has its Farm Information Bureau (FIB) and Departments of Agriculture, Animal Husbandry, Poultry, Fisheries, Food, Dairy etc looking after concerned areas of agricultural sector.

The investigation and evaluation of the library and information systems of all the organizations related to the agricultural sector of the State is a very vast subject. It will not be desirable to study in detail the libraries of those agricultural organizations and departments, where libraries or information divisions in the real sense of the term

hardly exist. In view of these factors, the present work confines its scope to all resource rich institutions in the agricultural sector and selected samples of various types of minor libraries inside and out side the sector in the State.

The library and information systems of institutions covered in detail are the following:

- a) Kerala Agricultural University (KAU) and its eight constituent colleges,
- b) Five ICAR Institutes existing in Kerala
- c) Selected institutions having good information collections on Biotechnology, forestry and other natural resources and agriculture related aspects.

For the remaining minor institutions and randomly selected out stream institutions relevant, statistical data available on resources and select aspects only is studied. But considering the horizontal and vertical levels of activities and programmes in agricultural sector as much data as possible on information resources available is collected and presented in this study from representative sets of libraries belonging to various organizations with activities relevant to agricultural sector. Such representative sample in the present study includes the following libraries.

- a) Departmental libraries of biotechnology, biochemistry, zoology, botany etc of University of Kerala, Mahatma Gandhi, Cochin, Calicut and Kannur.
- b) Research Station libraries under KAU and ICAR.
- c) Rural Libraries with Agricultural Information Service Corners, Krishi Bhavans and Veterinary Hospitals.
- d) Libraries or Information Services units under Agricultural Department of the State.
- e) Krishi Vijnana Kendras run by KAU, ICAR and NGO's.
- f) Libraries of Government Departments, and autonomous organizations with relevant information materials like, Legislature, Sahitya Akademy, State Institute of Languages etc outside agricultural sector.
- g) Libraries of NGOs dealing with agriculture, animal husbandry, fisheries, rural development and cooperation.

The libraries of constituent colleges of KAU came into existence in seventies, and those of other organizations during the next three decades. The Central library of KAU came into existence in second half of nineties. Of the other libraries some have limited resource-sharing facilities. Some are supported only by Central Government, some partially by ICAR and some partially by State and Centre. These factors and variables can reveal interesting aspects about their growth, status, facilities and services.

1.7.3. Aspects Covered

Details about the strength of scientists, collection of books, journals and electronic publications, ICT equipments, budget, etc of the institutions covered by the study are presented in different tables. The list of foreign journals, databases, costly reference sources in digital form, etc are presented in appendices. All these institutions covered came into existence during the period from 1970 to 1995. The strength of users vary from 20 to 1000

The present study covers in detail only the aspects of the libraries in agricultural organizations, which are relevant to resource sharing and networking. Other aspects have been discussed only in a general way. Detailed evaluation of the selected libraries of Kerala under KAU, ICAR and State and Central Government has been done in regard to the following aspects.

- a) Mandate: Objectives, Functions
- b) Organizational Setup and Budget
- c) Staff: Professionals, Non Professionals
- d) Collection: Books, Journals, Documents in Digital Media etc.
- e) Infrastructure: Equipments, Building
- f) Automation and Networks.

1. 8. Significance of the Study

Agriculture is the lifeblood of our economy. It contributes to nearly 25% of Gross Domestic Product and about 70% of the population is dependent on agriculture

for their livelihood⁴¹. So growth in the productive capacity of the agricultural sector is crucial to the survival and development of the country. Technological transformation that can boost agricultural production consists of improvements in material inputs, farming techniques, storage technology marketing and research. Effective integration of these factors is tied closely to adequate information flow, which can be ensured only by an efficient agricultural information system. So evaluation and improvement of existing information system is very crucial for agricultural growth.

There are a number of studies on development of information systems, resource sharing and networking in the context of special libraries serving engineering, health science, management, and other areas. There are also many studies related to agricultural information systems in foreign countries especially USA, UK, Russia and China. But there are only very few research works on agricultural library and information systems of India and their networking at the national or State level.

An in-depth study of the information services for agricultural sector in a region requires sufficient time for examining carefully the working of various types of libraries existing in that sector of the region. The effect of various factors, which interact to help or retard their operation, is to be noted in order to arrive at some sound judgement. An assessment of the achievements and failures of such information systems are essential to formulate realistic norms for their healthy growth. This needs a systematic study of the resources, organisation, and services of various representative libraries serving different functions related to agriculture at its various sub sectors in the region. The present research work has been undertaken with this motive.

No earlier studies have dealt comprehensively with an integrated view the library and information system supporting agricultural sector as a whole in the country or a State. Available studies limit their scope within a specific research institution, selected universities, and some sub sector or on building theoretical frameworks. The present study is the first attempt towards an in-depth investigation and evaluation of the resources, facilities and services of the libraries serving the different aspects like education, research, extension and development of the

agricultural sector of a State. It covers sample libraries of different levels and categories, from different sub sectors and functional areas.

The study advocates resource sharing in the areas of journal subscription, specialized databases and HRD for ICT, which can contribute to maximizing the utility of resources at our disposal. The suggested model for resource sharing and networking at State level is a very important outcome of the study. The study proposes the establishment of Agricultural and Farm Information Network for Kerala AGFISNET-K. The network configurations standards for software and hardware as well as the HRD programmes required for the AGFISNET-K are recommended based on tested functional models from those covered by the study with technology options if any that has become essential.

AGFISNET-K can serve as a model for other State agricultural information systems also. The following of such a model and standards recommended by the present study can enable the development of State level agricultural information system in India on a uniform pattern and their successful coordination at national level for effective integration under national AGFISNET.

1.9. Organization of the Study

The study is organized under seven chapters including this introductory Chapter. The present Chapter, which is the introductory one, discusses scope of agricultural science, nature of agricultural information as well as importance of information as an input for agricultural education, research, extension and development. The definition of the key terms, objectives of the study, methodology, the hypothesis, region and scope, samples used, the scheme of work and constraints faced and the relevance and importance of the topic are also discussed in this chapter.

In Chapter 2 literature generated in India and abroad on various aspects of agricultural library and information systems is surveyed. It includes books, reports, dissertations, seminar presentations and journal articles. Most studies have occurred in foreign countries and they deal with settings of concerned countries.

Chapter 3 discusses the development of infrastructures in agriculture sector in the country and in Kerala in a historical perspective. It makes a detailed assessment of institutions and organizations of Kerala engaged in agricultural education, research, extension and development and their library and information service units. The mandates of the institutes, the areas where research is going on under them and other aspects that may reveal their information requirements are studied. This is essential for effective planning of information systems and resource sharing and networking programmes.

Chapter 4 presents a comparative evaluation of the selected libraries and information systems in agricultural sector of Kerala. This chapter evaluates the mandate, budget, collection, infrastructure, networks and services, quality and quantum of staff, physical facilities, and computer and communication systems. Qualitative evaluation of the system and services based on results of survey conducted among system managers and users is also presented.

Chapter 5 makes a detailed investigation and evaluation of information resources available under six different sub sectors of agriculture; Crop Sciences, Veterinary Sciences, Fisheries, Forestry, Agricultural Economics, Agricultural Engineering etc. Institutions that are to take leadership in resource sharing in each of these areas are identified. Important aspects in which resource sharing is essential and cost effective are traced out. How institutions in the sector can fill the gap between what is published in agriculture and what is made available to their users is the aim of the discussion.

Based on the analysis in Chapter 5 of the information resources available in Kerala under different sub sectors of agriculture and their usage and possibilities for extending services Chapter 6 puts forward the proposal for establishing an Agricultural and Farm Information System (AGFIS) for Kerala. The functions of AGFIS, the categories of information to be included, the user categories and their training needs, levels of implementation etc are outlined. Phasing and timeframe for implementation are suggested. Standards required, network options, architecture etc are discussed. Organizational and management aspects related to implementation, functioning and sustainable development of AGFIS is presented.

Chapter 7 is the concluding chapter, which gives the summary of the findings and discussions. It also puts forward the necessary recommendations for improving information services in the agricultural sector of Kerala.

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Chapter 2

REVIEW OF LITERATURE

2.0. Introduction

Even though libraries existed throughout the last two millennia special libraries were of recent origin. Ancient libraries were of the nature of public libraries, which remained normally attached to educational or religious institutions. Libraries serving specific category of users especially on a specified subject area became common only in the second quarter of the twentieth century. Among them libraries serving agricultural sector came into existence only after 1950. So literature dating before that on agricultural libraries is very uncommon.

In India the first initiative to study agricultural library and information system was in 1957 after the establishment of Indian Council of Agricultural Research (ICAR). It was the Report of the Shaw and Rao Committee constituted by ICAR on library and bibliographical services for agricultural teaching and research in India. A search for literature on agricultural information services conducted at libraries of major agricultural institutions in India like IARI at Pusa, ICAR at New Delhi, National Library at Calcutta, NAARM and MANAGE at Hyderabad and Agricultural University Libraries of West Bengal, Maharashtra, Andhra Pradesh and Karnataka along with searches in CABI Abstracts, LISA, AGRIS and Internet unearthed only less than 60 papers, reports, dissertations and books pertaining to India. Total items about all countries of the world are also less than 350 on aspects related to agricultural information services. Out of the 300 PhD and MLISC dissertations in Library and Information Science done in India up to 2000 only 2 PhD Dissertations and 20 MLISc dissertations were related to library and information services in agriculture related areas.

The present study involves evaluating the existing library and information services in agricultural sector in total of a State of Indian Federation. The study has to

cover different types of libraries at different levels in agriculture and related fields existing in the region and various aspects of these libraries. The objective is to find out how far they can use existing systems and methods to fulfill the information requirements of the sector. A study covering all types of libraries in agricultural sector of any region of India is not presently available. But studies on libraries serving specific sub sectors of agriculture, individual libraries, specific categories or their specific aspects are available. They are also relevant to this study because they examine some aspect individually which is a part of the whole; the target of this study. Hence such studies are also surveyed in this review.

The present study covers related studies on different aspects of agricultural and farm information systems and services. Various primary and secondary sources, both published and unpublished have been examined for this research work. A select list of important works; published and unpublished consulted or made use for this study is given in the bibliography at the end. Different aspects studied by earlier researchers are reviewed here

2.1. Information for Agricultural Development

Randhawa's *History of Agriculture in India*,¹ and Agrawal's *Indian Agriculture: Problems, Progress and Prospects*,² provides a birds eye view of agricultural sector of India in a historical perspective. Pillai's *Agricultural development in Kerala*³ and Prakash's *Kerala Economy: Problems and prospects*⁴ give brief introduction to the agricultural scenario of Kerala and its problems.

Devarajan in his paper on *Information technology for Agricultural Development*⁵ discusses the importance of information systems for agricultural development. The paper points out that our population goes on increasing. Our annual agricultural production fluctuates due to weather, pests and plant diseases. So we have to take measures based on research to stabilise and improve agricultural production. Land available for cultivation is also limited. It goes on decreasing due to consumption for other purposes. Production can be increased only by qualitative improvement in farming, which requires improved agricultural production technology. This can be made available only through efficient research and

development programmes. Research efficiency as well as transmission of information generated in the lab to the farm depends on effective information services to the scientist and the farmer. The paper concludes that qualitative library and information services are crucial to agricultural development.

Deshmukh in his study *Role of an agricultural university library in technology transfer in agriculture*⁶ evaluates contribution made by the Indian agricultural libraries for agricultural education and research. It justifies the investment of public funds on them by their dissemination of research information that help to adopt modern technology for increasing agricultural production. The study emphasizes that to sustain the pace of research and development in agriculture government support for agricultural libraries and information services needs to be ensured.

Deshpande's study *Role of agricultural libraries in dissemination of agricultural information*⁷ discusses the significance of agricultural libraries. Explains the need for dissemination of agricultural information to different categories of users in agricultural sector to ensure quality and speed of development. The paper stresses the importance of documentation services in the field of agriculture.

Hayes in *The role of libraries in technology transfer for agriculture*⁸ examines the economic situation of the US and the measures adopted in agricultural sector to improve its competitiveness in the global marketplace. Information is viewed as an economic resource and thus the role of libraries and information professionals are perceived to be important to the technology transfer process. The conclusion of the study is that information is a most important constituent for improving productivity in agriculture.

Popov in his study *Disseminating agricultural information under conditions of a market economy*⁹ presents an analysis of the present state of Bulgarian agriculture, with proposed policies for reform. The study opines that the role of information services to maintain the quality and growth of production and marketing in agriculture is unique.

Sandhu and Singh in *Library services to agricultural research scientists*¹⁰ outline the work of agricultural librarians. It emphasizes the importance of libraries in transmitting information to farm. Explains how efficient information support can increase quality and relevance of the work of agricultural research scientists.

Eswara Reddy in *Agricultural information transfer in India*¹¹ identifies that transfer of agricultural technology is a prerequisite for increasing productivity. Reddy evaluates the decentralized information services attached to agricultural universities and research institutes, which cater the needs of teaching, research and extension staff. The study outlines the measures introduced by State and Central governments, agricultural universities and voluntary organizations to disseminate agricultural information. The programmes covered are national demonstration programmes; the 'lab to land' programmes; the training and visit system; and farm information communication centers.

Nwali in *Agricultural information provision in Nigeria*¹² discusses various agricultural information services in Nigerian universities and other institutes. These institutes geared producing adequate manpower required for Nigeria's agricultural sector. The study points out that technology transfer through information services is vital to agricultural sector to increase food production to feed the country's growing population. The study establishes that agricultural information system is necessary if the country is to attain self-sufficiency in food production.

Shrimali in the study entitled *An agricultural library-its purpose and functions*¹³ identifies that the agricultural library is a vital link between research and practice. To control the increasing amount of technical literature, the library must be well administered, well organized and well developed. Agricultural librarians should gain good knowledge of agriculture and related sciences. They should be on par with agricultural scientists and teachers.

Shill's study on *Information policies and equitable access to electronic government information: The case of agriculture*¹⁴ addresses the question of free access to government information in agriculture. Issues considered include; the impact of electronic technologies on existing dissemination structures, the policy shift

toward privatization of information dissemination, and factors influencing agricultural information policies. Presents recommendations to expand access to information in electronic formats without segmenting the user public along income lines.

The study by van Niekerk, *Specialist information provision: The agricultural model*¹⁵ points out that information in agriculture is necessarily influenced both by the features of the discipline and by the characteristics of the information generators and users. The broad range of information relevant to agriculture makes libraries a major player in agricultural development. There is considerable variation in educational levels, language and access to libraries among agriculturists. The agricultural library has to effectively re-pack agricultural information in ways compatible with specific user needs.

Svorenova's paper *Organization of the delivery of scientific, technical, and economic information to the sector of agriculture in the Slovak Republic*¹⁶ describes the role of information services in agricultural production, education and development. The study explains that by giving due importance to agricultural libraries in Slovakia, government has contributed immensely to the progress of agriculture in the country.

Ana's paper *Information for research on sustainable agriculture in tropical Africa: A collective challenge*¹⁷ describes the development of agricultural information systems in Africa and their contribution for development. Reviews the generation and use of agricultural information in the region. The relationship between information generation, repackaging and the users of the information is discussed. The effect of information on improved methods of farming and cattle rearing is examined.

Mbwana in a study *The role of agricultural information in research and training in Tanzania*¹⁸ discusses the importance of agricultural research and training in development. The study explains the need for the free flow of agricultural information to agricultural scientists for their efficiency in research and training activities.

Gyurk's study *Challenge for Hungarian agriculture: A new information infrastructure*¹⁹ explains the role played by scientific and technological progress in Hungarian agriculture. This has resulted in the transition of the country from a socialist to a market economy. The study opines that development of an agricultural information infrastructure can improve research and farming methods and will contribute to food self sufficiency in the country.

2.2. Agricultural Libraries and Information Systems

2.2.1. International

Hirst's *Information services on agriculture in industrialized countries*²⁰ does a historical survey of agricultural information dissemination projects. In the UK, local agricultural societies were the earliest purveyors of information. The earliest State-financed body for promoting agriculture was the Board of Agriculture, which is noteworthy for its publication *Annals of Agriculture* (1760-1822), a county-by-county state-of-the-art review of developments. The early Twentieth century saw the growth of agricultural research stations, particularly in the USA. Also national advisory services, and government-supported research councils, similar to Agricultural Research Council in Britain came into existence. Current development in agricultural information services includes the use of computer technology, and the establishment of the international information systems like AGRIS. The study opines that in future abstracting service will support current awareness. The full-length original will be supplied only on demand.

2.2.2. Specific Countries

Lassanyi's study *Information centers of the National Agricultural Library, U.S. Department of Agriculture*²¹; reviews the work of the eleven specialized information centers of the National Agricultural Library (NAL) of the United States Department of Agriculture (USDA). It also evaluates facilities for access to the NAL's databases; publications; and information. Howard's papers *The role of the National Agricultural Library*²² and *The National Agricultural Library as a source of agricultural information*²³ describes NAL, its clientele, collections, acquisitions, its

machine readable bibliographic database, and cooperative-cataloguing programmes. Discusses application of advanced information technologies. This includes merging of microcomputer and videodisc technologies, CD-ROM, and the electronic bulletin board. Kemp's *The strategic planning process at the National Agricultural Library*²⁴ reviews the strategic planning process, at the NAL, initiated in 1993.

Craig's report on *Information systems in UK agriculture*²⁵ draws attention to the main findings of British Library Research and Development Department on the topic. Discusses agricultural information in terms of; organizations generating information, users, user education, presentation of information and mechanisms and systems for information dissemination.

Namponya's *Agricultural development and library services*²⁶ analyses the sources of agricultural information, for farmers in Malawi. The study revealed 3 major sources; extension workers (59%), radio (27%), and friends and neighbors (9%). 1,400 extension workers made over 240,000 contacts with farmers during one year. The role of libraries in the indirect support of agriculture, by means of support for functional literacy programmes, is stressed by this study.

Goia's *Agricultural higher learning libraries: Present and hope*²⁷ describes the library and information services under the University of Agricultural Sciences in Cluj-Napoca, Romania. The collections have few western publications and a limited number of materials from the former USSR and the socialist countries. The study found that improving the services and computer applications have been hindered by lack of computers, reprographic equipments, and insufficient funding. Another study by Goia *The state of the University of Agricultural Sciences Library, Cluj-Napoca, Romania*²⁸ gives a brief report on that University Library. It notes the developments taking place in the faculties of the university and the problems this expansion causes to the university central library. Discusses also the lack of storage space, the beginnings of automation in the library and programmes for the exchange of publications. The pressures placed on the library by the crisis of transition from the centralized economy to the free market are also discussed.

Houng and Lewis devote their study *Information services for agriculture in Dominica*²⁹ to a small agricultural developing country. They examine the status and development of the information services for agriculture in Dominica. They conclude that cooperation and collaboration with other countries, possibly making better use of new information technologies, is a strategy for very small islands in the Caribbean, which should be encouraged.

Szabo's *Present and future of the Hungarian agricultural special library and information services*³⁰ describes the historical evolution of Hungarian special libraries. The development of scientific and technological information services in the field of agriculture in Hungary is described. Considers the pivotal role of the National Agricultural Library.

Shibanda's paper *Information for agriculture in Kenya*³¹ outlines the aims of the Kenya government with regard to agricultural development. It describes the role, aims, structure, and problems of the Agricultural Extension Services Division (AESD) of the government. Discusses the role of agricultural research and methods of disseminating information to farmers. The AESD is responsible for the Agricultural Information Services. It comprises a National Agricultural Documentation Center, an Agricultural Information Center and a Central Library with 93 branches in provincial and district offices, Agricultural Institutes and Farmer Training Centers. In addition, there are 32 libraries in agricultural research stations. Describes the aims, activities and problems of these services.

Gessesse's *Agricultural library and information development in Botswana*³² provides a profile of the agricultural library and information development in a Sub-Saharan African country--Botswana. Areas for regional cooperation in agricultural information work among the countries within the region have also been pointed out.

Alemna's study *Agricultural information provision in Ghana: The role of the library*³³ discusses the difficulties of agricultural development due to lack of efficient information systems. Although Ghana is mainly an agricultural country, the provision of agricultural information has been inadequate. There is a wide gap between demand and supply of data. Highlights the various problems such as the unavailability of

reliable statistical information, deficiencies in local agricultural information sources and services. Discusses improved methods for disseminating agricultural information in Ghana.

Qiaoqiao Zhang's *Agricultural library and information systems in China*³⁴ traces out the agricultural development, and the reform of the rural economy in China that has brought about great changes, resulting in increased demand for information. Highlights inadequate performance of existing agricultural library and information systems. An effective system calls for systematic allocation of information resources, and efficient information dissemination, which implies sharing and networking among libraries. Emphasizes the importance of library networking. Pan Shuchin's *The Library of the Chinese Academy of Agricultural Sciences*³⁵ studies the library established in 1957, which is one of the primary sources of agricultural information in China. The Library possesses a collection of over 350,000 volumes, including 3,000 current periodicals. Developments in the 80s have led to an expansion of collections and services, interest in new technology, and several cooperative activities within China and with other nations.

Watanapongse's study *Kasetsart University Library: Thailand national agricultural information services, problems and prospects*³⁶ outline the role of that library in the agricultural development of Thailand.

Mahoney's paper *Problems facing agricultural libraries in Bangladesh*³⁷ assesses the libraries offering agricultural information in that country. The Bangladesh Agricultural Development Corporation, the Bangladesh Agricultural Research Center, the Bangladesh Agricultural Research Institute and the Bangladesh Rice Research Institute are covered. Examines the major problems encountered like lack of awareness of the importance of information to development; low status of information workers; lack of adequate remuneration for libraries; inadequate contact between information professionals; and poor training.

Bloch's study *Agricultural libraries of Nepal*³⁸ points out that agricultural research in Nepal is under pressure to help increase food production. The paper concludes that libraries are to be strengthened to support this by effective information dissemination.

2.2.3. Specific Foreign Institutions

Rama Tirth in his study *The National Agricultural Library*³⁹ traces the history and growth of the NAL of the US Department of Agriculture. The study covers the growth of its collections; development of library services; classification and cataloguing; past librarians and directors; facilities of the building; commitment to agricultural information work; development and use of modern methods of Information Technology; publications, including Bibliography of Agriculture; the special cataloguing and indexing system and the Agricultural Sciences Information Network (ASIN). NAL's role in national and international cooperative efforts is examined. Notes the library's leadership in the field of agricultural information communication.

Kadzhheva's study *Lenningrad Division of the Central Scientific Agricultural Library of the V.I. Lenin All-Union Academy of Agricultural Sciences*⁴⁰ examines the functioning of the oldest agricultural library of Russia founded in 1838. Its history, up to the present, is the chronicle of the development of agrarian science in the USSR. The importance of the library for the implementation of practical objectives in agriculture, a task that the State is facing is discussed. The role of the library as a depository of the world's knowledge in the field of agricultural theory and practice, as well as library's current status is discussed.

Rasinski's *The Central Agricultural Library and the National Information System on Food Economy in Poland*⁴¹ examines the functions of that library like acting as the main center of source materials; information dissemination; and materials distribution in Poland. The study also covers National Information System on Food Economy which deals with agricultural supply and the food industry; production of primary agricultural products (raw materials); and food processing and distribution.

Peihua's *The model library project and the new library of Beijing Agricultural University*⁴² examines the system of that library established in 1990. Describes its project goals, planning, layout and service provision and provides basic data on the building, service divisions and use of the library.

2.2.4. Indian Systems

In 1956, the Indian Council of Agricultural Research appointed a Committee, consisting of Dr. Ralph R. Shaw and Dr. D.B. Krishna Rao, to conduct a study of library and information services for agricultural teaching and research in India. The committee evaluated the library situation in agricultural education institutions in the country and put forward suggestions for improving the systems and services. This is to be considered the first study of library and information services in agricultural sector in India⁴³.

In 1967, the ICAR appointed the Indo-American Agricultural Library Survey and Study Team with Dorothy Parker as Chairman to conduct a survey and make recommendations for the improvement of the libraries of ICAR institutes and agricultural universities existing at that time. The committee reported that the condition of library and information services provided at these institutions were far from satisfactory.⁴⁴ The committee gave various recommendations for improving collection, staff and services.

In 1975, the Regional Agricultural Study and Survey Team sponsored by ICAR again studied the working of the libraries of agricultural universities. The committee also found that the conditions of the libraries were not satisfactory. The committee opined that effectiveness and quality of education, research, extension and use of improved methods in farming needs better information dissemination. The committee gave its suggestions for need-based development of collection, staff and services⁴⁵.

Prasher in his study *University library management*⁴⁶ has evaluated the functioning of five selected agricultural university libraries of India. The study examined the position of the library in the hierarchical system of the organization, the internal organizational set up of the library, the physical infrastructure like building, furniture etc, collection, staff, services and other aspects in detail.

Subbaiah's study *Conceptual framework for an Indian National Agricultural Information System (INAGRIS)*⁴⁷ is relevant to the present research work. This study

builds up a conceptual framework for implementing a national level agricultural information system. It made an assessment of the agricultural user's information needs through a representative sample survey. It identifies the sources and characteristics of Indian agro biological literature. It analyzed the important national and international secondary services in order to find out the percentage of coverage of Indian agro biological literature. It has also evaluated the existing resources and services of agricultural libraries in India based on a few major libraries taken as samples. Subbaiah also proposes a plan for the establishment of Indian National Agricultural Information System

Arjun Singh's study *Assessment of Resources, facilities and services in libraries of forestry institutions of India: A proposal for resource sharing and networking* covers the libraries in all institutions in India engaged in research and development in forestry and related aspects. The resources available at various institutions their accessibility and the need for resource sharing are emphasized. A model plan for establishing a network of forestry libraries is presented⁴⁸.

Jag Mohan Rathore's study *Marketing of information services and products in agricultural sector: A study of marketing management of the libraries of agricultural research institutes of ICAR* evaluates the priced library services like CDROM search and downloading, reprographic services etc provided from various research institutes under ICAR in India⁴⁹.

Adarsh N. Gokul's study *Information needs and use pattern of veterinarians in the IT environment*⁵⁰ does a detailed survey of the library and information services in that sub sector of agriculture. It traces out the genesis and development of Veterinary Science at global and national level. Describes Veterinary and Animal Husbandry approaches in India historically. Gives a bird's eye view of institutional infrastructures for Veterinary Science and livestock development in Kerala under the colleges, Animal Husbandry Department, Dairy Development Department, Kerala Livestock Development Board, Kerala Cooperative Milk Marketing Federation, Meat Products of India Ltd, and Kerala State Poultry Development Department. Examines the information requirements of teachers, scientists and researchers of veterinary colleges, veterinarians of Kerala State Veterinary Council, District Veterinary Centres,

veterinary hospitals, polyclinics, dispensaries and other livestock sectors in Kerala. Studies users approach to different types of information sources. Assesses the existing facilities and drawbacks in accessing information. Proposes a design for development of a veterinary information system for Kerala.

Bose's *Agricultural Information System*⁵¹ discusses India's Participation in AGRIS and CARIS. Describes the history, structure and service of AGRIS, and the projected aims and services of CARIS. The contributions of Research Project Unit of the Indian Council of Agricultural Research (ICAR) which handled both the FAO projects in India until a fully-fledged Agricultural Research Information and Documentation Center was established at ICAR is examined.

Parikh's study *Information system for agricultural sector*⁵² discusses the need for a computerized information system on agriculture in India, and isolates the potential users of such a system at all levels in the discipline. It also discusses the objectives of agricultural policy; important issues related to that; types of decision to be taken in determining policy; areas of research useful in the decision-making process; analytical frameworks appropriate to decision-making, and types and availability of data. Outlines an information system to aid decision-making in a series of agricultural policy issues.

Banerjee's *Agricultural libraries in Delhi*⁵³ studies the functioning of 13 libraries of Delhi including IARI library having the status of National Agricultural Library and ICAR library at their initial phase. All of them deal with agricultural and animal sciences or related subjects. Many special libraries with material on agriculture are also covered. It is based on a survey on staff strength and services offered. Points out the need for provision of more services in them in areas mandatory to them as well as the need for cooperation between these libraries.

Madan Kumar in his study *Indian National Agricultural Library System: A need of the hour*⁵⁴ examines the agricultural library and documentation facilities in India under ICAR. It proposes an Indian national system for agricultural information with the library of the IARI as the National Agricultural Library, at the center. The system will have regional centers, with standards for their facilities and functions and

provision for cooperation. The study also covers the nucleus of a National Agricultural Research Information Center (NARIC) formed in 1977 at the Institute of Agricultural Research Statistics. The study also suggests the responsibilities to be undertaken by NARIC in the proposed system.

Singh and Pal in the paper *Agricultural Research Information System*⁵⁵ describes the information system launched by ICAR with support from CGIAR. The system has five modules; Agricultural Library and Information System, Agricultural Personal Information System, Agricultural Finance Information System and Agricultural Research Management Information System and a system for HRD in IT. The Paper also provides detailed information on the support provided by ICAR under NATP to State Agricultural Universities, ICAR Institutes etc for information system development in their campuses.

Livingston and Raju in their study *Agricultural library services in Guntur District*⁵⁶ reports the results of a survey of library and information resources for agriculture in the district of Guntur, in Andhra Pradesh. Points out the inadequacies of library facilities, proposes schemes for effective utilization of information resources through library cooperation and networking to support agricultural research and education programmes.

Hutchinson's work *Conducting a library evaluation in Tamil Nadu*⁵⁷ gives a brief account of an evaluation supported by World Bank at the Tamil Nadu Veterinary and Animal Sciences University in Madras. It includes a description of the veterinary and agricultural interests of the area. The study involved a SWOT analysis of facilities, staffing, professional development, technical services, automation, equipment and telecommunications, services, management, budgeting and networking. Recommendations were made for improvements to increase access to and use of information technologies for providing better service and for more efficient technical operations. Administrative policies and plans for developing the library as a national resource for the biological sciences were also addressed.

Livingston's study *Agricultural university libraries in India*⁵⁸ reviews the growth of agriculture and agricultural education in India, noting the impact of Joint

Council of Agricultural Research. Discusses the growth of agricultural special libraries, university libraries, including dairy research, veterinary research and fisheries research libraries. Comprehensive data on 28 libraries is presented in a tabulated form. Concludes by discussing the contribution made by these libraries to promoting research and extension activities as well as for self-sufficiency in food production in India.

Lal's research on *Growth of agricultural libraries in India in the post-independence era*⁵⁹ traces the origin and development of agricultural libraries in India beginning after the creation of the Department of Agriculture in 1873. The recommendations of various committees having bearing on library matters, as well as the impact of information technology on the storage and retrieval of agricultural information is discussed. The study foresees a bright future for agricultural libraries with the growing trend for national and international agricultural networks. Lal and Singh's *Growth and development of agricultural university libraries in India*⁶⁰ discuss in a historical perspective their importance in acquiring and communicating information to scientists. The study discusses the library's role in research, planning and development as well as information analysis and consolidation.

Mangla's *Agricultural libraries in India: An overall view*⁶¹ is a keynote address given at the All India Seminar on Agricultural Libraries and Information Services, Pant Nagar, December 1988. It outlines the contributions of libraries to developments in the field of agriculture. Discusses the outcome of the Green Revolution and developments in the field of agricultural education. Emphasizes the role of agricultural libraries in the agricultural educational system. Suggests areas for further debate.

2.2.5. Indian Institutions

Alha's *The First Indian Digital Library in Agriculture*⁶² describes the modern information system named KAULIS developed at Kerala Agricultural University. It consists of a modern library building with a plug and play type of LAN, which can accommodate 65 users terminal at the initial phase. The digital storage facilities available have provision for 6.5 crore-printed page equivalent information, as well as

video and sound files. The unit has an IT laboratory with systems running on Windows NT and Digital Unix platforms, Facilities are available for familiarising NT, UNIX, BasisPlus/TechLib Plus, various CD Networking packages and other software. The hardware used include, Alpha servers, Meridian CD Servers, Jukeboxes, Davis Multimedia projector with facility for accessing digital library as well as receiving telecasts from different locations etc. The content of the library covers agricultural research information for the period from 1970 to present as well as full text databases developed in-house as well as acquired, including PhD thesis of the University. The study concludes by stating that the system should be made accessible all over the country so that unnecessary duplication at other institutions can be avoided.

Rajamma in her study *Information system for tuber crops cultivation describes*⁶³ the library and information system and services of the Central Tuber Crops Research Institution, Thiruvananthapuram, its regional centre at Bhuvanewar and AICRP centres in various agricultural universities. The libraries under the institute have a rich collection of journals, books, proceedings of conferences, workshops etc related to tuber crops. The study puts forward recommendations for the establishment of a Tuber Crops Information System.

The paper by Wells, *KAULIS Online information services on aquatic and fisheries sciences*⁶⁴ describes the library and information service offered from College of Fisheries, Panagad, Cochin. The digitised collection at the library contains approximately five lakhs records on research in fisheries and allied subjects. The library also has a holding of 1000 books, 50 theses, 1200 reports and 600 bound volumes of journals on fisheries and related areas.

Nagarajan's *Information System for spices research*⁶⁵ describes the library and information systems under Indian Institute of Spices Research at Calicut. The information and documentation activities of the institute are surveyed. Development of database on Spice genes on the rich germ plasma resources of various spice crops conserved at the institute, the web based resource named Spice prop on various protocols developed in-house for micro propagation of spices etc are explained. Other databases and software developed at the institute are also discussed in the paper.

Ahmed's *Agricultural libraries in Kashmir*⁶⁶ report results of a survey of agricultural libraries in Kashmir. Based on the data obtained physical facilities, acquisition policies, budgets, collection, technical procedures, members, circulation and information services, staff structure and status are examined. The study highlights factors requiring consideration and suggests ways and means for improvement.

Eswara Reddy in his study *Information services and document delivery in food and agriculture in India*,⁶⁷ presents an overview of the library services of 23 agricultural universities, 36 farm research institutes and the All-India Coordinated Research Projects (AICRP) under ICAR. Bibliographic control at the national level as well as the lack of a comprehensive document collection at a single center is discussed. Reviews the document delivery system that exists among the agricultural institutes in the country. Points out the need for using modern methods of reprography, telecommunications facilities etc for the delivery of primary documents. Emphasizes the need for a South Asian Agricultural Documentation and Information Center.

Bankapur's *Need for National Agricultural Information Center in India*⁶⁸ points out that as agriculture is India's first priority in the plans; to solve the present food crisis application of improved methods developed by research is essential. For that the establishment of a 'National Information Center' on agriculture to monitor the literature of the subject and liaise with other national institutes for disseminating it to the farm is very important.

Singh and Sandhu in their paper, *Punjab Agricultural University Library*⁶⁹ studies the library, which was built in 1972 on modular principles. It occupies 93,320 sq.ft. on 5 floors. The functions and organization of the library are described with special attention to reference services and collection development. The University Library works in close cooperation with 5 research station libraries. Puts forward suggestions for improving the organizational setup.

2.3. Management Trends

Raman Nair's paper on *Sustainable Management of Library and Information Systems in Agricultural Universities*⁷⁰ evaluates present organizational set up, statutes, rules and procedures connected to that. Participatory methods experimented are discussed. The aptness of the existing system for the development of information and documentation services for agricultural science and technology in institutions in India is discussed. The study recommends various sustainable methods for the management of agricultural university libraries.

Raman Nair in another paper entitled *Who should manage Information Technology Development*⁷¹ addresses very important questions of concern in agricultural sector's information management. The study analyses in detail the implementation and functioning of the Agricultural Research Information System under NATP by ICAR. Even though developments have occurred under the programme for more than five years and millions of rupees has been spent in State Agricultural Universities (SAU) and research institutes all over the country on IT results are unbelievably poor. Not even a single important agricultural research document is available on the web under the programme after five years of development. Various cases are described. The study concludes that those having specialization in Information Science should manage IT at units where Information services are their mandate in agricultural sector.

2.3.1. Need based Development

Raman Nair's study *Priorities in information management systems for agricultural research and development in India*⁷² describes various information and documentation activities that are essential in the agricultural sector. Based on a survey of the requirements for agricultural information in different organizations and contexts the study recommends the methods for deciding priorities when decisions about staff, collection, services, networking, and other aspects are taken on agricultural information system development.

Raman Nair and Francis in their paper *Information needs of Agricultural Scientists in India: Problems and prospects*⁷³ which was based on a survey conducted among different types of information users in agricultural sector describes information needs and the ways for developing collections that can satisfy the needs. The study also surveys different types of documents recording agricultural information, their nature, their sources and difficulties in collecting them and the importance of each in different contexts.

Musib's paper *Information needs and sources of information of the rural agriculturalists*⁷⁴ reports results of a survey conducted among farmers in the district of Burdwan in West Bengal, to determine their information needs and the sources of information that can satisfy their needs. The important information sources were found to be; personal experience, friends, neighbors, relatives, family members, fellow professionals, and persons in agricultural offices.

Devi and Lahiri in their study *Information seeking behavior of the agricultural extension agencies*⁷⁵ evaluates sources of information in agriculture, the tasks of agricultural agencies in India, and the means and media used by officers of agricultural extension agencies for obtaining latest information. The study is based on the responses to a survey among extension officers and their assistants. The study demonstrates that officers relied heavily on the Department of Agriculture for their day to day information needs, since the library system for agricultural information is in a very under equipped and undeveloped condition. Recommendations for improvement are put forward.

McVey and Hanfman based on the results of their survey reported in the paper *National evaluation of user profiles in aquaculture*⁷⁶ found that one problem with information delivery to a specific segment of the agricultural community is identifying the characteristics and needs of the end users. Special profile is to be used for the evaluation of the products and services provided. Aquaculture Information Center of the National Agricultural Library, Maryland constructed a profile based on historical data and current assessments from several aquaculture information groups. Analysis of this data provided direction for future products and services within the aquaculture information community. Findings also highlighted the important need for

further tracking of such data. The study emphasizes on need for continued networking among information groups, and creation of formal guidelines for information access on specified areas for the end user.

De Arena in the study *Information use in faculty of agriculture and veterinary science: A case study*⁷⁷ gives the result of a survey of faculty working at the Department of Land and Animal Production of a university in Mexico City. The study indicates that factors such as age, experience and status influence information-seeking behavior. The investigation relates the fact that Mexico needs agriculture and veterinary scientists able to participate in solving the food problem. The study outlines the role libraries could play in keeping scientists up-to-date.

Ridout's study *Information needs of agriculture and small business*⁷⁸ discusses the information needs of farmers and farm managers in the agricultural sector of UK. It review's the sources of information available in UK accessible to farmers and farm managers. The study considers the implications for libraries in providing information to farms and related businesses.

Majid and Anwar in *Library use pattern of Malaysian agricultural scientists*⁷⁹ reports results of a survey conducted among scientists at major agricultural institutions, to determine their patterns of use of the library in research work. The study explores the methods used by agricultural scientists to get information from their libraries, the factors influencing library visits and the occasions for extensive library use. Most were found to visit libraries personally when they need to search the OPAC, scan periodicals, or use other sources for identifying new information on their topics. But they send junior scientists to get photocopies of articles, books or information from sources already known to them. Scientists were found to use library extensively while preparing research proposals and writing reports.

Sugunavathy in *Information needs of subject matter specialists in agricultural extension service*⁸⁰ emphasizes the need for improving information services to increase agricultural production. Discusses agricultural extension system and the crucial role of the subject matter specialist (SMS) in the spread of farm technology to extension officers and farmers. Based on study of 9 selected districts of Andhra

Pradesh information on seeds, soils and water management are found to be of top priority areas. An SDI system that could keep the specialists up to date in their area of activity is recommended.

Malhotra's *User studies in libraries of agricultural universities*⁸¹ reports results of a study of the role of faculty in promoting library use by postgraduate students. It is based on samples of postgraduate students taken from Haryana Agricultural University, India, and Punjab Agricultural University. The study identified and ranked statistically a total of 9 variables which could be used to predict whether the method of instruction used by teachers is library based or otherwise. The study examines the relationship between the adequacy of library collections and the amount of daily library use by postgraduate students. Results were based on samples taken. Results of the study revealed that the use of the library is not directly proportional to the relevance of the library resources to contemporary needs of the student community.

2.4. Infrastructure Resources

2.4.1. Budget

Hoyt's study *Zero base budgeting at the National Agricultural Library*⁸² discusses budgeting (ZBB) that takes place in three phases. The first is a cost center phase in which direct and indirect expenses were clustered round individual organizational objectives. Second is a draft or 'model' phase when management prepares a ZBB for a theoretical information dissemination system. Third is final or 'real' phase where an actual budget for the year is prepared. Each phase is discussed in terms of success and failure, implementation difficulties and techniques, decision package structure and content. The study provides the management guidelines, instructions and forms used in budget preparation.

2.4.2. Staff: Professionals, Non Professionals

*Report of the Expert Committee on Staff Pattern for Kerala Agricultural University Library and Information System*⁸³ studies the existing staff of KAU Central Library, its constituent college libraries, Regional Research Station Libraries and Research Station Libraries. It evaluates the level of services to be provided at these institutions and the qualification required for the staff to perform such functions efficiently. The workload and quantum of staff required is also studied. The report gives detailed recommendations on personnel matters like qualifications, duties, job descriptions, quantum of staff required, staff organization, procedures and the routine followed in running the library. Provides a formula for calculating staff in agricultural libraries.

Raman Nair's study *Staffing Agricultural Information Systems*⁸⁴ discusses the information system in India under ICAR and SAUs. The existing situation in regard to library and information staff at Department of Agriculture, Government of India, ICAR Institutes, IARI and State Agricultural Universities are surveyed. The level of staff, number of staff, qualification and service conditions are examined. The urgent need for refixing the qualifications in the context of Information and Communication Technology onslaught is pointed out. The study recommends the staff pattern, qualifications, and service conditions of the library staff at different levels. Puts forward suggestions in regard to the changes in line, as well as need for placing professionals at managerial levels in Department of Agriculture, Government of India, to coordinate library and information services under ICAR/SAUs. The amendments to rules, regulations etc that become essential are also pointed out.

Majid in a study *Characteristics of agricultural library manpower in Pakistan*⁸⁵ reviews the status of agricultural librarians in Pakistan. The aspect is discussed in relation to variables such as; professional qualifications, subject background, salary structure, and participation in continuing education activities. Examines the training programmes for non-professional library staff working in agricultural libraries. Suggests measures for professional development of agricultural librarians.

2.4.3. Collection

Lilley's *Information sources in agriculture and food science*⁸⁶ make a detailed survey of information sources on agriculture. It covers abstracts and indexes, bibliographies, CDROM databases, reference works, review publications, guides to thesis literature and current research. Conference literature, official publications, non-conventional literature, maps and atlases, statistical sources and the libraries are also surveyed. It also covers information sources on specialized areas like soils and fertilizers; agricultural engineering; weed biology, weed control and herbicides; crop protection; field crops and grasslands; temperate horticulture; tropical agriculture; animal production; veterinary science; forestry; food science and agricultural economics.

Irving in his evaluation study entitled *Information resources of the food and nutrition center*⁸⁷ describes the range of information sources available on-line, as CD-ROM, as well as printed documents at the Food and Agricultural Library.

Gwinn's *National preservation program for agricultural literature*⁸⁸ discusses the proposal of United States Agricultural Information Network to preserve the most important pre 1950 publications and the primary unpublished resources. This can document the history of the agricultural sciences in the USA in an archival sound format, and make them readily accessible. Participants of the programme will be land grant institutions, the NAL, and other libraries, societies, and archives with important historical collections. The first priority is the preservation of scholarly monographs and periodicals identified as the core historical literature of the agricultural sciences. Projects will employ a hybrid technology. The programme will also ensure that records for preserved items are included in national databases and that storage conditions for archival copies meet national standards. The plan envisages the formation of a 'National Agriculture Literature Archive' at the NAL.

Mangin's *NAL collection development policy on the WWW*⁸⁹ reports the availability of details of the NAL's collection development activities at its web site www.nal.usda.gov/acq/cdatnal.htm. Butler's *Development and preparation of the collection development policy of the National Agricultural Library*⁹⁰ describes the

formulation in 1978 of a new collection policy statement. It was necessitated by increased interest in certain subject areas and the introduction of LC classification at NAL. Details about guidelines used, formulation of scope statements, preparation of the index, and draft reviews are presented.

O'Hare's *British Library supported research in agricultural, biological and medical information*⁹¹ describes the work of the biological, agricultural and medical information Review Panels of the British Library Research and Development Department. It examines their impact on the information scene in these sectors within UK. The panels consisted of eminent information users brought together to review the research already completed in their subject areas, to identify the gaps and to propose what research could be done to fill in these gaps.

Salt in his study *Assessment of research level literature resources for agricultural engineering in a university library*⁹² examines the adequacy of information materials to support research on agricultural engineering in a decentralized university library system. The citations from 11 publications released by the Department of Agricultural Engineering during four years were examined. Of 372 citations, 207 (55.6%) were available in the engineering library, 59 (15.9%) available elsewhere in the university library system, and 106 (28.5%) were not available in the library system.

Frierson and Zoellick in *Information needs in agriculture and markets for CD-ROM products*⁹³ presents the results of a survey of 1200 agriculture libraries and information centers worldwide, carried out by the Consultative Group on International Agricultural Research (CGIAR), to assess the information needs in agriculture in the developing and developed countries, and to relate these needs to the potential for CD-ROM products. Users were also asked to assess the needs and markets for 2 major types of documents on CD-ROM, primary periodicals and CGIAR Center reports. Discusses the data from both studies together. Analyses the current information resources and practices; and the climate for application of new technologies in the agricultural community.

Demas and others in *Developing and organizing collections of computer-readable information in an agricultural library*⁹⁴ discuss the need for establishing collection of digitized information and related facilities in an agricultural research library. Provides an overview of the considerations for selecting hardware, software and standards. Standardized cataloguing practices, and policies governing loan procedures are also outlined.

Damodaran and Rao in their study *An analysis of the Indian Bibliography on Doctoral Dissertations in Oilseeds in India*⁹⁵, gives information about the growth patterns of the dissertations; institutions involved; and the contribution of agricultural universities. The study gives an elaborate view of the thesis literature available on the subject. The spread of dissertations according to faculties is analyzed together with information on their bibliographical coverage in University News, and the holdings of such dissertations in 76 Indian institutions.

2.4.4. Books

Goyal and Joshi in their study entitled *Book Bank scheme in an agricultural university*⁹⁶ explains the concept of Book Bank in agricultural university/college environment. Presents the features of the Book Bank Scheme. Sample taken for the study is Haryana Agricultural University. Its growth in collection, rental charges realized and the use of books from 1975-81 are discussed.

2.4.5. Journals

Musib in his study on *Production of journals in agriculture, agricultural economics and economics*⁹⁷ attempts to find out the countries publishing maximum number of journals in those fields. Analyses the frequencies and agencies of publications. USA was found to publish maximum number of journals in all the 3 fields; only 10 countries are sufficient to cover 70% of journal production. The most common frequency of publication is monthly followed by quarterly in the 3 fields and the most popular agency of publication is business firms for economics, government for agricultural economics and professional associations for agriculture.

Naidu in *Compilation of core periodicals in poultry science*⁹⁸ indicates methods for such compilation. Citation analysis was found to be most appropriate. Analyses citations from dissertations and research publications of the Department of Poultry Science of the Andhra Pradesh Agricultural University. Based on that the study compiles a list of core periodicals in poultry science.

Lal and Panda in *Research in plant pathology: A bibliometric analysis*⁹⁹ conducts a citation analysis of 20 doctoral dissertations submitted to the Department of Plant Pathology at Rajendra Agricultural University, India, during 1980-1993. It provides a ranked list of the 100 most frequently cited core periodicals representing 73.01 per cent of the references. More than 50 per cent of the references appear in the first 20 periodicals on the ranked list. Three primary journals – Indian Phytopathology, Phytopathology, and Plant Disease account for 25.64 per cent of the references. The study can serve as a tool for librarians in selecting core journals in the field.

Sarala in *A bibliometric analysis of the Journal of Tropical Agriculture*¹⁰⁰ presents the results of a study of papers published from 1989-94 in the journal, which is an official publication of Kerala Agricultural University. An analysis of contributions to the journal was undertaken by type, institution and country of origin, as well as their authorship pattern. An analysis of citations appended to the articles was conducted by the study to find the most frequently cited periodicals. Identifies the average number of citations per article and the types of documents cited. A ranked list of the 30 most commonly cited periodicals is given. Indian journals occupy 8 of the top 10 positions in the ranked list.

Asundi and Kabir in a study *Evolving criteria for identification and selection of core periodicals in a subject: A case study of Indian horticulture*¹⁰¹ identifies a list of core Indian periodicals in horticulture from a study of citations from 257 doctoral and master's degree dissertations in the field of horticulture submitted to the University of Agricultural Sciences, Bangalore during 1980-1989. A ranked list of 235 Indian primary periodicals was produced from the study. The data was also redistributed to identify subject coverage in peripheral subject areas. Five journals were found to constitute the core while 55 were identified as essential. The study

points out that the heavy concentration of large numbers of citations in a few periodicals means that librarians can have a large percentage of relevant literature in the field by subscribing to relatively few periodicals.

Jackson in his study *the scope of agricultural serials literature of the Science Reference Library*¹⁰² reviews the development of that library, and surveys the scope of its collection of agricultural serials. The library has a comprehensive collection in all branches of agriculture and associated industries except economics, statistics and social science. It is likely to cover most materials of value in the subject and where gaps occur, the library can usually provide a useful referral service through its back-up collection.

2.4.6. Documents in Digital Media

Shinde and Karande's study *Use of CAB International abstracting periodicals in Mahatma Phule Agricultural University Library*¹⁰³ reports results of a survey among staff and students, at the library on the use of 47 CAB International (CABI) abstracting services subscribed there. The study involved 140 teaching, research and extension staff members and 75 postgraduate students selected randomly. The findings reveal that for majority of users CABI abstracting services are adequate to meet their information requirements and they do not have to depend on other services.

Andre and Eaton in their study *National agricultural text-digitizing project*¹⁰⁴ describe the cooperative project of the NAL and 42 land grant libraries. It is a project for capturing full-text and images into digital format for publication in CD-ROMs. The digitization equipments were installed at the NAL. The search software, and collections of selected digitized documents was field tested by faculty and researchers at all participating libraries. Andre's study *Optical technology at the US National Agricultural Library*¹⁰⁵ surveys the experiments at NAL on digital technologies. The Digital Videodisc Project it tested provided access to textual and graphic material using the digital videodisc technology. It also provided experience in processing machine-readable source files for full text retrieval. The Forest Service Photograph Project utilized the analogue videodisc to provide access to a historic photo collection demonstrated how effectively slides, filmstrips, and posters can be accessed from that

medium. Two CD-ROM projects initiated there gave experience with processing large bibliographic files for retrieval via microcomputer. The National Agricultural Text Digitizing Project combines the experience of each of these projects to test the potential of optical scanning and storage technologies for capturing full text and image data, providing full text access and distributing them on CD-ROM. Andre in *Full text access and laser videodiscs: The National Agricultural Library System*¹⁰⁶ evaluates in detail the database, mounted on videodisc technology that successfully integrates digital data and analog graphics. The study discusses problems encountered in converting a print product to videodisc. The operational procedures of the above projects are analyzed in detail by Sitar in the study *National Agricultural Text Digitizing Project: System startup and operation*¹⁰⁷. It covers system planning and acquisition, selection of publications, document structure, design, scanning procedures, conversion of bit-mapped images to ASCII text, quality control, and pre-mastering of data onto 9-track tape. Andre's study *Towards the electronic library: The National Agricultural Library experience with CD-ROM technology*¹⁰⁸ describes various CD-ROM projects undertaken by NAL. It covers CD-ROM Sampler Project; National Agricultural Text Digitizing Project; and Digitized Document Transmission Project

Casorso in the study entitled *NCSU Digitized Document Transmission Project: Improving access to agricultural libraries*¹⁰⁹ describes a collaborative project between NCSU libraries, the NAL and 11 land grant university libraries. It addresses the basic issues involved in developing network based document delivery systems for library materials. Explains the technical, procedural and administrative issues related to the electronic delivery of digitized research materials via the National Science Foundation (NSF) net/Internet and campus telecommunications networks. Casorso's study *The North Carolina State University Libraries and the National Agricultural Library Joint Project on Transmission of Digitized Text*¹¹⁰ also explains the possibilities of digital media in extending information services. The NAL, NCUL, NCSU collaboration to identify and investigate issues on online document delivery systems are described. McCone and Starr in their study *Document delivery using image transmission over Internet: A pilot project at the National Agricultural Library*¹¹¹ also examines the possibilities of net for distributing agricultural information and documents. NAL and NCSU Library project for using the National

Science Foundation's high-speed telecommunication system for transmission of images as compressed and uncompressed files from their database is described. The paper discusses methods of for document delivery to the end user on campus LANs. Incorporating necessary rules on library's procedures is also suggested.

Swab and others in their study *NAL Home Page on the World Wide Web*¹¹² describes the work undertaken by the NAL World wide Web (WWW) Home Page Prototype Committee to the launch their website (<http://www.nal.usda.gov>). Plans for the further development of the NAL Website are discussed. The concerned server wide indexing experiments with various search engines, reorganization of the server's directory hierarchy, and installation of maintenance tools such as robots and spiders are also explained.

Mrazek in his study *Growing agriculture statistics on the Web: A primer*¹¹³ notes the lack of agricultural statistics on commercial online services. The study reviews the range of statistical sources available on the WWW, including the NAL's National Agricultural and Statistical Service, Foreign Agriculture Service and National Climatic Data Center.

Walton in *The National Agricultural Library Data Base*¹¹⁴ evaluates Agricultural On-line Access (AGRICOLA) through database of NAL. It contains more than 850,000 bibliographic records of documents acquired by NAL in the broad field of agriculture and related sciences. NAL uses the Cataloging and Indexing (CAIN) system for on-line cataloguing and indexing input. Describes search services and the derivation of the Bibliography of Agriculture and NAL Catalog from AGRICOLA tapes. Access to the AGRICOLA for on-line interactive bibliographic search through the net is also discussed.

Thomas in his study *Use of the CAB thesaurus at the National Agricultural Library*¹¹⁵ analyses the various reasons that necessitated the adoption of the CAB thesaurus by the NAL. It was based on the necessity for a controlled vocabulary in order to standardize the indexing process and facilitate the retrieval of information. The adoption required careful planning and coordination among the institutions that contribute to the database. A mini-index to the thesaurus and a guide to indexing were

prepared to facilitate its use. Training was given to all personnel involved. During implementation, many problems like the mixing of hierarchies, the existence of synonyms, difficulty of using large printed volumes of the thesaurus etc were identified. The NAL's work on an on-line version of the thesaurus is also explained.

Zhang and others in the paper *Information management for agriculture and natural resources*¹¹⁶ describes the concept behind Electronic Compendium, developed by CAB International. It is a comprehensive but portable library of material on selected subjects with a user-friendly search software interface. It is accessible on personal computers from CD-ROMs or via the Internet. This program for crop protection uses an integrated system to provide users with; data sheets for crops and pests, bibliographic references, pictures and distribution maps. Interactive pest identification keys; online glossary; and links with other expert systems available in the compendium are also discussed.

Van Boven and Spikman in their study *Introduction to end users of new electronic media in the Library of the Wageningen Agricultural University: An evaluation*¹¹⁷ studies the use of international bibliographic sources in agriculture; AGRIS, AGRICOLA, Current Contents and CABI on-line. CD-ROM has made databases accessible to students. After AGRICOLA on CD-ROM and Current-Contents on Diskette were introduced in the library a survey was conducted among the users. Users were asked to complete a questionnaire after searching either the AGRICOLA CD-ROM or Current Contents. The responses helped to evaluate the products. The study reveals that CD-ROM has proved a successful extension to the library's information services. But cost has prohibited institutions from subscribing to some major titles in CDROM.

Prierson and Zoellick's study *CIARL: The Compact International Agricultural Research Library: Designing a library on CD-ROM*¹¹⁸ discusses the first and largest agricultural digital library venture in the world. CIARL published by the Consultative Group on International Agricultural Research (CGIAR) is a library in CD ROMs of several thousand publications. 20 international agricultural research centers are participating in the activity and have selected their most important scientific and technical publications for inclusion. The CIARL include the complete text and images

found in the original printed publications as well as search mechanisms to facilitate retrieval. User interfaces is provided in different languages. The paper describes different aspects of the design decisions to be considered to create and maintain a usable and efficient multi-disc, multilingual, full text and image archive in digital form.

Bankapur's study *Need of national computer data bank for the indigenous farm-management-information-technology*¹¹⁹ records that there is a considerable amount of indigenous farm information and concerned technology. It is not properly streamlined and logically trimmed. Agricultural Research Information Center (ARIC) of ICAR has not fully exploited this source. The paper suggests a separate National Computer Data Bank for the indigenous Farm-Management-Information-Technology. Emphasizes the need to start exclusively Indian Agricultural Abstracts to keep alive programmes for dissemination and utilization of indigenous information on agriculture.

2.4.7. Other Non-Print Items

Naidu and Gunjal's study *Non-conventional literature in the agricultural libraries in India*¹²⁰ emphasizes the dominance of non-conventional library materials in agricultural sector. The study is based on results of a survey of 68 libraries under agricultural universities in India. The non-conventional library materials include; theses, conference proceedings, newspaper clippings, reprints, microforms, and audiovisual materials. Discusses the efforts of agricultural libraries in processing such literature and suggests measures for effective bibliographical control.

2.4.8. Building

Naidu and Gunjal in their study *Agricultural library buildings and their structure in India*¹²¹ emphasize the role of buildings in efficiency of the library. The study points out the fact that nearly 40 per cent of agricultural libraries surveyed possessed their own independent library buildings. Works out the area utilized for various library functions. The findings show that quite a large number of agricultural libraries need additional floor area to meet their immediate and future requirements.

Suggests that the libraries housed in non-functional buildings should plan for new library buildings on functional lines.

Aswath's *University of Agricultural Sciences Library, Bangalore: Structural evaluation of the library building*¹²² describes the planning and various aspects of the new building, which opened in 1976. The paper critically evaluates how the space is utilized at different functional points.

2.4.9. Equipments

Malhan and Kaur's *An assessment of reprographic resources in Indian agricultural university libraries*¹²³ describes the importance of reprography in modern libraries and documentation centres. Gives an account of reprographic services of 12 Indian agricultural university libraries. An account of equipment, budget, service charges, staff position and problems of reprographic services are given. A few proposals for the improvement of reprographic facilities are put forward.

Naidu and Gunjal in *Reprographic service in the agricultural libraries in India*¹²⁴ outlines the importance of reprographic services in the modern library service. Discusses reprographic services in Indian agricultural libraries, the photocopiers available, workload and maintenance of the machines. Describes the literature available in microfilm and the equipment available in agricultural libraries. Makes recommendations for the provision of reprographic services in agricultural libraries in India.

2.5. Documentation Works

Feidt in the study entitled *Nursery and Seed Trade catalog: Creation of a local database from OCLC cataloging data*¹²⁵ examines the joint database project undertaken by the NAL, USDA's Plant Variety Protection Office (PVPO), and Cuadra Associates. The project demonstrates the feasibility of downloading OCLC bibliographic records for subsequent enhancement and incorporation into local database. NAL's Cooperative Nursery and Seed Trade Catalog collection was chosen

as the object of this effort. NAL performed original cataloguing for records not already present on the OCLC System.

Edwards in the study *Indexing practices at the National Agricultural Library*¹²⁶ discusses the methods and indexing practices at the NAL. Indexers at NAL scan over 2,200 incoming periodicals for input into its bibliographic database, AGRICOLA. The NAL's coverage extends worldwide over a broad range of agriculture subjects. The study describes the various access points provided by AGRICOLA.

2.5.1. Services

Desmukh's *Information systems for agricultural sciences and technology*¹²⁷ contains the lectures given at an ICAR summer school for librarians from selected agricultural institutions discusses various aspects of library and information services to agricultural sector. Automation of libraries, abstracting and indexing of agricultural journal articles, different types of information services required in an agricultural research institution and related aspects are discussed.

Chakrabarty's study *Marketing information management with reference to agricultural marketing: Strategic thoughts*¹²⁸ reveals that strategic marketing information systems concentrate on the functions that contribute to the achievement of the organization's critical success factors. Describes the role of strategic marketing information systems in agriculture in India.

Prodhani's study *Press clipping service and its importance in agricultural research library*¹²⁹ describes the importance of the press cutting service in an agricultural research library. Discusses the procedure of selecting cuttings from newspapers and their systematic arrangement as per DDC.

Nehla and Murthy in their study *Agricultural Research Institute Library*¹³⁰ outline the role of the librarian in the context of satisfying user needs. Describes various methods of publicizing the resources of the library focusing on indexing and bibliographical activities. Examines aspects of collection building and programmes

intended to make users familiar with collections and documents. Describes the services provided by IARI.

Elso and Gutierrez in their study *Automated Services of the INIA Central Library*¹³¹ describes the initiation, evaluation and implementation of an SDI service based on the AGRIS database. Emphasis is placed on the important role played by the librarian in the construction of the SDI profile. The importance of institutional cooperation in such a project is stressed. Concludes with an outline of preliminary steps required for complementing the SDI with a retrospective search service

2.5.2. User Orientation

Phadnis and other in their study *Training of agricultural scientists in information use*¹³² outlines the present work of Indian agricultural scientists, and their need for published and unpublished information. Describes the complexities of some secondary source publications and the problems of information retrieval. There is a need to make agricultural scientists familiar with unpublished information and data sources. Discusses the role of the computer in information retrieval, and SDI services. Scientists should be trained for information collection, and familiarization techniques meant for that are mentioned

Cooper's study *Using CAI to teach library skills*¹³³ reveals that Computer-Assisted Instruction (CAI) is suitable for large ongoing orientation programmes. It regimes student involvement in the learning process and can be an effective instructional aid in teaching basic library skills. Describes problems encountered and discusses the decision to turn to CAI as a way of solving them.

Olsen in the study *Training experience with AGRICOLA at the National Agricultural Library*¹³⁴ is based on his practical experience in training users in on-line searching at NAL. Details are given of the manual used and the courses offered. General conclusions about essential user knowledge and skills, and the way to impart them are discussed. Olsen's *AGRICOLA training implementation by the National Agricultural Library*¹³⁵ discusses the training of users in handling digital information

sources. Describes NAL's users' manual aimed at the basic needs of new users unfamiliar with NAL indexing practices is evaluated.

Niekerk and others in *Library user education in tertiary education: Agriculture and life sciences*¹³⁶ examines library user education programmes for agricultural students at different levels. The approaches of different libraries are discussed comparatively. Describes two levels of formal library user education incorporated into the curricula. First level teaches elementary information retrieval and library layout. The next level is bibliographic instruction that trains in the use of secondary information resources.

Stewart, in *User education at the National Agricultural Library*¹³⁷ describes the stages in the development of a master plan for user education at NAL of the US. The purpose of the plan is to enable users to become independent and successful in their use of information resources. Statistics on the library's users were collected to identify the types of programmes needed. The range of NAL users were found to be very broad and many were not USDA personnel. Minimum performance objectives for specific groups of library users were proposed. It ranges from ensuring that users have a basic awareness of NAL's mission to their understanding of the wide range of access points and services the library has to offer. Prioritized methods for achieving these objectives were formulated and ways to implement the plan discussed. The success of the plan would be contingent on support and cooperation of the NAL administration, the USDA field libraries, and agricultural information centers.

Prozesky's *Information retrieval skills: A core module in science and agriculture?*¹³⁸ describes a course delivered at the Life Sciences Library, University of Natal, South Africa. The first of the course was for second year students registered for a degree or a diploma in the Faculty of Agriculture. Outlines the beginnings of the course and describes prospects for the immediate future in light of the outcomes-based curricula.

2.5.3. HRD for Staff

Bell's study *Review of education and training for agricultural library and information work*¹³⁹ identifies the types of documentalists and librarians in agriculture. They are formally qualified librarians, agricultural and other scientists specializing in information work; or personnel who have moved from administrative and clerical posts to library and information work. Current education and training reflect their varying needs. The programme includes; general long courses for appropriate specialization, graduate, postgraduate and higher degree programmes. There are also intensive short courses on special aspects and techniques; as well as general training in agricultural librarianship. A further method of training, which must be recognized, is the participation of consultants and advisors in training on-site. The study emphasizes that each of these methods has a place, determined by the standing and background of students, and geographical, linguistic, cultural and economic factors.

Aboyade's Edited Volume; *Education and training for library and information services in a predominantly non-literate society with particular reference to agricultural and rural development*¹⁴⁰ consists of papers presented at the FID/Education and Training Committee meeting, Ibadan, Nigeria, 6-9 May 1981. It contains four discussions on information services to agricultural sector. First is *Determinants of agricultural productivity among non-literate farmers-the Nigerian case*, by Francis S. Idachaba. Second one is *The agricultural extension information worker: His methods and materials*, by S.K. Taiwo Williams. *Information for extension workers in non-literate societies*, by Hamish Russell; and *Agricultural documentation and the transfer of scientific information to rural communities*, by Stephan M. Lawani are the other discussions. All these studies stress the importance of HRD programmes for the efficiency of extension worker as well as educating the farmer to apply the knowledge generated by research.

Irving in the paper *Computer assisted indexing training and electronic text conversion at NAL*¹⁴¹ describes a project of Indexing Branch of the NAL, USA. It was launched to move from their traditional method of training novice indexers to a computer based, largely self-directed training programme. The Computer Assisted

Indexing Tutor (CAIT) has been designed to standardize, streamline and improve the quality of indexer training. The programme provided support to the increased need of NAL indexers to more fully utilize microcomputers for indexing production. NAL also investigated the 'reinvention' of paper versions of frequently used indexing tools as electronic references.

Kaur in the study *Restructuring education for agricultural information professionals in India*¹⁴² discusses the requisite knowledge and skills for agricultural information professionals. The study advances suggestions for reorienting the existing syllabi of Indian library and information science schools to train agricultural information professionals. This is essential to fulfill their changing role in libraries and information centers.

Arboleda Sepulveda's paper *Continuing education for agricultural librarians and information specialists in Latin America*¹⁴³ emphasizes need for in-service training programmes. Responsibility for such programmes must be shared by individuals and institutions involved in the process. That is generators, intermediaries and users of information; library schools; agricultural institutions; international development organizations; and national and international associations of library and information specialists.

Kotei's study *Guiding principles to evaluate special training programmes and packages for agricultural library and information work*¹⁴⁴ reveals that distinctions between special, and general, training programmes are hard to make. Factors that can be considered special are the specific purposes of training, e.g. pest control, and the geography both physical and human of the area. Special training should be coordinated with other specialties. Programme outlines should relate to normal agricultural operations and methods. Innovative methods should be adopted, consistent with the complex, or unique, ecosystem and other environmental conditions. The study emphasizes that training programmes and policies should take cognizance of appropriate technological equipment, rather than non-operational ones.

2.5.4. Users Assessment

Ojha and others in the study *AGRIS database: An experience with CAZRI scientists*¹⁴⁵ evaluates AGRIS through a study and training project conducted using it at Central Arid Zone Research Institute in India for agricultural scientists. Provides an extensive manual prepared for users, which is user friendly and self-explanatory. The study reveals that the CAZRI scientists found the AGRIS CD-ROM database to be very useful and enjoyed the training.

In Hansen's *Use of the Danish Veterinary and Agricultural Library by direct library users and users of an online documentation service*¹⁴⁶ an analysis of the present use of the Library resources is carried out. It was intended to examine the results of the reduction in the acquisition budget. The survey checked which parts of the collection could be cut down without causing too much inconvenience to the users. Results showed that approximately 85% of requests for journals were covered by approximately 7% of the current serials. Approximately 30% of requests were for books. It was concluded that an efficient inter library loan system could fulfill some requirements. The study points out that a joint Scandinavian union catalogue of foreign serials will be a valuable tool for inter library loan.

2.6. Resource Sharing

Goyal's study *Sharing of theses by agricultural universities in India: Case study of thesis abstracts*¹⁴⁷ points out the need for thesis abstracts in the field of agriculture and allied subjects in India which resulted in a quarterly *Thesis Abstracts* published by the Haryana Agricultural University. Examines the coverage of Thesis Abstracts and depicts the subject-wise trends in the disciplines covered. Suggests the improvements for better coverage and prompt service of Thesis Abstracts to scientists.

Vahishth's study *Indian participation in INIS and AGRIS global information systems*¹⁴⁸ describes the factors that have led to increasing cooperation among various nations in information management. This has contributed to the development of worldwide information systems on agriculture. Highlights the role of UNISIST and various other international bodies and commercial concerns in creation and

maintenance of necessary infrastructure for information handling. Discusses the organizational and operational aspects of INIS and AGRIS and their products. Mentions Indian modes of communicating input data, and makes a case for their on-line availability of information to Indian scientists.

Naidu and Gunjal's study *Inter library loan service in agricultural libraries in India*¹⁴⁹ discusses the importance of resource sharing. It reports results of a survey of 84 agricultural libraries. The results helped to determine; the popularity of their inter library loan services, the types of documents borrowed and lent, and the response of libraries to requests received.

Thomas's paper *Coordinated program for State agricultural publications*¹⁵⁰ discuss problems associated with achieving bibliographic control of State publications. Considers the coordinated programme for the acquisition, cataloguing and document delivery of such publications conceived by the NAL and the State land-grant university libraries. The study point out that resultant collection is now accessible to a large community.

Chifwepa's study *Agricultural library cooperation in Zambia*¹⁵¹ observes the need for agricultural libraries to engage in inter library cooperation. This can alleviate the problems of resources scarcity and improve accessibility to available information. A survey of agricultural libraries revealed that only 5 of 19 agricultural libraries share resources. The probable result is, duplication and limited access to major portion of information and collections. Suggests a framework for improving accessibility of information and promoting inter lending.

Sinn's paper *NAL joins ARL Latin American project*¹⁵² reports on the NAL's cooperation with over 30 other research libraries in the USA and Canada. It is a project to make scholarly resources in the field of agriculture from Latin American countries more accessible worldwide. The Latin American Research Resources Pilot Project is a joint venture of the Association of Research Libraries (ARL) and the Association of American Universities.

Dubois's study *Publications exchange at the National Agricultural Library*¹⁵³ presents a review of the policies, responsibilities and procedures of the Gift and Exchange Unit of the NAL. Exchange operations, which formed a part of the earliest library traditions of the United States Department of Agriculture (USDA). It now aids NAL in meeting the challenges of acquisition operations, which must adopt continually during an era of rapid technological change and stringent funding.

Yaikova's paper *Experience of the Central Scientific Agricultural Library in the development of cooperation with IAALD member libraries in literature exchange*¹⁵⁴ deals with resource sharing in Russia. It explains that cooperation and exchange of materials between libraries, based on mutually beneficial goodwill, can be an important means of acquisition of foreign materials. The study reveals that agricultural libraries in the USSR attach great significance to this means of acquisition.

Suvorova's study *The international book exchange program of the Central Scientific Agricultural Library*¹⁵⁵ describes the book exchange programme of Russia's National Agricultural Library (CSAL) and reveals the role that the programme plays in the development of the library's collections today.

2.7. Extending Services to Villages

The study by Mayers entitled *Regional plan for the development of the infrastructure of an Inter American system of agricultural information: A formula for networking and information transfer*¹⁵⁶ presents an interesting view on library services. The study reveals that the failure to establish effective, integrated information systems especially for agriculture is a severe obstacle to economic development. Initiatives are nationally rather than regionally based, thus reducing the potential for maximizing information transfer. Proposes solutions to the chief problems, namely; cultural and political factors which do not recognize the importance of information, economic factors like inadequate finance; quality human resources, lack of professional training; poor ICT facilities; and failure to develop local resources. Recommends the setting up of regional task forces, coordinated by

the NAL to draw up national action plans and assign responsibilities for implementation.

Beavers and Sibia in *Strategies for improving information services to USDA scientists in remote locations of the US*¹⁵⁷ describes the collaborative efforts between USDA agencies, NAL and the Agricultural Research Service (ARS) to improve access to and delivery of information services to ARS researchers in remote areas. Focuses on a specific initiative designed to assist scientists who are employed at laboratories in rural and remote locations. Presents strategies for enhancing information access through improved delivery systems and services. Gives a brief description of the roles of the NAL, USDA agency field libraries and cooperating land grant university libraries in providing services for USDA staff and farmers.

Hartman and others in their paper *Enhancing access to agriculture and other extension materials: A cooperative project at Kansas State University*¹⁵⁸ examines how in information frontier; people engaged in agriculture and agricultural information resources can be linked in the changing world. Describes an integrated and coordinated effort to identify, catalogue, and provide access to the publications produced by the Cooperative Extension Service and Agricultural Experiment Stations.

Qiaoqiao Zhang's study *Improving the accessibility and availability of information in the agricultural library and information of China*¹⁵⁹ describes the design of a Cooperative Acquisition Programme (CAP) for regional agricultural information network. Presents a descriptive model of the CAP. The assignment of responsibility for collection and allocation of information resources is based on various aspects. They are assessment of collection strength and subject biases of the information centers; identification of geographical characteristics of information resource distribution; differentiation of sector characteristics of information resource distribution; identification of resources already available, both human and material and estimation of future potential.

Aina's study *Information for successful agriculture*¹⁶⁰ describes the importance of information for agricultural development in Africa. It outlines the information needs of farmers. Agricultural extension workers transmit information

generated by research scientists to the farm. The findings of research are transmitted through research libraries to public libraries, and thence to the agricultural extension workers. For the findings of research to reach the farmers who require it, more number of extension workers is required. But this is not a feasible approach because of the costs involved. The method suggested, by the study is to route information flow through local public to rural libraries and then to farmers. Although most farmers are illiterate, the study points out that a number of literate gatekeepers can be identified and encouraged to carry necessary information to the less educated

Goldberg's paper *Information for research on sustainable agriculture in tropical America: A collective challenge*¹⁶¹ discusses problems of communicating Agricultural Information in Remote Places. His analysis of international databases shows inadequate coverage of the diverse information sources on natural resource management. Furthermore, these databases are not readily available to regional researchers, extension workers, producers, policymakers, and information personnel. There are language, financial, and training barriers that limit or prohibit access. The study proposes that information providers, producers and intermediaries in 6 Latin American countries should work in partnership to ensure recovery of and access to key sources through a range of communication channels.

Kinara's study *Information communication in Kenya for agriculture: Basic problems and possible solutions*¹⁶² discuss major problem areas in information communication. The study recommends printing of reports, in-service manuals, and other publications to enable knowledge to flow from the researchers via the administrators and extension workers to Kenyan farmers.

Powell in his study *Information to the people: Cooperation between the library and agricultural extension*¹⁶³ examines the cooperation between the Extension Service and the Agriculture Library at Kentucky University. The study covers initiatives, which include new agent orientation, library participation in extension functions, working with extension specialists, and serving on extension committees.

2.8. Automation and Networks.

Raman Nair's paper *Agricultural and Farm Information System for Kerala (AGFIS)*¹⁶⁴ based on brief survey of libraries in agricultural sector in Kerala proposes networking and resource sharing arrangement between various libraries holding agriculture related information as a solution to resource crunch and diving library allotments. The paper provides recommendations on establishing a network of agricultural libraries and information systems existing from topmost level to the village. The hardware software requirement for the information and communication facilities proposed is also described.

Raman Nair's *Establishment of a digital library to support agricultural research, education and extension in India*¹⁶⁵ describes the advantages and cost effectiveness of digital libraries in content management and dissemination in agricultural sector. It points out the areas of agricultural information to be digitized at the initial phase. Describes the equipments, software and other requirements for content digitization, its organization, storage, dissemination etc. The study also explains a model digital library system for agriculture, developed in India.

Raman Nair, in his study *Content management for agricultural, research and development in India*¹⁶⁶ describes the special characteristics of documents meant for agricultural research and development. It discusses the problems like lack of more than one copy of unpublished reports, lack of their availability at the station, their ephemeral nature, and various other aspects that make their accessibility difficult for the user as well as the library. The study proposes that digitalization of such documents or collections are the method to conserve them and maximize their access and use.

A historical perspective of the modernization efforts at the libraries under Kerala Agricultural University is traced out in Raman Nair's paper *Impact of information superhighway on library services in Kerala Agricultural University*¹⁶⁷ It describes provision of high-tech physical facilities, the implementation of Library LAN, Digital Library project and the influence of Internet technologies on collection development, journal subscriptions and various services.

Raman Nair's *KAU on the Springboard to Cyberspace*¹⁶⁸ discusses IT application in KAU for collection development at the Central Library and various stations. Use of ICT in various documentation and publication projects is also covered. The paper also recommends the way in which different information systems can be integrated in the university to achieve cost effectiveness and efficiency.

Mohan's study *Agricultural information network in India*¹⁶⁹ traces the historical development of agricultural research institutes and their libraries in India. Surveys the world output of agricultural literature and the Indian indexing and abstracting services in agricultural sciences.

Lal and Bhatia's *Adoption of information technology by agricultural libraries in India*¹⁷⁰ assesses the extent to which, agricultural libraries in India are embracing information technology. Presents details on the distribution of specific kinds of information technology, language problems, role of government, budgets, and training library staff in Information and Communication Technologies.

Thomas's study *United States Agricultural Network: Genesis of a cooperative organization*¹⁷¹ describes the informal networking that has been a tradition in the US agricultural information community. It describes how recently, NAL has worked to create a formal organization. NAL's efforts have led to the formation of the United States Agricultural Information Network (USAIN), and an association whose goal is to provide a forum for discussion of agricultural information issues.

Ulmschneider and Casorso have collected together in their edited volume *Electronic document delivery: An overview with a report on experimental agricultural projects*¹⁷² research papers on ICT application in agricultural libraries. The studies included describe advances in computerization techniques for library cooperation and cooperative technical services. State-of-the-art review of techniques, which enable libraries to copy and deliver electronically, the items like paper documents, maps, audiovisual materials etc retrieved by library users are given. Describes essential components of electronic document delivery systems. Discusses various ICT programmes in undertaken by agricultural libraries.

Yapa in his paper *PURNA - AGRINET integrated information system of Sri Lanka*¹⁷³ evaluates the Agricultural Library Network of Sri Lanka (AGRINET). Describes library packages developed there based on the micro CDS/ISIS software. The system, handles major library operations. The study recommends the package for small and medium sized libraries with limited financial and personnel resources, which are looking for low cost integrated solutions.

Thompson's paper *Agricultural Network Information Center*¹⁷⁴ reports the launch of the pilot Agricultural Network Information Center (AgNIC), in the Internet. AgNIC provides a focal point for accessing agricultural information and was established through NAL collaboration with several US land grant universities and some of the Research, Education, and Extension agencies of USDA. Describes the main goals of AgNIC and the value added services it provides like prototype directory of databases, datasets and information systems related to agriculture as well as currently referred to as AgDB.

Dulle's paper *Networking agricultural libraries in Tanzania: Possible applications of information technology*¹⁷⁵ discuss the potential for electronic communications in disseminating agricultural information. Poor communication between agricultural libraries in the country is cited as one of the reasons for inferior information services in agriculture. The study recommends the establishment of an electronic network based on low cost communications technology to link agricultural libraries.

Lawrence's paper *US agricultural statistics on the Internet: Extending the reach of the depository library*¹⁷⁶ describes the facilities for access to information provided by USDA Economics and Statistics which is a shared venture. This service has made a growing collection of government produced agricultural statistics available free of cost via the Internet. The library provides a value added service by organizing the data, providing reference support, and preserving the information for future access. Discusses methods for incorporating electronic information into the day-to-day activities of the libraries.

Uddin and Rashid's study *Networking of Agricultural Information Systems in Bangladesh: A Model*¹⁷⁷ observes that insufficient reading materials, ineffective services, inadequate funds and lack of trained manpower are the factors affecting efficiency of agricultural library and information services in Bangladesh. To overcome these shortcomings the study recommends networking of the agricultural libraries consisting of universities, colleges and research stations in Bangladesh

2.8.1. Standards

Deshmukh's *Standardization of library and information services with special reference to agricultural libraries*¹⁷⁸ describes the need for preparing standards. Standardization of various aspects like building, staff, collection, equipments, services etc with special reference to scientific and agricultural libraries is discussed. The study also gives a historical perspective of the attempts for standardization in libraries of agricultural universities and research institutes.

Raman Nair's *Automating Agricultural University Libraries: Need for Standards and guidelines*¹⁷⁹, describes the need for standardization of hardware, software, staff, content development etc with regard to library automation and digital library development. The study points out that the failure of many automated systems as well as the delay in getting any result from Information Technology application in library environment is due to the failure to select relevant systems and applications. The study points out various aspects of the automated systems and services of agricultural libraries to be standardized.

2.9. Vision for the Future

At the end of seventies Information Technology has started influencing the information and documentation activities in agricultural sector also tremendously. An International symposium *International agricultural librarianship: Continuity and change*¹⁸⁰ was conducted at that time. It covers various aspects of the future of agricultural information systems and presented a vision for agricultural information systems. Richard in his paper presented at the seminar *The changing nature of agricultural librarianship: Observations and overview* described the changes already

taking place and predicted the future. Mohrhardt in his paper on *Research and innovations in agricultural libraries* outlined the work going on to modernize the agricultural libraries. Paz De Erickson in his paper on *Agricultural libraries and the spirit of cooperation: A continuing process* explained the information explosion happening in the area of agriculture and stressed the need for resource sharing to provide efficient information support. Chapin in his paper on *International agricultural librarianship*; compared the agricultural library facilities in various parts of the world. Scott's study *California Polytechnic State University: Recent changes in agricultural librarianship described the library modernization programmes implemented in those agricultural education institutions*. Sherrod's study *The future of international cooperation in agricultural information*, also stressed the need for cooperation between countries on the area of agricultural research information. Leatherdale's study *International frontiers in agricultural information services* explained the responsibility of international organizations in conserving and disseminating agricultural and food information for the welfare of mankind. Olsen and Epilogue, in their study *Management in agricultural research libraries: The next thirty years*, predicted the changes expected in the field and explained the ways in which professionals and systems can become prepared to accept the changes and develop further.

Andre and Pisa's study *Managing national resources in a time of change*¹⁸¹ discusses both the changing nature of information and the changes in the business of agriculture which are having a profound effect on the management of the programmes and services at NAL. Describes NAL and its variety of information services. Outlines its national and international relationships within the agricultural community and considers its attempts to improve access to agricultural information through strong cooperation. Looks briefly at a vision of NAL's future

Raman Nair's *Agricultural Information Systems: Vision 2020*¹⁸² gives a Vision document prepared for the Kerala Agricultural University Library and Information System. It gives a detailed account of the information systems development at the university and its constituent colleges and stations spread over the length and breadth of the State of Kerala. The system's mandate for the current and that proposed for the future, the present facilities and infrastructure, the achievements of the system and its

impact on the academic environment in various campuses are described. It also points out the shortcomings of the system, lessons learned from experience, the present information handling scenario and its strength, its weaknesses, and threats; its issues and strategies, as well as details of programmes and projects undergoing and envisaged for the future, Important inputs and out puts, and the methods the system has devised for resource generation and making it self sustainable are presented in the Vision Statement.

The studies covered above and few others existing, which had dealt with various facets of agricultural libraries, provided valuable preliminary information for starting this study of the libraries in agricultural sector of Kerala and for evolving guidelines and formulating suitable recommendations, which could be relevant to the State's conditions.

2.9.1. Conclusion

From the above review of literature it can be seen that research studies evaluating all aspects of the agricultural library and information services in total of a region, a State, or country in regard to India is not done earlier. The major researches done earlier on areas related to the present study are by Subbaiah, Pracher, Deshmukh, Singh, Gokul and Raman Nair. Pracher has studied the management aspect of agricultural university libraries based on four of the largest State Agricultural Universities of India. Subbaiah has built up a conceptual framework for implementing a national level agricultural information system. Deshmukh has worked on the standardization aspect of agricultural library and information services. Arjun Singh has evaluated the information resources and services for forestry. Rathore has studied marketing of information services and products in agricultural sector in the ICAR libraries. Gokul has studied information requirements of veterinarians and the resources and facilities of veterinary libraries in India. Raman Nair has done a study on staffing of various agricultural information systems in the Indian context. These studies are on specific groups of libraries in agricultural sector or specific aspects. All these prior studies have supported the present work on evaluating concerned aspects in the present context and for formulating suitable recommendations, which could be relevant to the conditions of the State of Kerala.

A careful review of the above studies also reveals that they are general in nature. They draw only broad conclusions, which are applicable, to the libraries of ICAR institutes as well as to State Agricultural Universities. An intensive study involving various representative agricultural libraries of university, research institute, government departments, NGOs and private organizations etc of different levels and extension catering to a wide variety of user categories like agricultural scientists, extension workers, students, administrators, planners, and farmers the most important category from a region, has not been undertaken so far.

The libraries of all categories and levels serving different areas and institutions in agricultural sector in a State or region is to be studied with an integrated view to find out the gaps in resources and services and how by effective coordination gaps can be filled and services can be improved by resource sharing and networking. So this is a virgin area when considered in the context of Kerala, the region within which present study is limited, as well as for other States, and also for India as a whole.

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Chapter 3

INFRASTRUCTURE IN AGRICULTURAL SECTOR OF INDIA AND KERALA

3.0. Introduction

The agricultural sector in India encompasses a broad spectrum of activities. The Departments of Agriculture in the Center and States created during 1880s, with the primary duties of agricultural enquiry, agricultural improvement and famine relief have passed through more than a century. During the period the system of governance in the country has undergone a discernible change from governing an important colony to managing of an independent democratic country. The nation was riddled with many formidable problems on economic, social, cultural and political spheres. It was under this changed scenario that agricultural sector assumed prime importance in the development process of the Indian economy.

The country has to meet the food and fiber needs of the large and fast growing population of the country on a sustained basis. More than 80 percent of the population living in rural areas that were wholly or partly dependent for their subsistence on agriculture sector was to be provided with gainful employment opportunities. Our government's enthusiasm with large-scale industries that was necessitated by global situations has not diluted the prominence of the agricultural sector because of the above-mentioned sheer compulsions.

3.1. Historical Perspective

Serious efforts were made and are continuing to tone up the agricultural sector for higher growth. The efforts consisted of strengthening the agricultural research system aimed at developing appropriate production technology, farm level extension of the new technology and agricultural education as well as institutional and policy support. Also agricultural sector was systematically toned up to yield marketed

surpluses, especially of food grain to feed the urban population through public distribution system. Agricultural sector thus acted as a lead sector that yielded capital surpluses and wage following a good classic model of economic growth and development like other agriculture dominated developing societies. This approach manifested through adoption of the process of investment planning and system of five-year development plans.

Keeping in view of the large-scale import of food grains in 1951 and the inflammatory pressures on the economy, the First Plan (1951-56) gave highest priority to agriculture including irrigation and power projects. About 46% of the total outlay that is Rs. 2069 crore was allocated for this purpose. This emphasis, however, got diluted in the Second Plan. Even the Third Five Year Plan did not absorb the reality of the situation and agriculture sector did not get adequate allocations.¹ This happened because of good production response of the agriculture sector in the First Five Year Plan. It was too late when the mistake was realized.

The policy-makers were forced to accord priority to the agriculture sector on technological improvement through expanding and strengthening the national agricultural research system. This included the central and State level agricultural universities and research institutes. The research effort was complemented with reorganization and toning up of extension network and agricultural education. In order to boost sustained growth in agricultural production, supportive institutional and policy framework was put in position through minimum support prices and procurement of agricultural produce by the government. The Food Corporation of India (FCI) was established. Public Distribution System (PDS) was a landmark in the history of Independent India. It was intended to provide price certainty to the producer at reasonable level, supply of food grains, sugar, oil etc to people at reasonable prices, and to create buffer stocks for food security. Recently Government of India has also established agricultural Research Information System (ARIS) to provide information support required for achieving quality and speed in management, research, extension, production and marketing in agricultural sector.

An evaluation of the library and information systems for agricultural sector in Kerala needs an understanding of the national level developments in agricultural sector. It is also essential to understand the system for agricultural education, research, extension and development existing in the country. The importance for information support mechanism for agricultural development and how it should change with the tune of time also needs to be discussed.

Library and information systems cannot exist in isolation. The attempts to sort out or make independent study of agricultural library and information systems as units separate from agricultural research, extension or development institutions will not give positive results. Hence agricultural library and information systems have to be seen in the context of organization's long-term goals and objectives. If this is not done by concerned organizations resources will be ill utilized and wasted. Hence this study examines in this chapter the historical roots of agricultural information service systems for education, research and extension in India with special reference to Kerala and their present status and possibilities.

3.1.0. Institutions and Programmes

In the early stage of education system in India, agricultural science was in the domain of public funded general universities, as a part of natural sciences. With advancements in science, agriculture, mainly crop science, was separated from natural sciences, but was again taught in the general universities. Crop research to some extent was also conducted.

The development of independent agricultural research and education institutions can be traced back to the late nineteenth century. The process started with the pioneering efforts of Lord Mayo, the then Governor General of India, leading to the establishment of Department of Revenue, Agriculture and Commerce in the Imperial and Provincial Governments in 1871.² Main functions of the Department of Agriculture, as defined in the resolution of 1881, were agricultural enquiry, improvement and famine relief³. During the last decade of the 19th century, experts were recruited in the Department of Agriculture, for research and teaching in

agriculture. Bacteriological Laboratory (now Indian Veterinary Research Institute, Bareilly) was started at Pune in 1890, to start organised livestock research. The Civil Veterinary Department was created in 1889 and five veterinary colleges were also established at Babugarh (1877), Lahore (1882), Bombay (1886), Madras and Calcutta (both in 1893)⁴.

3.1.1. Research Facilities

Agricultural research and education got major support in the first decade of the 20th century when Lord Curzon was the Viceroy of India. The most significant milestone was the establishment of the Imperial (now Indian) Agricultural Research Institute (IARI) at Pusa in Bihar in 1905. The 'Pusa' institute suffered from a devastating earthquake in 1934 and was therefore, shifted to New Delhi, a central place, in 1936. The success of research work at the IARI gradually led to the origin of a number of research institutions. Also in 1905, six agricultural colleges were established in important provinces at Pune (Maharashtra), Kanpur (Uttar Pradesh), Sabour (Bihar), Nagpur (Maharashtra), Faisababad (now in Pakistan) and Coimbatore (Tamil Nadu) with an annual grant of Rs 2 million from the Government of India. These colleges were adequately equipped with staff and laboratories and were charged with the responsibility of research and teaching⁵.

3.1.2. System for Co-ordination

Another significant development was the establishment of the Imperial (now Indian) Council of Agricultural Research (ICAR) in 1929, an autonomous body, on the recommendation of the Royal Commission on Agriculture (1926). The ICAR was mandated to *promote, guide and coordinate agricultural research* in the country. The ICAR was expected to supplement research activities of provinces and train scientific manpower. However, the ICAR had no administrative control over research institutions in the provinces.⁶ The establishment of the ICAR, in a way, was empowerment of agricultural research in India. Concomitantly, a number of central commodity committees were constituted, mainly for commercial crops. This includes committees for cotton, lac, jute, sugarcane, coconut, tobacco, oilseeds, areca nut, and

spices and cashew nut. These committees were semi-autonomous bodies financed by grants from the Government of India and were expected to promote overall commodity development, including research. In fact, many committees established research stations. These committees had representation of various stakeholders like producers, trade and industry, agricultural department, etc. The Vice-President of the ICAR was *ex-officio* President of the committees⁷. These committees built up small relevant document collections on concerned commodities on their headquarters.

The commodity approach to research lacked co-ordination between commodities and neglected research areas applicable across commodities like soil management. The need was, therefore, recognised to initiate research on cross-commodity basis. Also, the idea of rationalisation of research was getting momentum. These factors led to the establishment of Composite Regional Stations for research on cotton, oilseeds and millets in 17 regions in 1956. These stations were under the administrative control of the ICAR. The regional coordination committees monitored research progress. The Indian Central Cotton Committee, the Indian Central Oilseeds Committee and the ICAR shared the research expenditure⁸.

Although the ICAR was established as a coordinating body, effective research coordination was missing. It was because the ICAR did not have administrative control over many of the central or any of the provincial research stations. In order to provide effective coordination to commodity research, the concept of coordinated research project for crop improvement was introduced.⁹ In 1957, the first All India Coordinated Project (AICRP) on maize was started with the technical support from the Rockefeller Foundation. The project was multidisciplinary in nature and pooled staff working in different regions. This was the beginning of research planning on the basis of agro-climatic zones, cutting across political boundaries. The project was extremely successful. It paved the way for establishment of a series of All India coordinated research projects.

On the recommendation of the Agricultural Research Review Team (1964), the ICAR was reorganised in 1965 for *coordinating, directing and promoting agricultural research* in the country.¹⁰ All the commodity committees were

abolished. The research institutes under these committees and the Central Department of Agriculture and Food were gradually transferred to the ICAR. This led to centralisation of funding, execution and management of agricultural research with greater autonomy and empowerment to the ICAR. A Department of Agricultural Research and Education (DARE) was created in 1973 in the Central Ministry of Agriculture. Its responsibility was to establish direct linkages of the ICAR with central and State governments, and international organisations.

Gradually under ICAR several new research institutions came into existence. However, major expansion under the ICAR took place on the lines of commodity research. Funds for these research institutes were channelled through the ICAR from the central government. Research stations under the administrative control of the State governments continued to be funded by State governments.

3.1.3. Agricultural Education

Although a number of agricultural and veterinary colleges were functioning under the Department of Agriculture in the States, agricultural education maintained a low profile. These colleges were crippled with administrative and financial constraints. There was virtually no coordination between agricultural and veterinary colleges. The University Education Commission (1948) felt the need for establishing rural (agricultural) universities in the States¹¹. Subsequently, the two Joint Indo American Teams (1955 and 1960) endorsed the establishment of State Agricultural Universities (SAUs). The SAUs were set up on land-grant pattern of the American universities. The first one was started in 1960 at Pant Nagar in Uttar Pradesh. The SAUs were given autonomous status and direct funding from the State governments. These universities imparted education on all aspects of agriculture on the same residential campus and integrated teaching with research and extension. The US Agency for International Development (USAID) and the American Land-grant Universities helped development of SAUs in India. Subsequently, implementation of the recommendations of the Education Commission (1964-66) and Review Committee on Agricultural Universities (1977-78) streamlined their functioning. All

matters related to agricultural research and education in the States was transferred to the universities¹².

3.1.4. Regional Agricultural Research

Establishing the Regional Agricultural Research Stations (RARS) under the National Agricultural Research Project (NATP) in 1979 with assistance from the World Bank further strengthened the regional research capacity in the States. These research stations, in different agro-climatic zones of the States, were under the administrative control of SAUs. Addressing zonal research needs and fostering linkages between research, extension and farmers were the main responsibilities of these research stations. These stations have during their existence created significant quantum of data on concerned agro climatic region as well as relevant book collections.

Meanwhile, there has been tremendous growth in non-agricultural universities and other scientific organisations, notably, Council of Scientific and Industrial Research (CSIR), Department of Biotechnology (DBT), Defence Research and Development Organisation (DRDO) and Department of Science and Technology (DST). These organisations also continued to strengthen, directly or indirectly, agricultural research and education.

3.1.5. Agricultural Extension

The national agricultural extension system also evolved with the establishment of the Department of Agriculture in the Imperial and provincial governments. Efforts to strengthen this Department continued up to the time of Independence. Agricultural extension was one of the activities of the Department and no special attention was paid to accelerate transfer of technology efforts. However, some isolated attempts were made to start special rural development programmes, including improvement of agriculture. Soon it was realised that sporadic and ad hoc programmes might not be effective and that there was a need for sustained rural and agricultural development programmes. A nationwide, multi-purpose extension network backed with

professionals became indispensable. Consequently, 55 Community Development Projects were started in 1952. Each project covered 300 villages with a village level worker for a group of 10 villages. For each project, extension officers-technical persons in agriculture, animal husbandry, cooperation, village industries and rural engineering-were provided. The programme was based on the philosophy of integrated rural development. In 1953, the National Extension Service Programme, identical to the Community Development Programme but with less resource intensity, was launched with a view to cover the entire country by 1960-61.¹³ The programme aimed to accelerate the pace of rural development, including increased employment and production by the application of scientific methods in agriculture. The programme greatly emphasised the principle of development through *self-help and peoples' participation*. The central government met the cost of the programme.

3.1.6. Lab to Farm

Front-line extension work also was initiated as agricultural research system grew in the ICAR and SAUs. A directorate/department of extension was established in the ICAR institutes and SAUs. The basic objective of this department was to conduct extension research, demonstrate latest technologies, provide feedback to scientists, and provide training support to State Department of Agriculture.¹⁴ Besides, the ICAR started front-line extension projects, like National Lab-to-Land Project (1979). Another significant development in front-line extension was the establishment in 1974 of Krishi Vigyan Kendras (KVKS) and Trainers' Training Centres (TTC). KVKs and TTCs were aimed to improve technical literacy of farmers and rural women on the principle of *'teaching by doing and learning by doing'*. The ICAR institutes, SAUs and NGOs with support from the ICAR, now manage the KVKs.

The central government also launched several schemes to achieve self-sufficiency in food production. The important programmes were: Intensive Agricultural District Programme (1961) and Intensive Agricultural Areas Programme (1964). They concentrated on the transfer of 'package of practices' and supply of critical inputs to farmers. In other words, *extension strategy combined technical*

information with the supply of inputs. However, this strategy was discontinued with the reorganisation of the extension system under the Training and Visit System in 1974-75. The Training and Visit system gave emphasise to single-purpose professional extension workers, regular training of extension personnel and transfer of technology through personal contact with farmers. This concept was further strengthened through establishing research-extension-farmer linkages under the National Agricultural Extension Project (NAEP) in 1979.

3.1.7. Contributions from Industrial Sector

The participation of industries both from public and private sectors, in agricultural research was absent until 1950s. With the adoption of new seed-fertilizer technology in the mid-sixties, there was phenomenal growth in the industrial sector for the production of inputs. However research activities in these industries were at the margin. The entry of private sector in seed research started in the 1970s with the popularisation of hybrids. So industrial sector entered in a big way in the dissemination of chemical and mechanical technologies in the 1980s¹⁵. The late 1980s marked real beginning of private sector in seed business. Input industry promotes the use of modern inputs through mass media and linking information with the supply of inputs. The passing of new policy on seed development in 1988 streamlined seed research in the private sector. This allowed participation of trans national seed companies. Several NGOs also got involved in agriculture and rural development activities during the period.

The National Agricultural Research and Education System (NARS), as evident from the historical developments reviewed above, is dominated by the public sector. Although agriculture is a State subject in the constitution of India, major components of the research system were initiated and funded by the Union Government. The NARS has three main institutional set ups with different mandates. These are: ICAR institutes to cater to upstream research needs, SAUs engaged in teaching and research for respective States and ZARSs to undertake zone-specific research. The ICAR is linked with the Union Ministry of Agriculture through the DARE. The Council also coordinates directly with State governments and international organisations through

the DARE. The Governing Body consisting of eminent agricultural scientists, academicians, legislators and farmers' representative as its members is the chief executive and policy-making authority in ICAR. The General Body is the supreme body of the ICAR.

3.2. National Agricultural Research and Development System

In India there are four major organizational streams devoted to research, education and development in agriculture and allied areas. They are 1) ICAR System, 2) Central and State Ministries of Agriculture, 3) Central and State ministries of Forestry, Rural Development, Environment and related areas and 4) Autonomous Institutions and Non Governmental Organizations (NGO). A graphical representation of the infrastructure for agricultural development in India and its organizational streams are presented in Figure 3.1.

From the administrative viewpoint this is a three-tier system. At the centre, there is Indian Council of Agricultural Research (ICAR) with its 89 institutions to plan, promote, coordinate and execute research in the country. At the State level, there are 28 SAUs and one Central Agricultural University to impart education and conduct research for the respective States. Affiliated to the SAUs are 120 Zonal Research Stations to conduct adaptive research for the zone.¹⁶ Responsibility of extension lies with the State Department of Agriculture. The ICAR/SAU system undertakes only front-line extension activities. Funding to the ICAR is from the Union Government, while the State governments mainly fund SAUs and extension system. Some ICAR funds are also transferred to SAUs. Therefore ICAR and SAUs concentrate mainly on upstream and crop and resource management research, besides education. Within the ICAR/SAU system, location specific research on crop and resource management is generally concentrated in SAUs. Besides, several agencies such as general universities, other scientific organizations, departments/ministries at the Centre, private and voluntary organizations etc also participate directly or indirectly in research activities related to agriculture.

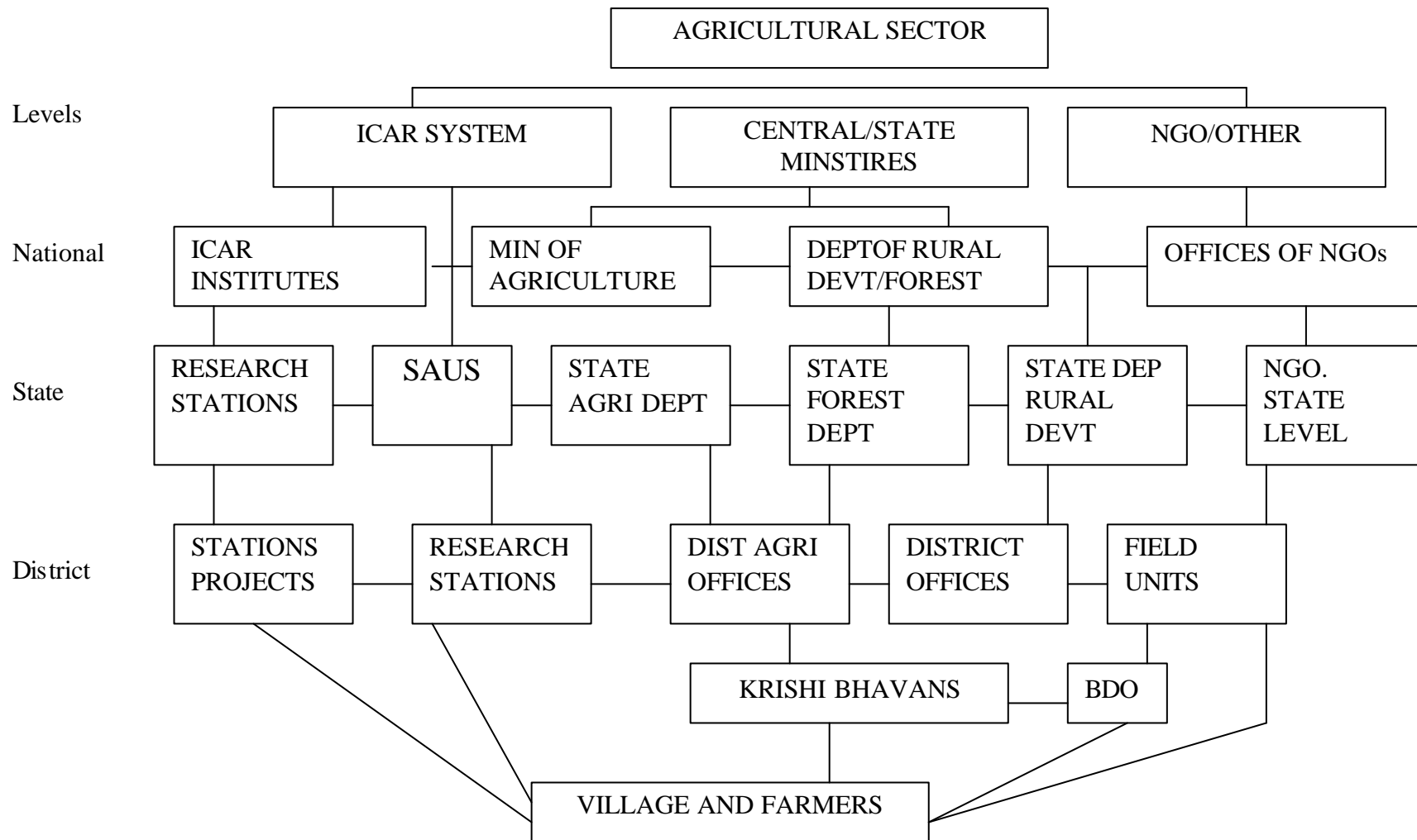


Figure 3.1: Streams of Infrastructures for Agricultural Sector in India

3.2.0. Indian Council for Agricultural Research (ICAR)

The ICAR is the apex body at national level mainly responsible for aiding, promoting and coordinating agricultural research in the country.¹⁷ It has the concurrent responsibility for research, education and extension. In addition to its promoting and coordinating roles, the ICAR is also directly involved in undertaking research at the national level, basic as well as applied. Areas on which ICAR concentrates on research are diverse problems facing production of crops, animals, fisheries etc, with the objective of evolving new production technologies suited to different agro-climatic conditions.

Although agriculture is a State subject, the ICAR has established a network of Central Research Institutes, National Bureau, Project Directorates, Coordinated Research Projects and National Research Centers to meet the agricultural research needs of the country. These are essentially meant for the (i) pursuit of basic research not undertaken at most of the SAUs, (ii) implementation of research mandates extending beyond the administrative boundaries of State, (iii) evaluation of research results through testing at multiple locations under the AICRPs, and (iv) development of manpower for the SAUs and other agricultural institutions.

3.2.1. Central Research Institutes (CRI)

The ICAR directly administers 45 CRIs in the areas of crops, horticulture, soils, engineering, animal sciences, fisheries and also the National Academy of Agricultural Research Management¹⁸. The CRIs carry out basic and fundamental research on problems of national importance with some focus on regional problems as well. These institutes are generally large-sized units with specified mandate. They are required to confine their activities according to their mandate. This may authorize them to work on problems related to a commodity (Central Rice Research Institute), a group of commodities (Central Plantation Crops Research Institute), a discipline (Indian Institute of Soil Sciences), a geographic area (Centre for Agricultural Research in Andaman and Nicobar Group of Islands), a technology (Jute Technological Research Laboratories), or a specific issue (Central Soil Salinity

Research Institute). There are also multi-discipline, multi-commodity institutes like the Indian Agricultural Research Institute. The CRIs have a network of regional stations covering diverse agro-ecological areas. These institutes are also responsible for transfer of technology. Some institutes like IARI and IVRI have Post-Graduate teaching programmes.

3.2.2. National Bureau and National Research Centers (NRC)

The ICAR has established 4 National Bureau to collect and conserve basic resources of agriculture. They have to initiate such measures that would lead to long-term productivity of these resources like animal, plant, fish and soil. The NRCs have been mandated for narrow concentrated mission on selected topics. They do not have a divisional structure or regional sub stations. The NRC for Groundnut was the first to be organized in 1979. The NRC for Orchids is one of the recent ones. The NRC for Yak is one of the most exotic one. The NRCs for mushroom, citrus, soyabean and meat products are examples of new centers being established in response to increasing demand for higher value of agricultural products. The NRCs are designated to concentrate on those crops and commodities not well served by the CRIs. The NRCs for arid horticulture, orchids, onion and garlic, citrus, fibers allied to jute, and meat and meat products fall in this category. Others are to undertake basic research not elsewhere available, the absence of which hampers development of a crop, commodity, or discipline. These include NRCs on medicinal and aromatic plants, weed control, soyabean, agro forestry and coldwater fisheries. Biotechnology as applied to agriculture is being introduced through these centers, one each for crop science, animal production, and animal health. Some of the NRCs may grow into full-fledged institutions once their standard of work is established and if the subjects assume greater national importance. All NRCs have small, specialized document collections on concerned topic to support research and development.

3.2.3. All-India Coordinated Research Projects (AICRP)

AICRPs are cooperative endeavors with the SAUs, general universities, State departments and NGOs involved in carrying out both multi-disciplinary and multi-

location testing of newly developed technologies and varieties. They were conceived as instruments to mobilize available scientific resources to find effective solutions for the national problems of agricultural production through inter-institutional interactions. These projects constitute an effective national grid of coordinated experiments by integrating different institutions and disciplines.

The All-India Maize Improvement Project was the first AICRP to be launched in 1957. Its remarkable success led to the extension of this approach to all the major crops and other areas like animal sciences, fisheries, soils, agricultural engineering and horticulture. Subsequently many such coordinated projects were initiated. The coordinating units are either located in the ICAR institutes or the SAUs depending on the location of the project.

3.2.4. Project Directorates (PD) and Centers of Excellence

Some of the AICRPs working on a single commodity or a group of related commodities have been upgraded into PDs because of increased importance and magnitude of the work involved. Except for the size and magnitude of work, they are essentially the AICRPs with added responsibility to undertake research on some other important aspects. There are now 10 such PDs under operation in the country in different disciplines.

To ensure continuing focus on the frontier areas of research, the scheme of Professors of Eminence and National Fellows (now ICAR Professors) has been started. The objective was developing strong centers of excellence in research and education around scientists of proven competence and leadership in the areas of basic research.

3.2.5. National Agricultural Research Project (NARP)

Agricultural research is essentially location-specific. Unless need-based research is conducted under the situations where it is to be utilized, the gap between technology generation and utilization is bound to widen. Therefore, the NARP was

launched in 1979 to strengthen the capability of the SAUs to conduct location-specific and production-oriented research on the basis of identified agro-climatic zones. The project envisaged covering of 120 agro-climatic zones of the country.

3.2.6. International Linkages

The professional competence of agricultural scientists in the country is being updated on continued basis. It is through in-service training and placement in advanced laboratories under bilateral agreements with foreign countries and international agricultural research centers¹⁹. Interaction with the international agricultural research systems both in the developed and developing countries has been an important facet of the ICAR. There are continuous multilateral cooperative programmes with the United Nations Development Programme (UNDP), United Nations Educational, Scientific and Cultural Organization (UNESCO), Food and Agriculture Organization (FAO), Swedish Agency for Research Cooperation between Developing Countries (SAREC) and other agencies. Consultative Group on International Agricultural Research (CGIAR) and the Centre for Agriculture and Biosciences International (CABI) have helped in the exchange of information on both research and education, exchange of experts and ideas and in equipping of laboratories with the latest equipments. At present there are more than 120 projects in operation with foreign collaborations and majority of them are with the USA, UK, Canada, the Netherlands, Australia and the EEC²⁰. The World Bank through credit assistance finances the National Agricultural Research Project (NARP), the National Seeds Project (NSP) and the recently initiated Agricultural Human Resource Development Project. As a pioneer member of the CGIAR the ICAR has cooperative agreements with most centers of the CGIAR. Our research programmes have benefited substantially from the interactions.

3.2.7. Agricultural and Traditional Universities

As agriculture is State subject the responsibilities for research, education and extension rest with the State Governments. Prior to 1960 the State Departments of Agriculture supported by the agricultural colleges affiliated to general universities

carried out agricultural research in the States especially on local problems. During the past 30 years research and education at the State level have been transferred to the State Agricultural Universities (SAU). There is a considerable variation between the states in the number of SAUs and the range of their constituent colleges. In addition, 4 of the ICAR institutes have the status of deemed universities. Many States have established multiple universities to meet regional needs. Starting with the G .B. Pant University of Agriculture and Technology, which was established in 1960 at Pant Nagar, Uttar Pradesh, there are 29 Agricultural Universities in different States of the country. There is also one Central University.

The SAUs provide integrated support to research, education and extension needs of agriculture and allied sectors in the respective States. The research infrastructure consists of agricultural experiment stations at the main campus and a number of regional research stations and substations located in different parts of the State. In some universities, advanced research centers have been established by combining related subjects in areas such as plant protection, agricultural engineering and water sciences.

The funding support for SAUs comes from the respective State governments and the ICAR. The SAUs receive assistance from the ICAR for general development, for implementation of various AICRPs and adhoc research schemes financed through the Agricultural Produce Cess Fund. To take location-specific land and crop production problems, the SAUs are assisted by the ICAR through the NARP under which regional research stations have been set up.²¹ In general the ICAR is to agricultural education, what the UGC is to general education in the country.

Even though since 1960s general universities transferred teaching and research responsibilities to the SAUs, some universities and technology institutes that had strong departments or facilities in agriculture or related sciences, continued to undertake teaching and research in agriculture. These universities continue to conduct research under the AICRPs and ad-hoc research projects financed by the ICAR. There are 15 general universities, which impart education and conduct research in

agricultural sciences also and a few others does this in limited way in terms of disciplines.

3.2.8. Other Organizations

There are many other Scientific Organizations under government departments, private and voluntary agencies, scientific societies etc engaged in various activities in agricultural sector. Many scientific organizations either directly undertake research, or sponsor and support programme related to agriculture. The Council of Scientific and Industrial Research (CSIR) through its network of national laboratories, provides research support in processing of agricultural products, recycling of agricultural wastes, development of various agrochemicals etc. The research at the Indian Council of Medical Research (ICMR) on the nutritional qualities of various agricultural produces including toxicity and occupational health of agricultural workers has greatly helped the ICAR in planning its research programme. The Bhabha Atomic Research Centre (BARC) is actively engaged in the screening of newer varieties of crops and preservation of agricultural produce. Indian Space Research Organization (ISRO) is helping the research system to assess India's soil and water resources. The IIT, Kharagpur is active in agricultural engineering, soil and water management and agronomy.

Several government departments, both at the center and in the States are involved in the country's research efforts in agriculture either directly by undertaking research them selves or indirectly by supporting research programme related to agriculture. The Department of Science and Technology (DST) promotes research on genetic engineering, post harvest technology and areas of basic sciences supportive to agriculture. The Department of Non-Conventional Energy Sources (DNES) works on the utilization of solar and wind energies and biogas for agricultural purpose. The Indian Meteorological Department (IMD) is actively engaged in research on crop-weather forecasting. Department of Ocean Development is involved in assessing the fishery resources in the country and promotes research in fisheries.

Some of the important bodies under various Central Ministries which have been making substantial contribution towards strengthening the agricultural research system in the country are the National Dairy Development Board (NDDB); National Wasteland Development Board (NWDB); commodity boards like Silk, Coffee, Rubber, Tea, Spices; and Coir Boards; Central Board of Irrigation and Power; Defense Research and Development Organization (DRDO) and Central Labor Institute. A large number of scientific and professional societies in the country also participate in research activities by publishing research journals and by holding symposia, seminars and conferences.

The agricultural transformation in the mid-sixties had a catalytic effect on the involvement of private institutions in the agricultural research activities. This was more so with the institutions engaged in the production of agricultural inputs, such as seeds, fertilizers, agrochemicals, agricultural machinery and implements. Many private institutions and voluntary agencies are taking part in AICRPs and are also undertaking short-term mission-oriented ad-hoc research schemes supported by the ICAR. The involvement of private agencies in agricultural research is gaining momentum with greater sophistication in technological development and better prospects of high returns on investment in agriculture.

3.3. Agricultural Science in Kerala

Travancore Government initiated scientific agricultural developments in the State in 1894.²² The then Diwan Sri Sankara Subbier opened an Agricultural Demonstration Farm at Karamana near Trivandrum in that year. The intention was to demonstrate to the agriculturists the improved methods of cultivation and the possibilities of introducing iron plow and exotic crops like ground nuts and new varieties of sugarcane. The farm was put under the charge of an officer from Madras trained in scientific agriculture. In 1896 a scheme was formulated for the introduction of elementary agricultural education in the State. Accordingly a few young men were trained in scientific agriculture at the Demonstration Farm. They were appointed as Headmasters of agricultural schools to which small farms of about one acre each were also attached. The idea was to impart theoretical and practical training in agriculture

to youngsters. In 1907 another Demonstration Farm was established at Quilon. In the same year the Directorate of Agriculture and Agricultural Research Laboratory was also established. In 1908 the Dewan Sir P. Rajagopalchari established Department of Agriculture. Departments established in British Indian provinces, according to the policy of the then Viceroy Lord Curzon was taken as model for this. In 1911 a cattle breeding farm was also opened at Trivandrum. An experimental farm was established at Kottarakkara to conduct experiments on cultivation of root crops, and a coconut farm at Alleppy for research on coconut cultivation and prevention of coconut palm diseases. In 1913 an entomology division was started to deal with the insect pests of crops. In the following years, farms and institutes for study of specific crops such as a paddy farm at Nagercoil and Eraniel, pepper farm at Konni, fruit farm at Cape Comerin another Demonstration Farm at Puliyara, coconut farm at Ochira and a cattle breeding farm at South Travancore were established.

Gradually the department became capable of effectively coordinating the aspects of agriculture like research, experiments, demonstration and propaganda, agricultural education, cattle improvement and subsidiary occupations.

The Agricultural Department has by 1940 at various institutes established strong departments for agricultural chemistry, agricultural bacteriology, entomology, mycology, and economic botany. For a long time fisheries was a division of the Department of Agriculture. In all the above institutions and divisions selectively acquired books on concerned subjects were maintained.

The research carried out in the laboratory was experimented in government farms. Only methods found to produce satisfactory results in the field experiments were recommended for adoption. The new knowledge so generated was brought to the notice of the people to enable them to put it into practice. An efficient information disseminating system also gradually evolved under the department. Methods used for popularizing scientific agriculture and animal rearing were publication and distribution of popular leaflets, delivering lectures often with magic lantern illustrations, holding exhibitions, conferences, fairs and festivals. Information materials were provided through rural agricultural libraries.

The Act No 43 of Government of Kerala established Kerala Agricultural University in 1971. With this most of the institutions/agencies and divisions of government related to agricultural education and research as well as farms and experiment facilities were transferred to the university.

3.3.1. Infrastructure of Agricultural Sector in Kerala

In Kerala the study identified approximately 6745 organizations, institutions and agencies engaged in various types of activities related to agricultural education, research, extension and development. They consist of small groups with staff and or beneficiaries of less than a hundred to more than 10 000. The statistics related to such organizations, institutions and agencies is presented in Table 3.1. Of this 1257 are related to agriculture, forestry etc., 4280 related to animal husbandry and related areas and 209 related to fisheries. From among this 43 institutions are major institutions when their mandate, budget, staff strength, resources at hand and activities and services are considered. These organizations or agencies can be grouped as follows, based on the organizations and government that supports maintenance and coordinates their activities.

- ?? Institutions under Indian Council of Agricultural Research (ICAR)
- ?? Institutions under Kerala Agricultural University (KAU)
- ?? Departments and divisions under Traditional Universities and Research Institutions
- ?? Institutions directly controlled by the Central Government
- ?? Institutions directly controlled by the State Government
- ?? Institutions under Non-Governmental Organizations

A list of important institutions from the above selected for the present study is presented in Appendix –6 and their location is graphically presented in Figure 3.2.

Table3.1: Organizations/ Institutions Working in Agricultural Sector of Kerala

Institution/Type	Agri	Vet	Fish	Eco	Major	Minor	Total
KAU Colleges.	05	01	03	01	10	00	10
RARS of KAU	06	00	00	00	00	06	06
Information/Sales Dns-KAU	09	00	00	00	00	09	09
RS of KAU	20	06	01	00	00	27	27
ICAR Institutes	03	00	02	00	05	00	05
Corporations /Boards	07	00	01	01	09	00	09
Federations/Councils	06	00	00	01	02	00	09
Directorates	03	03	01	01	08	00	08
Autonomous RI	05	00	00	00	05	00	05
LTD Companies	04	00	00	00	04	00	04
Soil Testing Labs	14	00	00	00	00	14	14
Fertilizer Quality Control Labs	02	00	00	00	00	02	02
Pesticide Testing Labs	02	00	00	00	00	02	02
Seed Testing Labs	01	00	00	00	00	01	01
Agmark Grading Labs	10	00	00	00	00	10	10
Reg Agri Tech Training Centers	05	00	00	00	00	05	05
Farmer Training Centers	02	00	00	00	00	02	02
Bio Control Labs	01	00	00	00	00	01	01
Paddy Development Agencies	11	00	00	00	00	11	11
Pest Surveillance Units	01	00	00	00	00	01	01
Seeds Planting Mat Prdn Cent	61	00	00	00	00	61	61
Krishi Bhavans	1069	00	00	00	00	1069	1069
Veterinary Hospitals	00	1069	00	00	00	1069	1069
Broiler Farms	00	15	00	00	00	15	15
Pig Breeding Farms	00	08	00	00	00	08	08
Diagnostic Labs	00	04	00	00	00	04	04
Jersey Farms	00	03	00	00	00	03	03
Goat Farms	00	04	00	00	00	04	04
Livestock Mgt Training Cent	00	06	00	00	00	06	06
Diary Cooperatives	00	3143	00	00	00	3143	3143
Diary Plants	00	17	00	00	00	17	17
Krsihi Vignan Kendras	09	00	00	00	00	09	09
Research Instns -Govt	01	01	00	00	00	02	02
Fisheries Cooperatives	00	00	201	00	00	201	201
Total	1257	4280	209	4	43	6202	6245

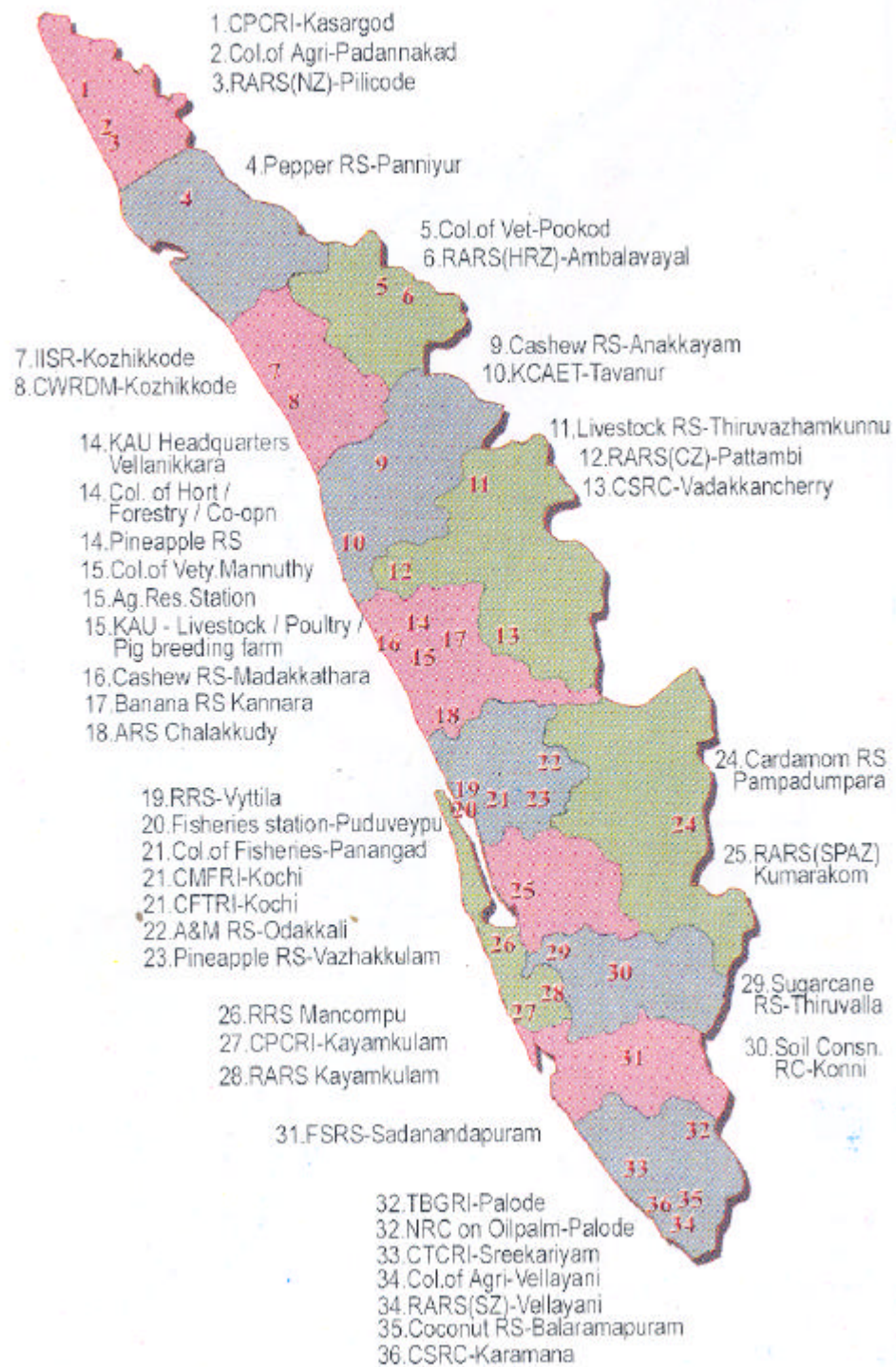


Figure 3.2: Location of Important Agricultural Research Institutions of Kerala

3.4. ICAR Institutes in Kerala

ICAR has five major research institutes in Kerala dealing with plantation crops, tuber crops, spices and fisheries technology. They are: Central Tuber Crops Research Institute (CTCRI) at Trivandrum, Central Plantation Crops Research Institute (CPCRI) at Kasaragod, Indian Institute of Spices Research (IISR) at Calicut, Central Institute of Fisheries Technology (CIFT) and Central Marine Fisheries Research Institute (CMFRI) at Kochi. The Sugarcane Breeding Institute of ICAR has substation at Kannur, Kerala. Three All India Coordinated Research Projects on palms, spices, and tuber crops also function in Kerala. Nine Krishi Vigyan Kendras of ICAR also function under various institutions in Kerala.

3.4.1. Central Plantation Crops Research Institute (CPCRI)

ICAR established Central Plantation Crops Research Institute (CPCRI) in 1970 with its headquarters at Kasaragod. It has research stations at Kayamkulam, Palode, and Peechi and also at other regions of India. The mandate of the institute is to develop appropriate production technologies for coconut, arecunut and cocoa through basic and applied research. With this aim it has to act as a national repository for the genetic resources of these crops, to produce parental lines and breeders' stocks of plantation crops, develop improved palm based cropping/farming systems through more effective use of natural resources to increase productivity and income from unit area, collect, collate and disseminate information on the mandate crops to all concerned. It has also to co ordinate research on these topics within the country and executes research programmes under the AICRP plans and to transfer technologies developed by it to the farmers through cooperation of developmental departments²³. Research projects going on at CPCRI include, crop improvement in coconut, arecunut and cocoa through basic and applied research, adaptive research on cashew and spices, high yielding coconut hybrids, standardizing coconut based farming systems, management of coconut root wilt disease affected gardens, production of indigenous genera hybrids in oil palm and standardizing input requirement for coconut, arecunut and spices etc. CPCRI has very strong Library and Information Divisions, which produce and market information products and services.

3.4.2. Central Institute of Fisheries Technology (CIFT)

Central Institute of Fisheries Technology (CIFT) established in 1957 under the Department of Agriculture is one of the seven premier research institutes for fisheries under ICAR. It is the only national center in the country where research in all disciplines relating to fishing and fish processing is undertaken. It conducts basic and applied research to address the problems related to a wide spectrum of marine and inland fisheries activities in relation to the global scenario. The mandate of the institute are; to evolve innovative and cost effective technologies for fish harvest, to develop standards for various aspects of post harvest technologies, to develop technologies for extraction of biomedical, pharmaceutical and industrial products from aquatic organisms and to provide consultancy services and to popularize the innovations for the overall development of the fisheries industry²⁴. Its mandates related to information management and dissemination are to act as a repository of information on harvest and post harvest technologies with a systematic database, to conduct transfer of technologies through training, education and extension programmes. CIFT has one of the best libraries on fisheries in India.

3.4.3. Central Marine Fisheries Research Institute (CMFRI)

The Central Marine Fisheries Research Institute (CMFRI) was established at Madras in 1947 by the Government of India under the Ministry of Food and Agriculture and was shifted to Cochin in 1971. In 1961 the administration came under ICAR. The various divisions of the institute attend the regional problems and the national priorities in marine fisheries and sea farming. It has a multidisciplinary approach to marine capture and culture fisheries. The institute has the mandate for assessing and monitoring the status of exploited and un exploited fish stocks, waters and ocean in relation to fishery dependent and independent factors and also evaluation of the techno – economics and socio economics of marine fisheries²⁵. Mandate also covers development of suitable technologies for sea farming of finfish, seaweeds and other cultivable marine organisms, up gradation of technologies through research and development in frontier areas of biotechnology, nutrition, pathology and endocrinology. Monitoring the health of the coastal eco systems in relation to

artisanal fishing, mechanical fishing and marine pollution also comes under its mandate. Its education and information related functions include transfer of viable sea farming technologies through extension education, specialized training and consultancy services, and post graduate education in marine fisheries and marine culture leading to MFSc and PhD degrees. CMFRI has a very good library system.

3.4.5. Central Tuber Crops Research Institute (CTCRI)

Central Tuber Crops Research Institute (CTCRI) established at Trivandrum in 1967 is an institute under ICAR. The AICRP on Tuber Crops operates from this institute. It has fifteen centers spread throughout the tuber crops growing areas of India. The institute is also one of the centers of AICRP on Harvest and Post Harvest Technologies. The institute has the mandate to undertake basic strategic and applied research for generating technologies to enhance productivity and utilization of tuber crops other than potato. It acts as a national repository of scientific information on tuber crops and coordinates network research with SAUs for generating location specific technologies. It acts as a center of human resources development for various clientele systems involved in tuber crops research and development and undertake transfer of crops technology through consultancy, outreaches programmes and linkages with development agencies²⁶. The Institute has a very good library facility and a valuable collection on tuber crops.

3.4.6. Indian Institute of Spices Research (IISR)

Indian Institute of Spices Research (IISR) Calicut is a constituent body of ICAR and is a major institute devoted to research on spices. It is an institute of excellence for conducting and coordinating research on all aspects of spices improvement, production, protection and post harvest technology. The institute has the mandate to; extend services and technologies to conserve spices, genetic resources as well as soil, water and spices agro-eco systems, develop high yielding and high quality spices varieties and sustainable production and protection system using traditional and non traditional techniques and novel biotechnology approaches, develop post harvest technologies for spices with emphasis on product development

and domestic and export purposes. It has to act as a center for training in research methodology and technology up gradation of spices, co-ordinate national research projects and monitor the adoption of new and existing technologies to make sure that research is targeted to the needs of farming community. It has to serve as a national center for storage, retrieval and dissemination of technological information on spices.²⁷ The major research projects undertaken are on management of phytophthora foot rot in black pepper, bio control strategy for foot rot and rhizome rot of ginger, biological control of insects, pests on black pepper and ginger, chemical control methods for major diseases and insects of black pepper, ginger and cardamom, large scale distribution of bio control agents, standardization of nutrient and water requirement including micro nutrients for black pepper, ginger and cardamom and establishment of invitro gene bank for spices conservation. Of the institute's germ plasma collection black pepper (3000) ginger (60), turmeric (802) Cinnamon (299) and Nutmeg (475) are the largest collections in the world. Other collections are Clove (220), Cardamom (280) Garcina (260 and vanilla (46). IISR has very strong library and information support systems.

3.5. Kerala Agricultural University (KAU)

Kerala Agricultural University (KAU) came into existence in February 1971, under the Kerala Agricultural University Act 1971 of the State Legislature. With respect to the teaching at the university and college level, and research and extension educational programmes in the field of agriculture, the territorial jurisdiction and responsibility of the university extend to the entire State of Kerala. The following are the main objectives of KAU²⁸.

- ?? Making provision for imparting education in different branches of study particularly agriculture, horticulture, and animal husbandry including veterinary and dairy science, co-operation, and fisheries, agricultural engineering, home science and other allied branches of learning and scholarship
- ?? Furthering advancement of learning and pursuing of research particularly in agriculture and allied science and
- ?? Undertaking extension education programmes.

KAU has the following functions to fulfill for achieving the above objective.

- ?? Provide instruction in agriculture and other allied branches of learning as university may deem fit.
- ?? Make provision for conduct of research in agriculture and allied branches of learning
- ?? Make provisions for dissemination of the findings of research and technical information through an extension education programme
- ?? To institute degrees, diplomas and other academic distinctions
- ?? To institute courses of study and hold examinations for and offer degrees, diplomas and other academic distinctions on persons who have pursued a prescribed course of study or carries out research as may be prescribed in the university or an institution recognized in this behalf by the university
- ?? Confer such honorary degrees and other distinctions as may be prescribed
- ?? Provide lectures and instructions for field workers, village leaders and other persons not enrolled as regular students of the university and grant them such certificates as may be prescribed
- ?? Operate with other universities and authorities in a manner and for purpose as the university may determine, subject to limitations prescribed by the act
- ?? Establish and maintain colleges relating to agriculture, fisheries, dairying, veterinary medicine, animal science, home science, agricultural engineering, forestry, water management and soil conservation and allied sciences
- ?? Establish and maintain laboratories, libraries, research stations, institutions and museums for teaching, research and extension education
- ?? Raise and maintain farms and plantations for teaching, research and extension education and appoint persons to such posts

KAU fulfills its obligations and commitments through a network of institutions spread over 36 campuses through the length and breadth of the State consisting of ten constituent colleges, six Regional Agricultural Research Stations (RARS), 26 Research Stations (RS), three Centers of Advanced Studies, the Central

Training Institute, the Communication Centre, the KAU Press, five Krishi Vignan Kendras, and the Central Library; and with the support of a team consisting of nearly 1000 academics (teachers/scientists), over 800 technical staff, 1300 administrative staff and about 2200 permanent labor and nearly 500 casual labor²⁹.

3.5.0. Education and Extension Institutions Under KAU

KAU offers courses leading to Bachelor's Degree, Master's Degree and PhD in agriculture and allied subjects like horticulture, veterinary and animal husbandry, fisheries, cooperation and banking etc. Postgraduate diploma courses in agriculture related subjects like plant protection; natural rubber production, land and water resource development and management etc are also conducted. University conducts its courses and research programmes mainly from ten college campuses located in different parts of the State. They are the following.

College of Agriculture, Vellayani, Thiruvananthapuram

College of Horticulture, Thrissur

College of Agriculture, Padannakkad, Kasaragod

College of Forestry, Thrissur

College of Co-operation, Banking & Management, Thrissur

College of Veterinary & Animal Sciences, Mannuthy, Thrissur

College of Veterinary & Animal Sciences, Pookode, Wayanad

College of Fisheries, Panangad, Ernakulam

Kelappaji College of Agricultural Engineering & Technology, Tavanur

College of Dairy Science & Technology, Idukki

3.5.1. College of Agriculture, Thiruvananthapuram

College of Agriculture (COAT), Vellayani, Thiruvananthapuram was established in 1955 on the banks of Vellayani lake and the college campus has a total area of 243 hectares including 165 hectares of kayal land. The mandate of the college is as follows:

- ?? making provision of imparting education in different branches of study particularly agriculture, horticulture, agricultural engineering, animal husbandry including veterinary and diary sciences, home science and other allied branches of learning and scholarship.
- ?? furthering advancement of learning and pursuing of research particularly in agriculture and allied courses.
- ?? undertaking extension education programme

Lead functions of the institute are providing instructional facilities for UG and PG students in agricultural fields and providing facilities for MSc (Ag), PhD and other research projects.

Auxiliary functions are production and distribution of quality seeds and seedlings through instructional farm, production and distribution of earthworms, vericomposts, coir pith composts and mushroom spawn, participation in exhibitions and agricultural fairs, liaison with development departments and other government departments as well as formulation, implementation of research projects funded by the University, KSCSTE and other external agencies.

The college has 14 departments carrying out teaching, research and extension activities. They are departments of Agronomy, Plant Physiology, Plant Breeding & Genetics, and Horticulture, Soil Science & Agricultural Chemistry, Plant Pathology, Agricultural Entomology, Agricultural Extension, Home Science, Agricultural Economics, Agricultural Statistics, Animal Husbandry, Agricultural Engineering, and Physical Education. The college has instructional farms also. The college has one of the best libraries under KAU with building LAN and connection to Campus Network.

3.5.2. College of Horticulture

College of Horticulture (COHV), Vellnikkara, Thrissur was established in 1972 with the main objectives of starting graduate programme in Horticulture and strengthening research and extension activities in horticultural as well as other crops.

The college has an instructional farm for imparting practical training to students and also for undertaking faculty research activities.

The mandate of the college is teaching at UG and PG level as well as providing research facilities for PhD for courses in agriculture, horticulture, agricultural statistics and home science. The college also takes up research and extension activities in all identified thrust areas in the faculty of agriculture.

There are 16 departments in the college namely Pomology and Floriculture, Plantation Crops and Spices, Olericulture, Processing Technology, Agronomy, Agricultural Botany, Soil Science & Agricultural Chemistry, Agricultural Entomology, Plant Pathology, Agricultural Economics, Agricultural Extension, Agricultural Statistics and Agricultural Meteorology. The Centre for Biotechnology, Radiotracer Laboratory and Instructional farm are also functioning under the college. The college library has a large collection of back volumes of journals and rare books.

3.5.3. College of Agriculture, Kasaragod

College of Agriculture (COAP), Padannakkad, Kasaragod was started in 1994. The college fulfills the aspirations of not only the farming community but also the entire population of the Malabar region. The mandate of the institution is teaching, research and extension in agriculture and allied areas. The lead functions are:

- ?? Making provision for education in different branches of study, particularly agriculture and other allied branches of learning and scholarship.
- ?? Furthering the advancement of research, particularly in agriculture and other allied sciences with stress on problem oriented and post graduate research.
- ?? Undertake a need based and location specific frontline extension education programme.

The college has Departments of Agronomy, Horticulture, Plant Breeding and Genetics, Biotechnology, Computer Science, Instructional Farm, Agricultural

Economics, Agricultural Engineering, Agricultural Entomology, Agricultural Extension, Agricultural Statistics, Home Science, Plant Pathology, Plant Physiology, and Soil Science & Agricultural Chemistry. The college has a good library, which is in its initial phase of development.

3.5.4. College of Forestry

College of Forestry (COF), Vellanikkara, Thrissur was established in 1986. It conducts Under Graduate and Post Graduate courses on Forestry and allied areas. In addition to teaching the institute is engaged in research and extension activities related to forestry. The mandate of the College of Forestry is to carry out teaching and research in forestry and make forestry professional, rather than protective. The subjects covered include wood science, environmental science, wild life etc. The college has three major departments. They are Department of Silviculture and Agro forestry, Department of Tree Physiology and Breeding and Department of Wildlife Sciences. The college has built up a selective and specialized collection on forestry and wildlife.

3.5.5. College of Co-operation, Banking & Management

College of Co-Operation, Banking & Management (CCBM), Thrissur was started in 1982 with the main objective of imparting education in cooperation along with different branches of study. The mandates of the institution are:

- ?? to assist in meeting the rapidly growing needs of managerial manpower for formal and informal co-operatives, financial institutions, agribusiness enterprises and other rural development organizations.
- ?? to undertake research on organizational, managerial and operational problems of co-operative, financial institutions, agribusiness enterprises and other rural development organizations.
- ?? to foster entrepreneurial ability to extend management and organizational skills to the rural community.

?? to offer training for policy makers and administrators in the development departments, enterprises, organizations and institutions.

The college has the Departments of Rural Marketing Management, Development Economics, Co-operative Management, Rural Banking and Finance Management. The college has a library specializing in agricultural economics and related areas.

3.5.6. College of Veterinary and Animal Sciences

College of Veterinary and Animal Sciences (CVA), Mannuthy: was established in 1955 with a view of training sufficient veterinary personnel. The college has livestock farm, poultry farm, pig breeding farm, and goat farm, diary technology unit and meat technology unit as well as veterinary hospitals. It has under it a Livestock Research Station at Thiruvazhumkunnu and Cattle Breeding Farm, Thumboormozhi to facilitate research and training.

The mandate of the institution is teaching, research and extension to provide manpower in the field of veterinary and animal husbandry and also to help the farming community in respect of animal health, production and animal husbandry.

The college offers BVSc, MVSc and PhD programmes. In addition to teaching a number of research projects aided by the university and external agencies are being operated in the college. Importance is also given to the transfer of technology. The college has 20 Departments, which are for Anatomy, Animal Reproduction, Animal Breeding & Genetics, Biochemistry, Clinical Medicine, Dairy Science, Extension, Livestock Production Management, Livestock Product Technology, Microbiology, Nutrition, Parasitology, Pathology, Pharmacology and Toxicology, Physiology, Poultry Science, Preventive Medicine, Surgery, Statistics and Veterinary Public Health. The library of the college is the largest one on the subject with journals, books, thesis, and other documents on veterinary and animal sciences and related areas. The following Institutions and centers function under the college.

Centre for Pig Production & AICRP on Pigs, Mannuthy
Centre for Advanced Studies in Poultry Science, Mannuthy
Centre for Excellence in Pathology, Mannuthy
Veterinary College Hospital, Mannuthy
Live stock Research Station, Thiruvazhumkunnu
Cattle Breeding Farm, Thumburmozhi
Regional Cattle Infertility Research Centre, Kozhikode
University Veterinary Hospital, Kokkali
Livestock Farm and Fodder Research & Development Scheme, Mannuthy
Meat Technology Unit, Mannuthy

3.5.7. College of Veterinary & Animal Sciences, Pookode, Wayanad

The College of Veterinary & Animal Sciences (CVAP), Wayanad started function at a temporary campus in Mannuthy in 1998. Presently the college is offering UG programmes in Veterinary & Animal Sciences. The mandate of the college is to impart veterinary education and to provide qualified veterinary personnel. The college has a small and selective collection of documents and is developing a library system.

3.5.8. College of Dairy Science & Technology, Idukki

The College of Dairy Science & Technology (CDIA), Idukki started functioning in 1993 with a Degree programme attached to the College of Veterinary & Animal Sciences, Mannuthy. The main objectives of the college is to offer degree programmes (B.Tech Dairy Science and Technology) and Post graduate diploma programmes in the subject as well as extending academic and research support to intra and inter faculties of KAU. The college has started to develop a library system and has already acquired a small collection of relevant documents. The mandate of the college is to conduct research and development in

- ?? milk production and augmentation activities
- ?? fodder research and development of low cost feed for milch animals
- ?? utilization of agro based products for value addition in dairy products

- ?? development of diary products incorporating diary by products
- ?? total quality management in diary sector(including quality control, quality improvement and quality assurance of various diary products)
- ?? fabrication of low cost diary equipments as well as equipments meant for the preparation of indigenous milk products
- ?? utilization of non-conventional energy sources in the field of dairying.
- ?? extension programmes like training to different categories of people in diary husbandry and diary processing, consultancy services for establishment of diary farms and plants etc.

3.5.7. College of Fisheries

The College of Fisheries (CFISH), Panangad, Cochin was started in 1979. The mandate of the College of Fisheries is the development of fisheries sector of the State and the country. The college forms the nucleus of the establishment of the Fisheries University in the State to undertake and coordinate active programmes in teaching, research and extension in fisheries.

The college offers 4-year degree programme leading to the degree of Bachelor of Fishery Science (BFSc) and Post Graduate programme MFSc in the disciplines of aquaculture, fishery biology, and processing technology. The college has departments for Aquaculture, Fishery Biology, Fishery Hydrography and Processing Technology. The college conducts various extension activities to both fresh water and brackish water farmers. The college has an excellent print and non-print document collection on fisheries related areas.

3.5.8. College of Agricultural Engineering Technology

A Rural Institute was established at Thavanoor on the south bank of Bharathapuzha in Malappuram District in 1963. It was brought under KAU in 1971 and was upgraded to Kelappaji College of Agricultural Engineering (CAE) in 1985. The mandate of the college is to impart education at UG and PG levels in the faculty

of agricultural engineering, to conduct research and undertake development in various disciplines of agricultural engineering and to provide extension support to agricultural department and farms. The college conducts various extension activities like demonstration of farm machineries, seminars, training and workshop for agricultural officers and agricultural assistants on farm mechanization etc.

The college has departments of Land and Water Resources and Conservation Engineering, Department of Irrigation and Drainage Engineering, Department of Farm Power, Machinery and Energy, Department of Post Harvest Technology and Processing as well as in many allied areas. Its library is the most reliable collection on agricultural engineering in the State. The collection also contains a large number of documents in regional languages intended for the rural population.

Table 3.2: Courses Conducted in Colleges under KAU

Faculty	Courses	Colleges
Agriculture	BSc (Agriculture) MSc (Agriculture) MSc (Horticulture) PhD	COAT, COH, COAP
Food Science	MSc (Home Science) MSc (Food Sc and Nutrition) PhD	COAT, COH, COAP
Veterinary & Animal Sc	BVSc / AH MVSc B.Tech (DS &T) PhD	CVA, CVD, CVI
Fisheries	BFSc MFSc PhD	CFISH
Agricultural Engineering	BTech (Agricultural Eng) MTech (Agricultural Eng) PhD	CAE
Agricultural Economics	MSc (Agricultural Statistics) BSc (Cooperation & Banking) MSc (Cooperation & Banking) PhD	CCBM
Forestry	BSc (Forestry) MSc (Forestry) PhD	COF

3.5.9. Courses Offered in KAU Colleges

The above institutions together offer the courses leading to the award of UG, PG and Research Degrees in different branches of agriculture specified in Table 3.2.³⁰.

3.5.10. Extension Institutions Under KAU

Extension programmes of the KAU are intended to provide technical support and consultative service to Government Departments engaged in agricultural development work and to farms on a selective basis. These extension education programmes of the university are planned organized and conducted by the Directorate of Extension at the university level.

The extension programmes of KAU are implemented through the Communication Centre, the Farm Advisory Service, the Central Training Institute, the KAU Press and Information cum Sales Centre, which are the constituent units of the Directorate of Extension. The Transfer of Technology programmes is implemented through the Krishi Vignan Kendras, National Demonstration Scheme, Tribal Area Research Centre, the Lab-to-Land and Village Adoption Programmes and also through various Institutions/Research Stations under the KAU. The details of the Training and Extension Centers functioning under KAU are discussed in the following paragraphs.

3.5.10.1. Communication Centre, Mannuthy

Function of the Communication Centre, Mannuthy, Thrissur is to provide information support to extension personnel of the development departments, voluntary agencies, cooperative societies, farmers and others through a variety of media. The Centre has three sub units, Publication Unit, Information Unit and the Exhibition and Graphics Service Unit. They together perform the function of information communication.

3.5.10.2. Central Training Institute, Mannuthy

Central Training Institute at Mannuthy in Thrissur is the nodal point of all training activities of the university. The institute co-ordinates training on agriculture and related subjects to the technical personnel of the State departments such as Agriculture, Animal Husbandry, Dairy Development, Fisheries, Forestry, Commodity Boards, Banks and such other agencies. It caters to the training needs of the State development departments, commodity boards, banks, Defense Departments, Union Territory of Lakshadweep etc.

3.5.10.3. Agricultural Technology Information Centre, Mannuthy

The Information and Sales Centre (I&SC), Mannuthy started functioning in 1993 as an independent unit under the administrative control of the Directorate of Extension. The primary objective of the centre was to act as a centre of excellence in the sphere of dissemination of technologies and distribution of quality products developed by the KAU akin to a super market approach. The Information and Sales Centre, established under KAU earlier at Mannuthy, was upgraded as Agricultural Technology Information Centre (ATIC) under NATP project funded by ICAR and World Bank. The official operation of ATIC commenced with effect from 2000. The mandate of the centre is:

- ?? to provide *a single window delivery system* for agricultural information as well as products and technologies developed by the university with a view to deliver quality services to the clientele.
- ?? to strengthen the *farm advisory services* by adopting a multi disciplinary approach to problem solving.
- ?? to provide mechanism *for feedback* from the end users to the research system.
- ?? to function as a *repository of agriculture information* pertaining to farming skills and practice farm inputs and agricultural education.

- ?? to offer *consultancy services* to the differ stakeholders in the State.
- ?? to offer *training* to unemployed youth to make them job providers, rather than jobseekers as per the ABARD project.

3.5.10.4. Krishi Vigyan Kendras Under KAU

The mandate of the Krishi Vigyan Kendras are to impart up-to-date knowledge to farmers, farm youths and farm women, on crop planning, crop production techniques, animal husbandry, dairying, forestry, home science and fish farming etc to improve their skills and understanding in scientific functions. Their auxiliary functions include

- ?? to conduct socio economic surveys to assess the impact of training on the economic conditions of the farmers
- ?? to act as potent instrument for transferring modern farm technology to the farming community through various extension media, frontline demonstrations, on farm testing seminars, exhibitions etc
- ?? to conduct in-service training programme for the personnel of the development department
- ?? establishing rapport with various social organizations functioning in this area of operation
- ?? strengthening the linkages with various development departments in the region.

The following Krishi Vignan Kendras (KVK) are run by the university in the State.

- ?? KVK, Sadananthapuram
- ?? KVK, Pattambi, Mele Pattambi
- ?? KVK, Ambalavayal, Wayanad
- ?? KVK, Manjeswar, Vorkady

3.6. Research Institutions Under KAU

The KAU has a research policy the objectives of which are the following.

- ?? to develop economically efficient low and medium cost technologies
- ?? to increase agricultural production and net income of farmers and fishermen of Kerala and
- ?? to provide adequate job opportunities for these communities by making best use of the available land, water and other production resources.

Fundamental and applied researches are undertaken by the university to develop efficient technologies for the establishment of economic agro-livestock - fisheries farming systems suitable for the homestead and other farming systems of Kerala. While solutions to farming problems are worked out the feasibility of field adoption of these solutions in the light of socio-psychological aspect of the farmers are also being investigated. Within the objective university undertakes research through its various campuses and research stations.

3.6.0. Research Stations: Zonal Classification

Research Stations are mainly classified under five zones according to different agro climatic regions. existing in Kerala mentioned elsewhere. They are Northern, High Range, Central, Special and Southern Zones. There are some problem related zones also. Each Zone has a Regional Agricultural Research Station (RARS) and various Research Stations (RS) under them. The zone wise classification list of RARS and RS is presented in Table 3.3

Table 3.3: Zone wise Classification of Agricultural Research Stations in Kerala

Zone	Regional Agricultural Research Stations and Research Stations
Northern Zone:	Regional Agricultural Research Station, Pilicode, Kasaragod; Pepper Research Station, Panniyur.
High range Zone	Regional Agricultural Research Station, Ambalavayal; Wayanad, Cardamom Research Station, Pampadumpara, Idukki.
Central Zone	Regional Agricultural Research Station, Pattambi, Palakkad; Banana Research Station, Kannara Marakkal, Thrissur; Agronomic Research Station, Chalakudy, Thrissur; Cashew Research Station, Madakkathara, Thrissur; Cashew Research Station, Anakkayam, Malappuram; Aromatic & Medicinal Plants Research Station, Odakkali; Pineapple Research Station, Vazhakulam, Muvattupuzha, Ernakulam; Agricultural Research Station, Mannuthy, Thrissur; Plant Propagation & Nursery Management Unit, Thrissur.
Special Zone of Problem Areas	Regional Agricultural Research Station, Kumarakom, Kottayam; Rice Research Station, Vyttila; Rice Research Station, Moncompu, Thekkekara Alappuzha; Sugarcane Res. Station, Thiruvalla, Kallungal, Pathanamthitta; Agricultural Drainage Scheme, Karumady, Alappuzha.
Onattukara Zone	Regional Agricultural Research Station, Kayamkulam, Alappuzha
Southern Zone	Regional Agricultural Research Station, Vellayani, Tvpm; Cropping Systems Research Centre, Karamana, Tvpm; Coconut Research Station, Balaramapuram, Tvpm; Farming Systems Research Station, Sadananthapuram, Kottarakkara; Soil Conservation Research Centre, Konni, Pathanamthitta.
Research Stations	Covered by NARP Set up: Cattle Infertility Scheme, Vellimadukunnu, Kozhikode; Cattle Breeding Farm, Thumburmuzhi, Chalakudy, Thrissur; Livestock Research Station, Thiruvazhamkunnu, Palakkad; Poultry & Duck Farm, Mannuthy, Thrissur; University Livestock Farm, Mannuthy, Thrissur; Centre for Pig Breeding & Research, Mannuthy, Thrissur; Fisheries Station, Puduveyppu, Kochi.

3.6.1. Regional Agricultural Research Station, Vellayani

RARS, Vellayani, Trivandrum for the Southern Zone has been functioning since 1982. Presently it is NARP (Southern Region). The mandate of the Station is to undertake research on crops for partial shade conditions and export oriented vegetables and cut flower production. Stations conducts location – specific research on the field problems relating to tuber crops as well as development of suitable technology for the farming systems in the different agro ecological situations of the zone as well as multi tier cropping systems suited to different homesteads. In addition testing and verification of research results on pulses, oil seeds, cereals (rice), coconut, banana, pepper etc is done here. Main functions include research on crops for partial shade conditions; export oriented vegetables and cut flower production. Verification functions of the station include rice, fruits, homestead farming, coconut, tubers, vegetables, farm machinery and garden tools.

3.6.2. Instructional Farm, Vellayani

The Agricultural College Farm Vellayani has the major objective of imparting field training to UG and PG students in agriculture. It was equipped with infrastructure facilities for conducting agricultural research and extension education programmes for the whole State. This farm also serves as a major revenue earning station under KAU. Production and distribution of quality seeds and planting materials suited to the humid tropics satisfy the social commitment of this station. The mandate of the station include:

- ?? providing basic instructional facilities for UG and PG students in the agricultural field.
- ?? providing research facilities for post graduate and other research programmes
- ?? production and distribution of quality seeds and other planting materials
- ?? participation in exhibitions and agricultural fairs.

3.6.3. Cropping Systems Research Centre, Karamana

Cropping Systems Research Centre, Karamana, Thiruvananthapuram was established in 1955 with the objective of conducting simple fertilizer use trials and soil fertility investigations. The lead function of the station is research on rice and rice based cropping systems. The main objectives of the experiments in rice based cropping systems are to study the production potential of the systems under adequate and limited resources, judicious use of fertilizers, integrated management of nutrients, efficient use of irrigation water and management of problematic weeds. The testing and verification functions include multi location trial and integrated production trials with fish, livestock, poultry, bio energy conversion and organic recycling and water requirement of crops.

3.6.4. Coconut Research Station, Balaramapuram

Coconut Research Station, Balaramapuram, Thiruvananthapuram was established in 1948. The main objective of the station is to conduct research on coconut in typical red loam soils of Kerala, especially the Vellayani series under Neyyattinkara-Vellayani soil association with particular emphasis on the agronomic and plant protection aspects. The thrust area of research is the manorial agronomic and plant protection aspect relating to coconut in red loam soils. Lead functions are agro techniques for coconut based farming systems in red loam soil, intercropping in coconut and pest/disease management in coconut.

3.6.5. Farming Systems Research Station, Sadanandapuram

Farming Systems Research Station, Sadanandapuram, Kottarakkara was established in 1979 under the National Agricultural Research Project as per the recommendations of the Research Review Committee of ICAR for NARP. Its major objective is to undertake research on homestead farming and soil and water conservation. The functions are:

- ?? to conduct detailed survey and analysis of the homestead of the State
- ?? to develop suitable homestead models for holdings of different size and different farming situations and to conduct detailed economic analysis of the same
- ?? to evolve agro- techniques on a whole system approach for various perennial combinations and crop-livestock/ crop-poultry/ crop -livestock-fish combinations.

Auxiliary functions of the station are to evolve tapioca based cropping systems suitable to the zone as well as vegetable improvements and standardization of their agro techniques.

3.6.6. Soil Conservation Research Centre, Konni

Soil Conservation Research Centre, Konni, Pathanamthitta came under the administrative control of KAU in 1998. It is under the administrative control of NARP Southern Region, Vellayani, and its major functions are to undertake research on soil and water management and related areas. The objectives of the station are

- ?? to conduct basic and strategic and applied research for developing location specific technologies on soil and water conservation
- ?? to provide scientific leadership for solving area specific problems in soil and water conservation
- ?? to act as a centre for imparting training in modern research methodologies and technology up gradations in field of soil and water conservation

3.6.7. Regional Agricultural Research Station, Kumarakam

Department of Agriculture Government of Kerala initially established the station at Kumarakam, Kottayam in 1947 and transferred it to KAU in 1972, which made it RARS under NARP. The main objective of the Station was to conduct research on coconut and coconut based farming systems with special reference to

coconut diseases. With the implementation of NARP the station became lead station to conduct problem oriented location specific research on all crops in the special zone of Problem Areas of Kerala State. The mandates of the station include research on coconut and coconut based farming systems, integrated farming and coconut root wilt disease. The following are the functions of the Station:

- ?? to serve as regional centre for solving location specific problems in special zone of problem areas comprising the Kuttanad and the Pokkali tract.
- ?? to take up research on integrated farming systems incorporating crops, livestock and fish
- ?? to promote research efforts in respect of food grains
- ?? to evolve agronomic practices and land use patterns in the influence area of the station, viz the special zone problem areas
- ?? to coordinate research efforts in the control and management of the dreaded disease, root (wilt) of coconut
- ?? to promote extension of technology to the farming community
- ?? to coordinate and guide the research activities in substation.

3.6.8. Rice Research Station, Monkompuzha

Rice Research Station, Monkompuzha in Kuttanad Taluk of Alappuzha was started in the year 1940 and later transferred to the control of KAU. The mandate of the station was to take up work on location specific research needs of rice in Kuttanad. The functions of the station include evolving high yielding rice varieties with multiple resistance to pests and diseases, standardization of management practices so as to increase productivity, formulating integrated management practices to control weeds, pests and diseases and evolving low cost production technology for Kuttanad.

3.6.9. Regional Agricultural Research Station, Kayamkulam

Rice Research Station, Kayamkulam was established in 1937 by University of Travancore and it came under KAU in 1972, which was later made an RARS. The major objectives of the station are evolving high yielding varieties of rice, sesamum and pulse suitable for the sandy tract of Onaattukara region, formulating improved agricultural technologies and plant protection measures for the cultivation of rice, sesamum, pulses and vegetables. It imparts training to the personnel of the Departments of Agriculture and farmers of the region in the latest agro-techniques for cultivation of the above crops and also mushrooms. Mandate also includes conducting adoptive trials and demonstrations of research findings and improved cultural practices in the cultivator's fields. For this it adopts nearby villages and demonstrates the improved agricultural practices and research findings developed by it.

3.6.10. Rice Research Station, Vyttila

Rice Research Station, Vyttila was taken over by KAU in 1974. The main objectives of this station are to evolve high yielding saline tolerant rice varieties suited to the low lying coastal areas and to find out sustainable and eco friendly agronomic practices for the cultivation of rice in the areas. Its mandate also include, evolving cropping system and practices by which the annual income per unit area can be increased to the optimum level by adopting integrated farming of rice, fish and prawn in the region's lands and evolving semi intensive cultural practices for fishes and prawn in brackish water ponds.

3.6.11. Sugarcane Research Station, Thiruvalla

Sugarcane Research Station at Thiruvalla was established in 1976 by KAU with the complete assistance from ICAR under the AICRP on Sugarcane. The mandate of the station are to function as lead station for sugarcane research and development in Kerala State and to carry out research on vegetables prevalent in the tract mainly on cucurbits, bhindi, brinjal and chillies.

3.6.12. Agricultural Drainage Scheme, Karumadi

Agricultural Drainage Scheme, Karumady, Alappuzha was established in 1981. The thrust area of research of the station are; to comprehend the effect of surface drainage system on the movement of soil liquids, to study the pattern of hydrological cycle occurring in the watershed areas and its importance and influence on the drainage. The objectives are to develop feasible technology for the layout of sub surface drainage system suitable for peak and muck soils, to develop drainage pattern requirements for different crops, to evaluate the feasibility of using the return flow from drainage for irrigation in relation to water quality rating, and to evaluate socio economic benefits acquired from the drainage projects.

3.6.13. E.C.F. Unit, Kayamkulam

E.C.F. Unit, started in 1971 has functioned in different districts all over the State is an on form field testing research unit of cropping systems research project. It is presently working in Kayamkulam. As against earlier concept of the same type of experiments all over the nation, new on farm research work is done on location specific problems and the area of operation is the NARP. The project helps to refine and develop location specific technologies and will help in confirmation of advanced technologies under actual farming situation.

3.6.14. Regional Agricultural Research Station, Pattambi

RARS, Pattambi in Palakkad District, was started in 1927. It came under KAU in 1972. Presently it heads the research stations for the Central Zone. The mandate of the Station is generation and transfer of technology related to rice and rice based cropping systems, pulses, vegetables, organic farming and seed technology. The lead functions are rice, pulses, horticultural crops and rice based farming systems. The auxiliary functions are animal management, horticultural and vegetable crops, and mechanization in rice farming, crop weather modeling and agro forestry. The station has released 55 rice varieties. The station has one of the largest document collections on rice in India, which includes very old and rare research reports on the topic.

3.6.15. Banana Research Station, Kannara

Banana Research Station at Kannara in Thrissur District was established in 1963. The main objectives of the station are germplasm collection, maintenance, evaluation and description of banana, jackfruit and pineapple to recommend the popular and promising cultivars large-scale cultivation. Other objectives are developing better clones or cultivars of banana, jackfruit and pineapple through selecting and hybridization, standardization of agro techniques for banana and pineapple under different cropping systems. It formulates and recommends suitable control measures for pests and diseases of banana and pineapple. It also formulates small-scale post harvest processing techniques in banana and pineapple.

3.6.16. Agronomic Research Station, Chalakudy

Agronomic Research Station, Chalakudy, Thrissur was established in 1972. The mandate of the station is to develop low cost high tech water use and high profit land use pattern by evolving production technologies for utilizing scarce moisture resources and to serve as a model centre of crop production for the command area of Chalakkudy irrigation project.

The station develops cropping patterns ideal for varying water management and fertility situation. It conducts tests on adaptability and performance of new crops and varieties under different moisture conditions, estimates the water requirement of crops like rice, pulse, tuber crops, banana, pineapple etc to evolve measures for increasing water use efficiency of important crops of the area. It also works out the economics of cultivation, and conducts studies on ground water fluctuations, quality of ground water and recycling of drainage water for cultivation. The objective is to find out cheap and efficient methods of irrigation for different crops. Farm water management studies in the command area are also done under the station.

3.6.17. Cashew Research Station, Madakkathara

Cashew Research Station, Madakkathara, Thrissur was established in 1973. The station undertakes All India Coordinated Cashew and Spices Improvement Projects of the ICAR. The mandate of the station is

- ?? to evolve high yielding varieties of cashew by selection and breeding
- ?? identification of varieties resistant/tolerant to pests
- ?? to develop suitable agro techniques for achieving higher production and productivity
- ?? to standardize suitable vegetative propagation techniques.
- ?? to evolve effective control measures against major pests of cashew
- ?? transfer of technology to farmers and extension agencies on improved crop production techniques
- ?? distribution of quality materials of elite varieties or types.

It has established a gem plasma conservation block with 127 accessions. It has also evolved various high yielding cashew varieties. It has a highly selective valuable collection of books and research reports on cashew.

3.6.18. Cashew Research Station, Anakkayam

Cashew Research Station, Anakkayam, Malappuram was started in 1963. The objectives of the station are to evolve materials, methods and means to increase the yield potential of cashew through breeding, selection and recommendation of proper manorial schedules, cultural practices and measures to control pests and diseases.

3.6.19. Aromatic & Medicinal Plants Research Station, Odakkali

Aromatic & Medicinal Plants Research Station, Odakkali: was started in 1951. It is a lead research center for development and cultivation of medicinal plants. It gives emphasis to strengthen research on aromatic crops with special reference to post

harvest technologies. The mandate of the institution is to provide research and development support to the medicinal and aromatic plant cultivation in the State. Lead functions include

- ?? intensification of research on aromatic and medicinal plants
- ?? transfer of technology to the targeted group
- ?? supply of good quality planting material
- ?? quality testing and evaluation
- ?? germplasm collection and maintenance of selected mandate crops

Auxiliary functions include development of watershed management practices with special emphasis on ground water conservation and to tackle issues on environmental concerns specifically toxic residues in food chain. The station has a good collection of books on medicinal and aromatic plants and forestry.

3.6.20. Pineapple Research Station, Vazhakulam

Pineapple Research Station at Vazhakulam, Muvattupuzha, Ernakulam was started in 1995 and is also having a pest and disease surveillance unit under it. The mandate of the station is research on pineapple for development of new varieties, and developing sustainable farming technologies for higher yield and quality of fruits and control of pests and diseases. The station conducts survey on pests and disease occurrence in pineapple and to carry out research on nutritional aspects, cropping intensity and post harvest technology.

3.6.21. Agricultural Research Station, Mannuthy

Agricultural Research Station at Mannuthy was started 1957 as Rice Research Station and was transferred to KAU in 1972. Apart from KAU research projects the station undertakes rice research under AICRP. It extends facilities to NBPGR to conduct trials on rice. The mandates of the station are:

- ?? evolving rice varieties with high production potential suited to kole lands
- ?? development of production technology of rice
- ?? evolving bitter gourd and snake gourd varieties suitable to summer rice fallows
- ?? development of production technology for vegetables
- ?? production and distribution of breeder and foundation seeds of paddy
- ?? evolving hybrids in vegetables
- ?? maintenance of commercial nursery, production of quality seed materials and farm advisory services
- ?? imparting training for various production technologies and work experience programme in rice and demonstration in use of modern agricultural implements

3.6.22. AICRP on Weed Control, Vellanikkara

The centre was established in 1985 to conduct research on the biology and management of problem weeds in the State. The mandate of the Centre is

- ?? to develop most effective and economic weed control recommendations for field crops, plantation crops and aquatic areas.
- ?? to conduct survey of weed flora, their distribution, ecology and habitat and to prepare weed map of the State
- ?? to standardize analytical techniques for estimating herbicides in soil, crop and water systems and to monitor the fate of important herbicides used in Kerala
- ?? to test available tools/implements for weed management
- ?? to train extension personnel in weed management

3.6.23. AICRP on Medicinal and Aromatic Plants

This is one of the eleven coordinated centers of ICAR on medicinal and aromatic plants. The mandate of the centre is to carry out research on crop

improvement agro techniques and quality analysis of mandatory crops, as well as germplasm conservation.

3.6.24. AICRP on Biological Control of Crop Pests and Weeds, Mannuthy

The Centre started functioning in 1972. The mandate of the centre is to evolve bio control techniques against weed problems of Kerala. And survey and identification of the natural enemies of crop pests, evaluations of promising bio control agents of pests of crops like rice, vegetables, fruits and coconut.

3.6.25. Regional Agricultural Research Station, Pilicode

RARS, Pilicode Kasaragod came under KAU in 1972. The main objectives of the station are to perform statewide lead function for research on coconut and to serve as a commodity verification-testing center for rice, pulses and oil seeds. Earlier its activities were centered around introduction of coconut cultivars from different parts of India and other countries, selection, hybridization, identification of superior local and hybrid varieties and their distribution among farmers, After the implementation of NARP research on rice, pepper, vegetables, pulses, tubers etc were also initiated. In addition to these animal sciences were also included to strengthen research on Malabari Goats.

3.6.26. Pepper Research Station, Panniyur

Pepper Research Station, Panniyur was started in 1952 and it came under KAU in 1972. The station was started with the objective to conduct research on various aspects of pepper industry in the country so as to give it a firm footing and confidence to face competitions from other pepper producing countries of the world. The main objectives of the station are to do research on crop improvement, crop management, and crop protection aspects of black pepper. It also acts as an important coordinating center of the AICRP on spices of the ICAR. The station is unique among all agricultural research stations in India, in that it is the only station solely devoted to research on black pepper.

3.6.27. Regional Agricultural Research Station, Wayanad

RARS at Ambalavayal in Wayanad was established in 1945 and was brought under KAU in 1972. The mandate of the station was to carry out research on various aspects of improvement of agriculture in Wayanad in general and the colonization area in particular and to render technical advice on scientific cultivation to the farmers in the area. Lead functions of the station are pepper and pepper based cropping in high ranges, hill paddy, cool season vegetables, soil and water management, subtropical fruits and coffee based cropping systems. Its verification functions include essential oils and medicinal plants and ginger.

3.6.28. Cardamom Research Station, Pampadumpara

Cardamom Research Station, Pampadumpara, Idukki was established in 1956 under the Department of Agriculture and was transferred to KAU when it came into existence. The mandate of the station is to evolve high yielding varieties of cardamom and standardization of location specific agro – techniques for successful cultivation of cardamom, black pepper and cool season vegetables. Auxiliary functions include supply of superior quality planting materials of rose and other ornamental plants, as well as to serve as a centre for agricultural extension and education activities in Idukki District through the organizational participation of farmers training programmes, field demonstrations and farm advisory services. The station undertakes research programmes on the various agronomical, botanical, entomological and psychopathological problems of cardamom cultivation. It also studies soil and water management problems in Idukki region, standardization of agro techniques and formulation of plant protection measures.

3.6.29. Fisheries Station, Puduvaippu

This station started in 1979 at Puduvaippu imparts practical training on brackish water fish culture. It also conducts research to develop appropriate farming

techniques for better production from unit area. Its mandate includes the supply of commercial brackish waterish seed to the farmers and other research institutions. It conducts training programmes on water aquaculture, and utilization of marsh lands for agricultural purposes.

3.6.30. Centre for Pig Production and Research, Mannuthy

This Centre was established in 1965 by Department of Animal Husbandry, Government of Kerala and was taken over by KAU in 1972. The mandate of the station is:

- ?? to conduct research on various aspects of pig production
- ?? to function as demonstration unit for farmers and instructional unit for students
- ?? to produce and distribute good quality piglets to farmers.

3.6.31. University Livestock Farm and Fodder Research and Development Scheme, Mannuthy

Started by Government of Kerala the centre was taken over by KAU at the time of inception of the university. The mandate of the station is livestock production and management, fodder research and supply of fodder materials, instruction of students and facilitating research on these aspects.

3.6.32. KAU Dairy Plant, Mannuthy

KAU Dairy Plant is an experimental dairy plant established in 1986. The mandate of the plant is handling the milk produced in the university livestock farm and imparting practical training to students in the operation of milk processing equipment and manufacture of various milk products. The centre also provides technical advises for setting up small-scale milk processing plants by milk processing societies and other agencies.

3.6.33. AICRP on Poultry, Mannuthy

AICRP was established by ICAR in different agro climatic zones of the country. This centre in Kerala was established in 1976. The mandate of the unit is to develop a commercial variety giving average yield of 270 eggs of standard size with less than 1% laying house mortality per month.

3.6.34. University Goat and Sheep Farm, Mannuthy

Goat production is a major animal husbandry enterprise in the State due to the unique socio economic and agro climatic constraints of the State. The farm was established in 1995. The animal stock consists of alpine-malabari and sannen malabari crosse. The mandate of the Farm is to; provide instructional facilities for the BVSc and AH degree programmes, provide research facilities and to undertake research activities in small ruminant production, maintain and provide high quality goat and sheep to State's farming community and provide packages for sustainable goat production in the State.

3.6.35. Centre for Advanced Studies in Poultry Science, Mannuthy

The Centre functions under the Faculty of Veterinary and Animal Science of KAU. The mandate of the institution is to undertake teaching, research and extension in poultry sciences.

3.6.36. Cattle Breeding Farm, Thumburmuzhi

The farm was started as a dry cattle salvage farm in 1957 under the Department of Animal Husbandry, GOK. It was taken over by KAU in 1972. The mandate of the Station is; to develop the farm as a model diary farm, to provide facility for research on large animals, to provide on farm training to veterinary and animal science students, to transfer technology to farmers, to extend facility of artificial insemination to local cattle and to supply improved varieties of fodder strips to farm

3.6.37. Livestock Research Station, Thiruvazumkunnu

This station was started by Madras Government in 1950 and was transferred to Kerala State Animal Husbandry Department in 1956 and subsequently to KAU in 1972. The mandate of the Station is:

- ?? to hold problem oriented and adaptive research projects in animal nutrition, breeding and management and to advice local farmers on recent advancements in scientific management of livestock and technology transfer to villages in the form of providing artificial insemination facilities, veterinary aid etc.
- ?? to evolve elite cross bred diary cattle suitable to agro climatic conditions in Kerala by scientific breeding, feeding and management practices, fodder production and associated research as well as, tree and agricultural crops nursery management; and conservation of the natural forest eco system attached to the station

3.6.38. Centre for Advanced Studies in Animal Genetics and Breeding, Mannuthy

The centre conducts academic and research activities. It has expertise on genetic analysis of animals including detection of abnormalities at molecular level. The centre also supports State to frame appropriate breeding policies from time to time. Breed characterization, germplasm conservation and breed improvement are the functions of the Centre.

3.6.39. University Veterinary Hospital, Kokkali

The hospital started functioning in 1904 and was adopted by KAU in 1972. The mandate of the hospital is to function as teaching and clinical training hospital for UG and PG students. The main functions are:

- ?? to provide clinical training and facility for research
- ?? to offer short term courses on veterinary faculty
- ?? to function as a referral veterinary hospital for the veterinarians and analysis and interpretation of clinical materials for field cases
- ?? Immunization and health education programme for controlling animal diseases

3.6.40. Regional Cattle Infertility Research Centre, Kozhikode

The Centre was started in 1984. The main functions of the Centre are the following;

- ?? to study the incidence, nature, magnitude and prevalence of infertility conditions in crossed cattle of Malabar districts
- ?? to investigate the nutritional cause of anoestrus in crossbred cattle
- ?? to study the incidence of clinical endometrics and its therapy based on antibiogram

3.6.41. Kerala Horticultural Development Programme

The R&D component of Kerala Horticultural Development Programme started functioning at Trichur under KAU in 1994. This forms part of a venture of the State Government and European Economic Community. Its mandate is to conduct research on fruit crops like banana, mango, and pineapple, as well as vegetables and post harvest technology of fruits and vegetables based on farmer's problems.

3.7. Organizations Under Government and Non Government

Many institutions under Union and State governments, non governmental organizations, private companies, autonomous institutions and societies are working in the agricultural sector of the State in areas of education, research, extension and development. Major organizations only are covered in this study.

3.7.1. Department of Agriculture, Government of Kerala

Department of Agriculture deals with the formulation and implementation of various programmes to augment production of both food crops and cash crops in the State. It undertakes activities among farmers to promote scientific methods of cultivation, plant protection etc. and also arranges the supply of high yielding varieties of seeds, seedlings planting materials and plant protection chemicals to farmers. The department also formulates policies and programmes relating to provision of credit to farmers. agricultural research, education and extension are three important functions of the department. It runs agricultural farms and also has an engineering wing.

There are separate field departments for Animal Husbandry and Dairy Development There is a Directorate of Soil Conservation, which has a soil conservation wing and soil survey wing. They undertake investigation preparation, and execution of all the soil conservation work

Department of Agriculture has offices at the regional, district and Panchayat levels. It has a presence in the village Panchayat through Krishi Bhavans.

The department has under it Quality Control Laboratories, Pesticide Testing Laboratory, Fertilizer Quality Control Laboratory, Seed Testing Laboratories, Soil Testing Laboratories, Agmark Grading Laboratories, Sales Cum Service Depots, Parasite Breeding Stations, Regional Agricultural Technology Training Centres, Farmers Training Centres, and Engineering Divisions. The present Schemes of the Department are the following:

- ?? grass root level support system for agricultural development with programmes for Agriculture Information Centres, Software Agricultural Portal, training to officials, establishing facilities for Krishi Bhavan offices and district level offices.
- ?? sustainable development of rice based farming system intended to implement package of measures capable of augmenting rice productivity and make rice cultivation more profitable.

- ?? coconut based farming system to increase production and productivity of coconut by providing irrigation facilities, supply of quality planting materials, adoption of systematic plant protection measures, scientific fertilizer application, promotion of multi-species cropping, mixed farming system and product diversification.
- ?? integrated nutrient management system intending to promote usage of organic manures so as to maintain and to enhance the fertility level of soil.
- ?? integrated pest management system intended to have a full fledged pest surveillance system in predominant rice growing areas, creating awareness among farmers, adoption of suitable eco-friendly integrated pest management system and thereby to enhance the production and productivity of the crops.
- ?? farm information and communication schemes intended to equip farm information organization to cater the multiple nature of information support demanded by the media as well as local bodies. A full-fledged information-cum-data centre at the head quarters with appropriate system for regular reporting and delivering of information with modern communication system will be established. The Farm Information Bureau (FIB) is getting equipped with all modern communication systems including own building and upgraded quality of services. The FIB continues to conduct farm news service including publication, farm fairs and exhibitions, video production, organizing farm book corners, farm feature service etc. It publishes "*Kerala Karshakan*", a biweekly agricultural publication.
- ?? crop insurance intended to provide compensation to the insured major crops, in the event of damage due to natural calamities.
- ?? small farm mechanization and agricultural engineering service intended for promotion of mechanization in agricultural sector by introducing suitable equipments and farm machineries with the primary aim of increasing productivity, minimizing cost of cultivation and overcoming difficulties caused by labor shortage in peak seasons.

- ?? vegetable promotion programme to attain self-sufficiency in the field of vegetables production in the State, and to promote cultivation in the rainy winter and summer seasons will be promoted.
- ?? homestead farming to identify potential clusters of homesteads for agricultural production and market-oriented development with all the required forward and backward linkages.
- ?? promotion of hi-tech innovative agriculture indented to develop all innovative hi-tech agri-business ventures by giving suitable and need-based support.
- ?? human resources management for training support to field functionaries of Department and Panchayats.

3.7.2. Department of Forests and Wild Life (DFW)

Department of Forest and wild Life of Government of Kerala organizes various information and publicity programmes from its campus in the Office of the Chief Conservator of Forests, Trivandrum. The campus has an excellent library with rare reports related to forestry and wild life. The Library also has various digitized information resources, which include virtual libraries and museums on birds, cat species etc.

3.7.3. The Kerala Forest Research Institute (KFRI)

KFRI is established under the Science and Technology Policy adopted by the Government of Kerala as an autonomous institution in 1975 to undertake research in areas like forestry, biodiversity etc., that are vital to the development of the State. The institution fulfills number of economic, social and environmental objectives set by the Government. KFRI is strategically located in the midst of a tropical forest at Peechi about 20km east of Trichur. The main campus extends over an area of 28 ha and forms part of the picturesque reserve forest of the Peechi Forest Range. The Institute has two sub-centres - one at Nilambur in North Kerala and the other at Velupadam, Palapilly in Trichur District.

The KFRI main campus at Peechi is designed and constructed by the reputed architect Mr. Laury W. Baker in his unique low-cost style. It has laboratories, library; and other facilities attached to various Divisions. The laboratories are well equipped to undertake research of disciplinary and multi-disciplinary nature.

The sub centre at Nilambur has a unique Teak museum displaying artifacts and utility items of teak wood, scientific information on various aspects of teak cultivated, and wood utilization.

KFRI has one of the best scientific libraries in Kerala with over 12,000 books, 6000 back volumes of journal and 7000 reprints of scientific papers covering all disciplines related to forestry. There are also computer facilities, modern microfilm reader cum printer, photographic and art sections, a Bamboo Information Centre (BIC-India), and a computer database on Indian Forestry Literature. The Institute has a Local Area Network (LAN) connecting the various Divisions and to the Internet.

The facilities at the main campus include; Herbarium, Medicinal Plant Garden, Orchidarium, Insect Collection, Xylarium, Wood Treatment Plant, Mist Chamber for clonal propagation of tree species, and Tissue culture.

There are research Divisions for Agro forestry, Plant Pathology, Botany, Plant Physiology, Ecology, Economics, Entomology, Genetics, Extension, Soil Science, Silviculture, Statistics, Wildlife Biology, Wood Science and Non-wood Forest Products.

Agro forestry Division has a mandate to study various ecological, social and economical features of land use to evolve strategies to make agro forestry ecosystem more productive and sustainable. Publicity, organizing exhibition, popular talks on environment and forestry etc are other activities carried out by the division. Botany Division is engaged in taxonomic studies on forest plants, including floristic inventories. Other areas covered are assessment of biodiversity, studies on endemic, rare, threatened and endangered forest plants and their conservation. Ecology Division's research interests include vegetation mapping and analysis using remote

sensing techniques, plant diversity, phenological patterns, ecosystem composition of various associations in forest formations, studies at landscape level. Soil Science Division's mandate is to enhance the forest productivity by suitable soil management measures and to preserve the existing natural forests. The thrust areas of research in the division are soils under various plantation species, reforestation of degraded land, soil and moisture conservation in degraded forestlands, nutrient cycling, and soil amelioration using fertilizer inputs.

Entomology Division conducts research on present and potential insect pest problems relevant to all aspects of forestry and developing suitable methods to reduce the economic loss caused by pests. The division maintains an excellent insect collection and renders identification services. In addition, fundamental studies are carried out on insect taxonomy, fauna and ecology and insect diversity in forest ecosystem. Genetics Division's objective is genetic improvement of various tree species for faster growth, good form, disease and pest resistance and better wood quality. Species and provenance selection, selection of candidate plus trees, progeny trials, clonal and seed orchard establishment, floral biology, tissue culture and genetic variability in trees are the thrust areas of research of the division.

Non-wood Forest Products Division prepares Quantitative Resource Inventory of NWFPs and their sustainable extraction. Studies are also undertaken on ethno botany. The division also undertakes Systematic of NWFPs, propagation of medicinal plants. Plant Pathology Division is geared to tackle disease problems in nurseries, plantations and natural forest. Studies are carried out on management of diseases through biological means and tree improvement to reduce economic loss. Species and provenance trials are carried out to identify disease resistant and fast grown types. Promising clones of eucalypts have been developed and released to the Forest Department. Fundamental studies on macro fungal flora, VAM, N₂ fixing symbioats of trees, microbial pest control, wood decay and sap stain fungi, genetical variability in host parasites using molecular markers are also undertaken. The division renders service to Forest Department in managing disease problems.

Plant Physiology Division's objective is to conduct research on the functional aspects of forest trees. Division's main research interests are concentrated around ecophysiological aspects such as water relation, canopy, gas exchange, microclimate, utilization etc. of eucalypt, acacia, teak and vegetative propagation of eucalypt, teak, bamboo and reeds. Studies are carried out on seed viability, variability in bamboo using molecular markers, etc. Silviculture Division forms the link between theory and practice. It has been conducting research on techniques of afforestation, seed technology, management of plantations, developing nursery techniques for various species, including root trainer technology and composing, establishment of germplasm collection, developing multi-tier forest system with operation research, forest inventory and GIS.

Economics Division provides a better socio-economic insight into different aspects of forestry. Various research interests of the division are biodiversity, especially non-wood forest products, farm forestry, human ecology, forest management, and techno-economic aspects of forest-based industries. Statistics Division takes care of the statistical aspects of various research investigations undertaken by the Institute. This involves designing experiments, sample survey and statistical analysis of data. It also develops appropriate software for statistical analysis. Research is also undertaken on developing new statistical techniques suited to specific needs, growth modeling, data bank for forest sector, structural dynamics, wood balance study and weight-volume relationships. The division also provides statistical services, including analysis of data to the Forest Department.

Wildlife Biology Division is engaged in documenting the distribution and monitoring of the wildlife in various Sanctuaries and National Parks in Kerala. Detailed studies on habitat utilization, ecology and behavior of selected animals, including rare and endangered ones, man-wildlife conflict, etc. are also conducted. The division provides technical support to Forest Department in undertaking periodic wildlife census. Wood Science Division functions with the objective to unlock the untapped potentials of the available resources of wood especially indigenous tree species/non-conventional species, bamboo and rattan by appropriate treatments and to increase the service life of wood by appropriate treatments. The main thrust areas of

research in the division are wood quality of faster grown trees, wood-processing technology and techno-economic study of saw milling industry. Extension Division extends the research findings in KFRI to the Kerala Forest Department and other user agencies. This division also looks after publicity related matters in KFRI.

3.7.4. Tropical Botanical Garden and Research Institute (TBGRI)

TBGRI is the biggest botanical garden in Asia which maintain a 300acre conservatory garden with 50 000 accessions belonging to 12 000 tropical plant species and their genetic variants. TBGRI is a garden system and a research and development system in one. The overall research and development activities are geared to achieve the most tangible results of conservation and value added product oriented sustainable utilization of plant genetic resources of the region. The R&D programmes oriented to accomplish these ultimate objectives are therefore integrated and multidisciplinary in nature. They involve the most pertinent components of the survey, exploration, collection, introduction, characterization, evaluation, documentation and development of location oriented production technology. It is based on the local resources and thereby it provides gainful employment to the people of the concerned region.

The main objectives of institute are to study and conserve the tropical plant genetic resources and develop strategies for their sustainable use. It conducts botanical, chemical and pharmacological research and development of scientifically validated and standardized herbal drugs, and other industrially important chemicals and value added products for food, cosmetics etc. For this it develops location oriented production technologies that utilizes local resources and human skill. To translate the fruits of research to socio-economic advantage it conducts training and extension services. It also conduct collaborative research programme with similar institutions in India and abroad. The institute has divisions on computer and IT, conservation biology, ethno pharmacology, Plant systematics and evolutionary science. Major programmes undertaken include development of tissue culture techniques for more than 50 plant species including 22 rare and threatened medicinal plants and 26 horticultural plants. It develops standardized technology for mushroom

cultivation, formulas of various scientifically validated herbal drugs, and also develops DNA finger print facility for medicinal plants.

3.7.5. Centre for Earth Sciences Studies (CESS)

CESS is a Centre of Excellence in Earth Sciences instituted by the Government of Kerala in 1978. It is an autonomous research centre to promote and establish modern scientific and technological research and development studies in earth sciences. CESS pursues multidisciplinary approach in problems related to land, sea and atmosphere. Its objectives are:

- ?? to conduct research and development activities in basic and applied fields
- ?? to organizes user training and academic programs,
- ?? to provide consultancy and organizes various activities for science popularization.
- ?? to institute and maintains earth science museums, natural monuments and parks
- ?? to conducts lectures, seminars, workshops, field discussions etc. on problems related to earth sciences
- ?? to carry out promotional studies in the field of mineral development
- ?? to develop techniques and design tools for Earth Science Studies
- ?? to work in collaboration with other Earth Science Institutions - State, central and international

CESS promotes scientific and technological research and development studies of importance to India and to Kerala in particular, in the field of Earth Sciences. It trains Government officials in planning and project evaluation in the field of mineral resources on land and offshore. It conducts studies in river basin evaluation, ground water management, coastal erosion and other special problems. Among its areas of activity those of interest to agricultural sector are; basic research in earth system, micro-level watershed planning, air/water/land/noise pollution studies, natural hazards management, GIS/GPS applications, Remote sensing applications, participatory

planning, coastal and estuarine management, terrain analysis, natural resources management, river sand mining, and micro level planning

The CESS library has 15,000 books and back volumes of 200 journals in earth and environmental sciences. The library provides Current Awareness Services, Selective Dissemination of Information Services, bibliographies compiled on request, Document Delivery Service on payment basis and inter-library loan facilities for members.

3.7.6. Centre for Water Resources Development and Management (CWRDM)

Recognizing the need for catering to the R&D needs in the field of water management, the CWRDM was established as an autonomous research organization by the Government of Kerala, under Science and Technology Policy in February 1978. The Centre originally established at Thiruvananthapuram was shifted to Calicut in 1979.

The Centre initially had six scientific divisions, dealing with surface water, ground water, water management-agriculture, water quality and environment, education and extension, and library and documentation. After a decade, scientific divisions to deal with computer applications and isotope hydrology have been added to the earlier list. In order to cater to the requirements of main areas of research, certain central facilities like water analysis laboratory, cartography, reprography, manned observation stations, remote sensing cell and a museum have also been established. To take care of the special research and development needs of different hydro-ecologic regions of Kerala, five regional centres were also started.

The Centre has substantially contributed to the scientific hydrologic studies and water management in the region. The projects of CWRDM were funded by different departments and agencies of the Central and State Governments in addition to the international agencies like UNDP, UNEP, World Bank, USAID, NAS (US), JBIC, ICFE, etc. Starting with the establishment of a data management system for the region, the Centre tackled different problems pertaining to forest and urban

hydrology, estuarine management, groundwater development, water quality management, water-related environmental issues, wetland management, watershed development, agriculture water management, irrigation and drainage issues, etc. Several tools like mathematical modeling, systems approach, isotope hydrology and remote sensing techniques were made use of in the studies during the 1990s. More than 2000 scientific papers and 500 research reports were brought out based on these studies. The hydrologic data generated by CWRDM are expected to be of immense use to the water managers of Kerala.

Around 3000 government officials and thousands of farmers were trained in the Centre. Training on watershed management was also conducted at CWRDM for the Panchayats of northern Kerala. Several national level training programs on irrigation management, watershed development, and wetland management were conducted in CWRDM, in addition to providing training and research opportunities for students and research scholars.

3.7.7. Centre for Development Studies (CDS)

CDS is an autonomous research institute established in 1971 supported by Government of Kerala, Indian Council for Social Science Research (ICSSR) and Reserve Bank of India (RBI). The main objectives of the Centre are to promote research and teaching in the discipline relevant to development. Research at CDS concentrates on broader aspects of development at the regional and national levels with special reference to agriculture, rural economy, employment and wages. Some of the areas in which studies are going on include farm production, agricultural prices, agricultural labor, land tenure and reforms, cropping pattern, dairy economics, livestock economics, fisheries economics, health economics and nutrition etc. The Centre has one of the very beautiful and serene campuses in the country designed by the world famous architect Laurie Baker. The library is housed in the most important structure physically located at the centre of the campus. The building has ten floors dedicated to ten subject classes of the Dewey Decimal Classification Scheme.

3.7.8. Coconut Development Board

Coconut Development Board is a statutory body established by Government of India for the integrated development of coconut production and utilization in the country with focus on productivity increase and product diversification. Functions of the board include adopting measures for the development of coconut industry, recommending measures for improving marketing, imparting technical advice to those engaged in coconut cultivation and industry and encouraging adoption of modern technologies for processing of coconut. It also undertakes functions like fixing grades, specifications and standards, as well as assisting, encouraging, promoting and financing agricultural, technological, industrial or economic research. Collecting statistics and also undertaking information and publication activities related to coconut and its products forms its other functions. The board produces publications in different languages, and screens films, organizes and participates in exhibitions, fairs, seminars and workshops. It trains youth in harvesting and plant protection. Farmers are trained in scientific cultivation and post harvest processing. It has established a national information center cum electronic data processing unit. It has good library, which provides lending services, Inter library loan, reference services, current awareness services and reprographic services.

3.7.9. Coir Board

Coir Board is an autonomous statutory body established by the Government of India under Coir Industry Act 1953. It undertakes wide range of activities for the development of coir industry including; scientific, technological, and economic research and development activities, collection of statistics related to exports and internal consumption of coir and coir products as well as development of new products and novel designs. It conducts publicity for promotion of exports and internal sale, marketing of coir and coir products in India and abroad and also organizes training activities for grooming skills.

3.7.10. Central Coir Research Institute, Alleppy

Undertakes research activities for different aspects of the coir industry beginning from the method of extraction of fiber to the processing and manufacture of end products. Areas of special attention of the institute are identification of new user areas for potential utilization of coir, coir waste, coir pith and improvements in processing for better quality. The institute has been constantly pursuing efforts for developing effective substitute to wood and wood based compositions from coir.

3.7.11. Rubber Board

Rubber Board was constituted under Rubber (Production and Marketing) Act 1947. Its functions are to promote the development of the rubber industry by undertaking, assisting and encouraging scientific, technological and economic research, training in improved methods of planting, cultivation, manuring and spraying. It provides technical advice to rubber growers. Improving the marketing of rubber, collection of statistics from growers, dealers and manufacturers, and also advising government of India on all matters related to rubber industry, including the import and export of rubber are other functions. It also facilitates Indian participation in international conferences and seminars etc.

Rubber board undertakes research and development on scientific technological and economic aspects of natural rubber (NR). This includes agricultural research consisting of crop improvement programmes through breeding and selection, propagation techniques, germplasm collection, conservation and utilization, genetic engineering and molecular biology, rubber based farming systems, soil and nutrient management, drought management, diseases and pests and their control, plant protection techniques and microbial management of soil fertility and environmental pollution, plant physiology and exploitation studies and agricultural economics with emphasis on cost production and ancillary products. Research on Technological aspects include studies on rubber processing, product development and quality improvement of processed rubber and rubber products, blends of NR with other

polymers, modification of NR, reverse engineering and recycling. It has also functions related to marketing research, technical consultancy service, training and engineering services related to rubber processing.

3.7.12. Spices Board

Spices Board is an apex body under the Ministry of Commerce, Government of India for the export promotion of Indian spices. The Board is a developmental, regulatory and promotional agency for Indian spices. Its broad based activities include formulation and implementation of quality improvement systems, research and development programmes, education and training of farmers, processors, packers and exporters on post harvest handling and registration and licensing of traders and exporters. It acts as a databank and communication channel for importers and exporters and promoters of Indian spices abroad. The board is also in association with International Trade Centre Geneva implementing a World Bank project called “Empowerment of Rural communities to Export Organic Spices”. The programmes under this project include improvement and promotion of organic production of spices, certification and export of selected spices like black pepper, white pepper, ginger, turmeric, cardamom, clove, nutmeg, and herbal spices like rosemary, thyme, oregano, and parsley. The programme is conducted in selected project sites including Idukki, Waynad and Nilagiris districts of Kerala and also in other States through identified NGOs. The project consists of imparting training to NGOs and farmers on basic standards, organic production methods, documentation, inspection and certification.

3.7.13. Tea Board

The functions of Tea Board are to promote development of tea industry for which specific measures are to be taken regarding regulation of production, improvement of quality, undertaking scientific, technological and economic research etc.

3.7.14. Marine Products Export Development Authority

Marine Products Export Development Authority is a statutory body under Ministry of Commerce, Government of India. The role envisaged for it under the statute is comprehensive – covering fisheries of all kinds, increasing exports, specifying standards, processing, marketing, extension and training in various aspects of the industry. It acts as a coordinating agency with different central and State Government establishments engaged in fishery production and allied activities. The schemes of the authority comes under four major heads; export production capture fisheries, and culture fisheries, inducting of new technology and modernization of processing facilities. It also attends market promotion work programmes and does the registration of infrastructure facilities for seafood export trade. It also undertakes collection and dissemination of trade information, projection of Indian marine products in overseas markets by participation in overseas fairs and organization of international seafood fairs in India.

3.7.15. Centre for Agricultural Informatics (CAGI)

CAGI of Varanasi has Technical Division and regional chapter at Tellycherry, Kannur District and is a research organization registered under Government of India Act XXI of 1860. Its mandate is to assist agricultural education, research, extension and development by evolving information and communication strategies. Its objectives are to provide training and advisory services to organizations in agricultural sector for enabling them to identify appropriate policies for information management and the implementation of new knowledge and Information and Communication Technology (ICT). Other aims include providing information support for improving the efficiency and relevance of agricultural research, to enable agricultural researchers and policy makers better informed when decisions are taken about agricultural education, research, extension and development programs and relevant networks. It is also expected to function as a center of excellence in agricultural informatics³¹.

For use in agricultural sector CAGI has in association with other agencies developed a package *Nitya Archives*, which is a full text retrieval utility for the archiving and organization of files, reports, books, journals thesis/dissertations, audio and video files and other documents in digital libraries and information systems. This package interfaces the world's most powerful search engine developed by Unesco for CDS/ISIS with popular e-publishing solutions. *Nitya Archives* combines high-level text compaction technique and sophisticated free text search and retrieval procedure. Any piece of information contained in any page of any document archived and kept using this package can be retrieved within seconds. Searches can be by title, author, subject(s), free text and Boolean logic. Proximity searches also will be possible. CAGI has using this package developed prototypes of Digital Libraries of agricultural theses, forestry reports, department files etc. The package has also been used for developing a biodiversity database.

3.7.16. Farm Information Bureau (FIB)

Integrating the Agricultural Information Service of the Department of Agriculture and Information Unit of the Department of Animal Husbandry FIB was established³². It started functioning in 1969. FIB is the nodal agency providing active and complete information communication support to the extension and developmental activities in the farm sector in Kerala. This is a unique organization, which looks after the publicity, and propaganda activities of the Department of Agriculture, Animal Husbandry, and Diary Development, Cooperation etc. *Kerala Karshakan* a premiere publication of agricultural front is published by FIB. It also produces technical bulletins regularly to help the extension staff and farming community. The daily news bulletin prepared by it named *Karshika Mekhala Varthakal* is broadcast by AIR. It also supports the Agricultural section of most of the dailies published from the State. The Bureau publishes an annual Farm Guide, leaflets, booklets and pamphlets for the farming community, as well as video films of agricultural information. FIB has two regional Divisions at Ernakulam and Calicut and District Units at other 11 districts.

3.7.17. Kerala State Land Use Board (KSLU)

The KSLU Board under Government of Kerala carries out surveys and investigations related to land and water management. It is the accredited Remote Sensing Center and also serves as an information center on natural resources like soil, water and plants. It maintains remote sensing and statistical databases related to different districts and prepare land use planning reports. It is the work center for the National Wasteland Development Board. Its document collection include approximately 2000 resource maps on Kerala in paper as well as in digital media.

3.7.18. Oil Palm India Ltd

Oil palm India limited is a joint venture of Government of Kerala and Government of India. Recently the company took over the Oil Palm Research Station at Thodupuzha with the objective of producing quality hybrid seed materials.

3.7.19. Kerala State Planning Board (SPB)

Kerala State Planning Board has a major division related to agricultural development planning. Research and studies on various aspects of planning for development of agriculture, animal husbandry and related areas are conducted here to formulate plans and policies related to agricultural sector. The specialized library of the Board is one of the very few excellent information support facilities existing directly under GOK.

3.7.20. Other Government Institutions

Kerala Agro Machinery Corporation, Ernakulam; Central Integrated Pest Management Centre, Kochi; Kerala Livestock Development Board, Tvpm; Poultry Development Corporation, Tvpm; Kerala State Veterinary Council, Tvpm; FACT, Kochi; Indian Potash, Ernakulam; NABARD, Tvpm; KERAFED, Tvpm; Horticultural Products Development Corporation, Tvpm; VSSC, Tvpm etc. are some of the organizations whose activities are directly or indirectly related to agriculture.

3.7.21. Programme for Community Organization (PCO)

Origin of the network dates back to the seventies, when a diocesan rehabilitation project resettled fishermen from various localities in an uninhabited stretch of coast later called Marianad, about 20km north of Thiruvananthapuram. One of the major problems that the fishermen faced in the new settlement was that of marketing their fish catches. The marketing system of the region at that time involved beach auctions controlled by merchants and middlemen, and was exploitative in nature for several reasons. Confronted with this, the fishermen, with the assistance of a team of social workers, decided to set up their own marketing system, and appointed their own auctioneer. Faced with a determined set of fishermen, the merchants eventually had to yield. The fishermen then took over a dormant co-operative society that had been registered in the village earlier and started operations formally. After a few years of functioning of the Marianad Matsya Utpadaka Co-operative Society (MUCS), it was proposed that this model of fish marketing societies be spread to other parts of the district. For this experiences voluntary workers who set up the MUCS set up an NGO called Programme for Community Organization (PCO).

PCO works with men, women and young people to focus them on better management of fishery resources and better education, health, sanitation, transportation and housing. Through P.C.O., women traders and vendors have been able to confront exploitative taxes and harassment of women at the markets. Several programmes have been undertaken to develop leadership and organizational skills of women from fishing communities, enabling them to analyze and respond to their problems and to take part in decision-making processes affecting their lives. Similar programmes, especially in resource management, have been held with fishermen. Among its other activities, PCO worked to organize and promote new fishermen societies in many fishing villages in Trivandrum District, all based on the original model of fish marketing society that was evolved in Marianad. A few that came into existence in Kerala due to the effort of PCO are Trivandrum District Fishermen Federation, Fishermen Welfare Society and Malabar Federation of Fishermen Societies.

3.7.22. Attappady Social Service Organization

Attappady Social Service Organization is an NGO and it focuses on the integrated development of the tribal in the rural areas of Attappady; helps the people to construct proper houses keeping in view the importance of sanitation, provides to tribal people new techniques in animal rearing and agriculture.

3.7.23 Gandhi Smaraka Grama Seva Kendram, Kasaragod

Gandhi Smaraka Grama Seva Kendram (GSGSK), Karadka, Kasaragod is an NGO which organizes training programmes in agriculture, animal husbandry, and income generating techniques and economic development of the weaker sections.

3.7.24. Hilda Trust (HiLDA), Sultan Bathery

Hilda encourages community participation in the development process and self-reliance through people centered development initiatives. It also focuses on empowerment of the disadvantaged rural and tribal people.

3.7.25. Neyyatinkara Integral Development Society, (NIDS)

Neyyatinkara Integral Development Society, (NIDS) Vazhuthoor, Neyyatinkara, Trivandrum is an NGO. The vision of NIDS is the formation of a just society through participatory social action programmes. Its mission is to interact with the poor and needy to realize their need and to plan and execute appropriate programmes through direct intervention. It concentrates its activities on six basic segments namely socio-economic development, agriculture development, health and alcoholism, women and child development and labor justice peace commissions.

3.8. Libraries Outside Agricultural Sector

There are many organizations outside the agricultural sector, which conduct research and development activities in many aspects of interest to agriculture. Most of these institutions hold information and document collections highly relevant to agricultural sector. Some of the important organizations of relevance are discussed in the following paragraphs

3.8.1. Cochin University of Science and Technology (CUSAT)

CUSAT is a premiere science and technology university in the country. The objectives of the university are promotion of graduate and post graduate studies and advanced research in applied science and technology, industry, commerce, management and social science. Of the nine faculties and 25 departments of CUSAT many are relevant to agricultural sector.

School of Environmental Studies under the university is a center for higher learning dedicated to environmental protection and sustainable development. The school offers MSc in Environmental Technology in two sub disciplines; environmental engineering and environmental biotechnology. Doctoral programmes are offered in the disciplines of environmental biology, environmental chemistry, environmental microbiology and environmental toxicology. Department of Biotechnology offers MSc and PhD programmes in Biotechnology. Areas of research include genetic engineering, cell biology, plant biotechnology etc. Department of Polymer Science and Rubber Technology conduct UG, PG and PhD programmes. Thrust areas of research are conducting polymers, Rubber to metal bonding, polymer composites recycling etc.

School of Industrial Fisheries offers MSc programme in Industrial Fisheries, and also PhD program in diversity of subjects ranging from fisheries biology, aquaculture, fishing craft and gear technology, fisheries economics and fisheries management. School of Marine Sciences offers PG Diploma in coastal zone

management. Have departments for study on atmospheric sciences, chemical oceanography, marine biology, microbiology, and biochemistry.

Department of Applied Economics offers Masters programme in Business Economics, MPhil in Applied Economics and PhD. Thrust areas of research are problems of regional development in Kerala, industrial economics, fishery economics and environmental economics. School of Management Studies facilitates Masters Programme in Business Administration, International Business, MPhil in Commerce and also PhD programme in the above subjects. Other relevant departments and centers in CUSAT are Departments for Ship Technology, Integrated Management of Coastal Zones, Mangrove Studies, Monsoon Studies, Rural Development and Appropriate Technology, Economic Policy analysis etc.

3.8.2. University of Kerala

University of Kerala has also many departments conducting research on areas relevant to agriculture. The Departments include those for Aquatic and Biological Sciences, Biotechnology, Biochemistry, Botany, Zoology, Management Studies and Economics. The Oriental Research Institute and Manuscript Library has a very rare collection of ancient works on Vrikshayurveda, Mrigayurveda, aromatic and medicinal plants etc in Sanskrit. The University Central Library also has a good collection of documents on agriculture and related areas.

3.8.3. Mahatma Gandhi University

Mahatma Gandhi University has also few departments conducting research of interest to agricultural sector. The Departments include those for Biochemistry, Botany, Zoology, and Economics, Statistics etc. The MG University Library also has a good collection of books and journals relevant to agricultural research.

3.8.4. University of Calicut

Calicut University has also under it various departments conducting research on areas relevant to agriculture. The Departments include those for Biochemistry, Botany, Zoology, and Economics, Statistics etc. The University Central Library also has a good collection of documents on agriculture and related areas in English and Malayalam. The collection includes many PhD dissertations relevant to agricultural sector.

3.8.5. Sree Sankaracharya University of Sanskrit

The University has a department of Ayurveda. The library collection include various manuscripts and books in Sanskrit and English related to aromatic and medicinal plants, Vrikshayurveda, Mrigayurveda, as well as research on ancient Indian ecology and related topics.

3.8.6. Government and Private Colleges

The Government Engineering Colleges, Law Colleges, Arts and Science Colleges and Ayurveda colleges hold books related to agriculture and biosciences, agricultural engineering etc. Ayurveda colleges have books relevant to aromatic and medicinal plants. Many private colleges existing in the State also hold relevant documents.

3.8.7. Kerala Legislature Secretariat

Kerala Legislature Secretariat has a very strong Research and Information Division, which covers agriculture, related areas also. The division supports legislators to be aware of the earlier legislations in the country as well as other countries on aspects related to agriculture.

3.8.8. Libraries Under State Library Council

Many of the 5000 and more libraries coming under Grantha Sala Sangham had Krishi Pusthaka Corners. They also conduct various programmes related to agriculture as part of their extension programmes as well as in association with government and other agencies.

3.8.9. State Institute of Languages.

State Institute of Languages publishes books in Malayalam Language. Hundreds of books related to agriculture have already been published in Malayalam. The books have reached most of the colleges and rural libraries in Kerala. The contribution of the institute for dissemination of information on sustainable agriculture, animal rearing etc. is unique. The institute also has a good collection of books on agriculture and related areas.

3.8.10. Kerala Sahithya Academy

Kerala Sahithya Academy and institutions under it have very good collection of books on agriculture, bioscience and related areas published in Malayalam from very early days of the starting of printing in the region. The collection also contains journals and manuscripts on Ayurveda, Siddha, and also aromatic and medicinal plants.

3.9. Need for Inter-institutional Participation

The above survey of institutions in agricultural sector of the State of Kerala show that they together undertake the functions of education, research, extension and development in the fields of agriculture, animal husbandry, home science, fisheries, forestry and allied sciences. The subject fields these institutions cover include agricultural botany, agricultural economics, agricultural engineering, agricultural entomology, agricultural extension, agricultural meteorology, agricultural statistics, agronomy, animal husbandry, home science, horticulture, olericulture, processing

technology, plant breeding, genetics, plant pathology, plant physiology, plantation crops and spices, pomology and floriculture, soil science & agricultural chemistry, biotechnology, computer science, forestry, wood science, environmental sciences, wild life, ecology, aquaculture, fishery biology, and processing technology, irrigation and drainage engineering, machinery and energy, post harvest technology and processing, anatomy, animal reproduction, animal breeding & genetics, biochemistry, clinical medicine, dairy science, livestock product technology, microbiology, nutrition, parasitology, pathology, pharmacology and toxicology, physiology, poultry science, preventive medicine, surgery, statistics, veterinary public health and also many others coming under the broad group of agriculture and biosciences. Research or development in none of these areas can be conducted as in watertight compartments. So cooperation between these institutions is important.

3.9.1. Conclusion

In the coming days in addition to improving food and nutritional security agriculture would be guided by concerns for environmental protection, sustainability of production and supply as well as profitability of farm enterprises. GATT, liberalization process and globalization of markets would call for competitiveness and efficiency in agricultural production and agricultural sector would have to stand against many challenges using knowledge generated by research and development.

All these necessitate efficient library and information systems and interaction of the scientists from different areas working in the institutions mentioned above as well as speedy acquisition and dissemination of research information on all relevant areas.

The success of our agricultural sector in a free and competitive national or international market would depend on inter-institutional participation in development. Efficient information systems, the complex gamut of interacting activities that can enable continuous identification of problems under changing environment and development and utilization/ transfer of appropriate technology will be essential for sustainable agricultural development.

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Chapter 4

DATA ANALYSIS – I

RESOURCES AND SERVICES IN AGRICULTURAL SECTOR OF KERALA

4.0. Introduction

The agricultural sector in Kerala hold information generated in the region as well as acquired from outside sources. The quality and accessibility of these resources has a major role to play in agricultural development. The present chapter analyses the data gathered through a survey conducted among librarians and information users from agricultural sector. The chapter evaluates resources, services and infrastructures for agricultural information handling existing in Kerala.

Approximately 250 institutions having information sources are functioning in agricultural sector excluding Krishi Bhavans and Veterinary Hospitals, small cooperatives. Among them about 50 are major institutions when the resources, facilities, functions and financial allotments are considered. Other 200 are minor institutions without planned information support systems.. From among them system and user surveys covered 30 major institutions and 60 minor institutions. There are also hundreds of institutions outside agricultural sector engaged in research and development activities in areas of interest to agricultural sector. Detailed analysis was limited to the 30 resource rich institutions, which together cover all subject areas related to agriculture. Data was also gathered from 25 randomly selected institutions outside the stream of agriculture. System and user surveys and interview schedule among approximately 600 scientists, managers and farmers were used to evaluate the quality, accessibility and efficiency of the resources and services.

4.1. Status of the Institutions

Most of the Agriculture related institutions in Kerala were established in the last quarter of the twentieth century. Those, which existed earlier, were also

reorganized during that period to their present form. Majority of these institutions in Kerala come under Kerala Agricultural University (KAU). A few institutions are under Indian Council for Agricultural Research (ICAR). There are also some institutions directly controlled by the Central Government. Many autonomous institutions under State Government also function in the agricultural sector. The Departments of Agriculture, Animal Husbandry, Fisheries etc have under them various division's and institutions spread throughout the State. A few Non-Governmental Organizations also undertakes activities, which are of relevance to the agricultural sector.

The preliminary survey conducted for the present study revealed that there are library and information service divisions in all the above said institutions and departments. They were started immediately after the establishment of the concerned institutions. Their size and type vary from a mere shelf in a multipurpose room or a small room with a collection of 100 to 500 books and a non-professional staff to very large institutions that can stand with any of the high-tech libraries in the country. All the libraries have good collections in different areas of agriculture. A few have vast collections of data on agricultural research. They have sophisticated Information and Communication Technology (ICT) based systems for information storage and dissemination and are providing highly advanced services. They have even ventured into marketing of information services and products including HRD programmes in Agricultural Informatics.

4.2. Mandate

The mandate of institutions coming under the ICAR, Government of India and State Government, functioning in the agricultural sector of Kerala are in total to plan, undertake, and promote education, research, extension and development in agriculture, forestry, veterinary and animal sciences, diary sciences, fisheries, food, agricultural engineering and allied areas. In keeping with this mandate agricultural research institutes in the Kerala attempts to serve the needs of the agricultural sector of the State.

Of the 90 libraries in agricultural sector, which provided information on their major activities 14 institutions, have education, 68 research, 39 extension and 62 development as one of the mandate of their parent institution. Areas of active research are found to be on crops and livestock reared in the region and other related aspects which include cereals, pulses, tubers, vegetables, fruits, condiments & spices, oil seeds, beverages, green manure, crops, fodder, crops, other crops, trees, medicinal plants, animals, birds, fishes

Developments in the agricultural sector of the State need qualitative improvement in farming, animal husbandry, fisheries and related areas. This requires improved technology, which result from efficient research and development programmes. This in turn depends upon the quality and quantum of work done by scientists working in agriculture and bioscience fields. Their quality and speed depends on efficient information support systems. Agricultural libraries and information service units have to play a vital role in knowledge communication. They have to keep the scientists posted with the latest knowledge and advancement in their respective fields of specialization. This forms the mandate of the libraries in agricultural sector.

4.2.1. Objectives

The mission statement of their parent institutions expresses the overall aim of the library and information service systems of institutions in agricultural sector. It is to provide information support for the development of the State and the country through education research extension and development in agricultural sciences. The basic objectives are¹:

- ?? to build up information resources on agriculture, veterinary and animal science, fisheries, food science, forestry and allied areas.
- ?? to support education, research, extension and development in agriculture and allied fields through provision of information and knowledge.

?? to fulfil the knowledge requirements of students, faculty, researchers, extension workers, decision makers in agricultural sector and farmers.

?? to continuously assess the information requirements in agricultural sector and to create necessary information bases in traditional and electronic media to provide information support to the systems and user communities to be served.

4.2.2. Functions

In order to fulfil the aims and objectives specified above the libraries in agricultural sector of Kerala performs the basic function of acquiring, organising, managing, and disseminating information. As part of this they facilitate access to information in agriculture and allied areas available worldwide.

4.3. Libraries in the Overall Set-up

Information service scenario has witnessed revolutionary changes in the mediums and methods for accessing, storing, organising, processing and disseminating information. World Wide Web has accelerated the move towards a more electronic library environment and the digital culture is gradually pervading all aspects of library routines. Library management functions are currently a highly specialised activity as the forces affecting the supply; organisation and delivery of information adjust to the new digital paradigm. Hence libraries in most of the specialised institutions in the agricultural sector occupy the status of independent divisions.

In State Government's Departments of Agriculture, Animal Husbandry, Dairy Development, Fisheries, Forestry, Land Use, Irrigation etc there are libraries and information units. There is also a common system under Farm Information Bureau (FIB), which looks after library, information and documentation activities related to agricultural sector. The organizational set up of these institutions is depicted in Figure 4.1. Their libraries and information units have status of independent divisions or departments.

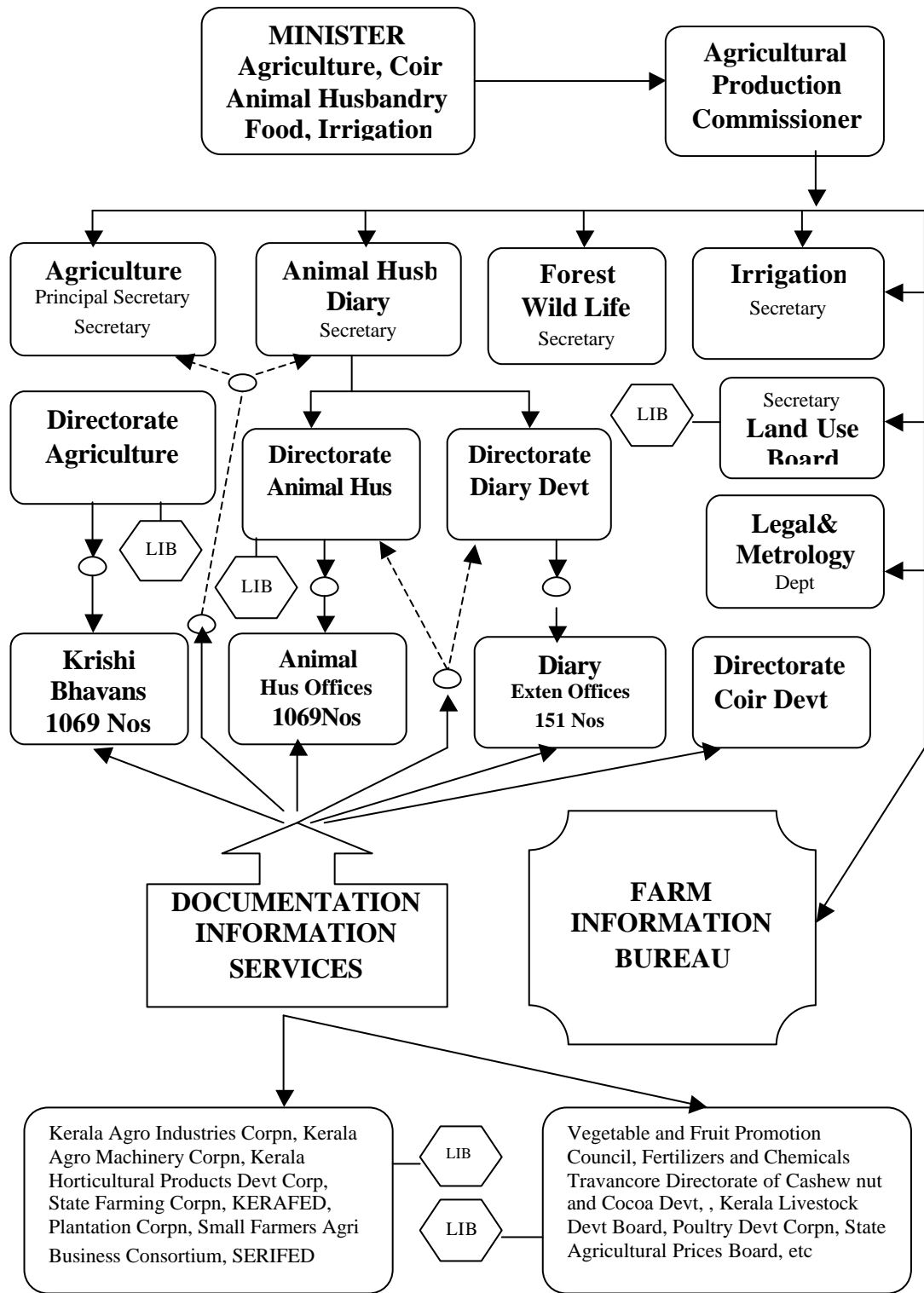


Figure 4.1: Organizational Chart of the Major Departments/Organizations of Government of Kerala Related to Agriculture and the Existing Library and Information Support Provision for Them

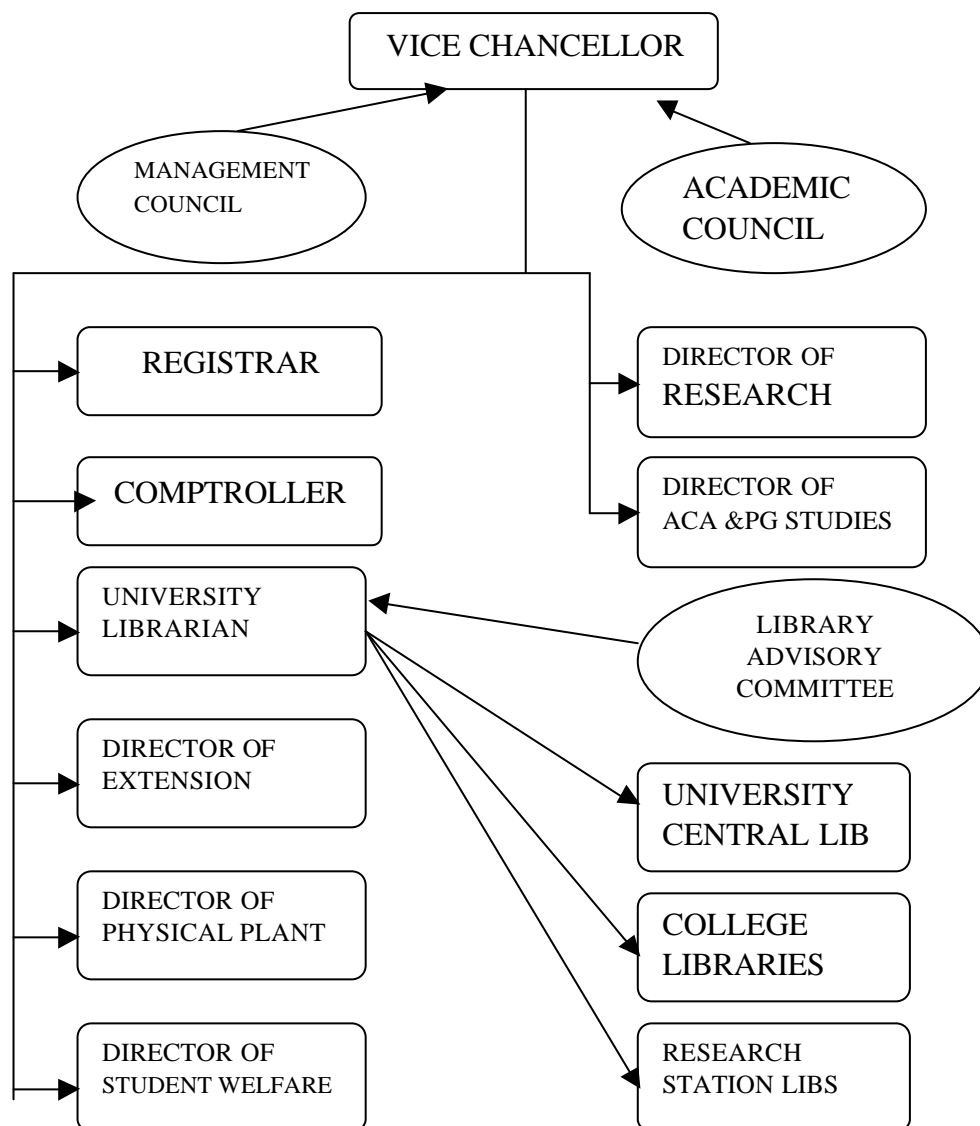


Figure 4.2: Organizational Chart of the KAU Showing the Position of Library System

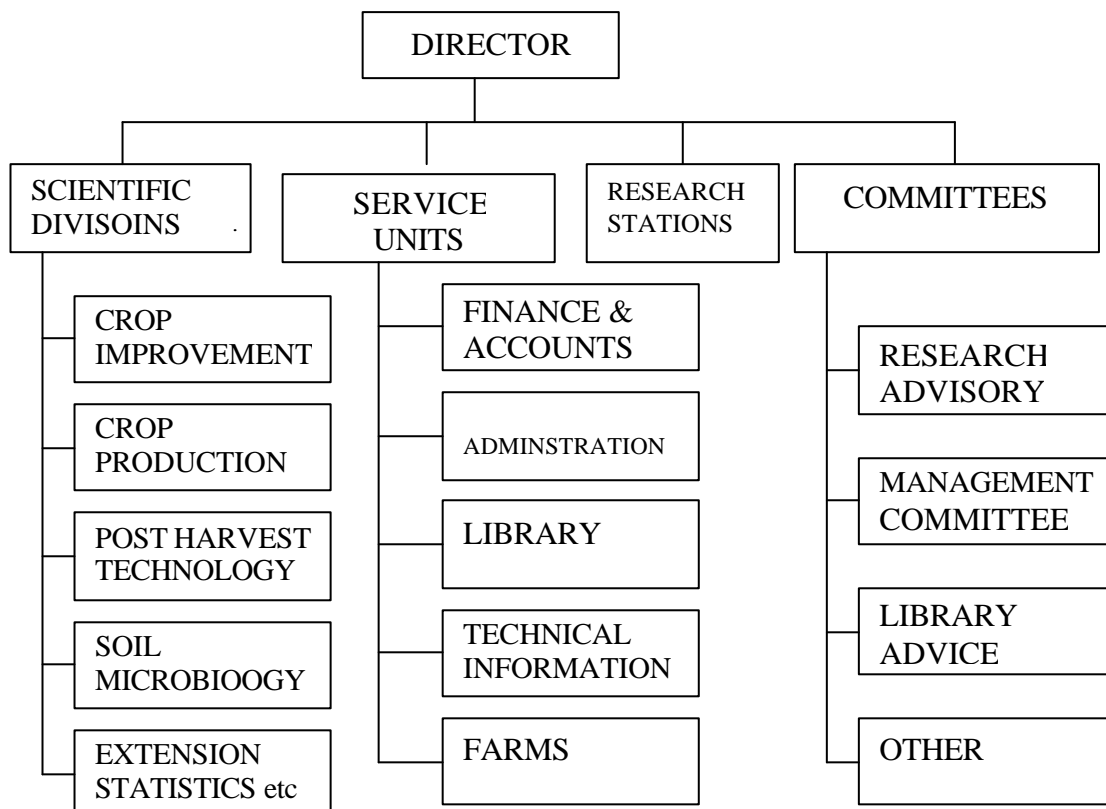


Figure 4. 3: Organizational Chart of (IISR) an ICAR Institute in Kerala Showing the Position of the Library

In KAU, as revealed in Figure 4.2 the Library is one of the eight major statutory functional divisions of the university. It is headed by one of the eight statutory officers in second level of management; with wide administrative and financial powers². In all the institutions under KAU, libraries have status equal to other academic and scientific divisions.

In ICAR institutes functioning in Kerala Libraries come at third level. The organizational set-up of the Spices Research Institute³ at Calicut, under ICAR is given in Figure 4.3. Other ICAR institutes CPCRI, CMFRI, CIFT, etc also follow similar pattern.

4.3.1. User Participation in Management

Most of the institutions under ICAR, KAU and State Government functioning in agricultural sector of Kerala have Library Advisory Committees (LAC). These committees are constituted by the executive order of the Vice Chancellor or Directors. The LAC serves as a link between the library and beneficiaries of the system. The role of the committee is advisory. It makes recommendations related to the; broad policies for development of the library resources, facilities and services. Budget allocation among various competing demands and revision/changes in library policies at periodic intervals is also done as per its recommendations. In institutions under KAU the libraries have also Management Councils, which acts as instruments for intra departmental participation in library development.

The composition of the LAC is slightly different from institution to institution. At KAU the chairperson is the Vice Chancellor⁴. In KAU colleges, the Deans or Associate Deans who head of the colleges act as Chairpersons of IACs. At ICAR institutes the Chairperson is the Director of the concerned institution or a senior scientists nominated by the Director. The strength of the membership varies from 2(RARS) to 20(KAU). The committees have representation from various areas of activity in the agricultural sector like student, teacher, administration, as well as different subject representations. In most of the organizations Librarian acts as the

Secretary of the LAC. The Library Management Councils constituted in KAU Libraries consist of the lowest level staff including Class IV to the highest-level staff that is Librarian or scientist in charge of the library as members. They sit together and discuss and approve all the plans, proposals and policies to be submitted for sanction/consideration of the higher-level unit, university or LAC.

4.4. Internal Organization

In all institutions Librarians or officers in charge of the library is directly responsible for the overall management of the library. He is responsible to the Vice Chancellor or Director of the concerned institutions as well as Executive/Management Committees of the organizations. The librarian has immediate command of the library professionals in his division as well as immediate or extended command of other staff in all the libraries coming under the institution. The Librarian of KAU has vast administrative and financial powers, which extends over institutions functioning under KAU in different parts of the State. Organizational set up of libraries under KAU is presented in Figure 4.4.

Providing information support to the students, scientists, extension activists, administrators, or farmers is the function of the libraries and information service units in agricultural sector. For this they acquire, organize and disseminate information. Facilitating access to information stored elsewhere also has become the activity of such systems with the emergence of Digital Libraries and the Internet. Efficient organization of the library or information system is a most important prerequisite for their successful functioning. In Kerala these systems follow traditional functional staff structure. In this the hierarchy of responsibility is departmentally defined. At the top of the pyramid, the Head of Library and Information Services or the Librarian is responsible for the overall control - forecasting and planning, coordinating and general organization. Below him at large institutions are the librarians of second level in charge of divisions of the library and information system for administration, acquisition, cataloguing, circulation, reference services, periodicals, IT enabled services, Library LAN administration, etc. Within each of these major divisions junior

staff attends routine and clerical operations. The Figure- 4.5 gives the internal organizational setup of KAU Central Library, which is the biggest library in agricultural sector in Kerala with most modern facilities. In KAU Central Library the library activities are organised into ten divisions meant for 10 different functions listed below⁵.

AD	Administration
AC	Acquisition,
CA	Cataloguing,
JO	Journals,
RE	Reference
CI	Circulation,
MA	Maintenance
IT	IT Enabled Services
LA	LAN Administration
HR	HRD in IT Lib Sc
PU	Publications

Details of functional divisions available at other major libraries are presented in Table 4.1.

A few of the libraries in major institutions do not have divisions for some functions. But the available divisions as part of their normal responsibilities attend those functions also. Libraries in all the institutions in agricultural sector of Kerala perform all the functions specified above. Some libraries being single staffed the functions are managed by the same staff. In some libraries one staff manages two or more functions. A few libraries have separate division for all these functions. But the terminology used for naming the divisions may differ.



Figure 4.4: Organizational Set up of the Library and Information System Under KAU

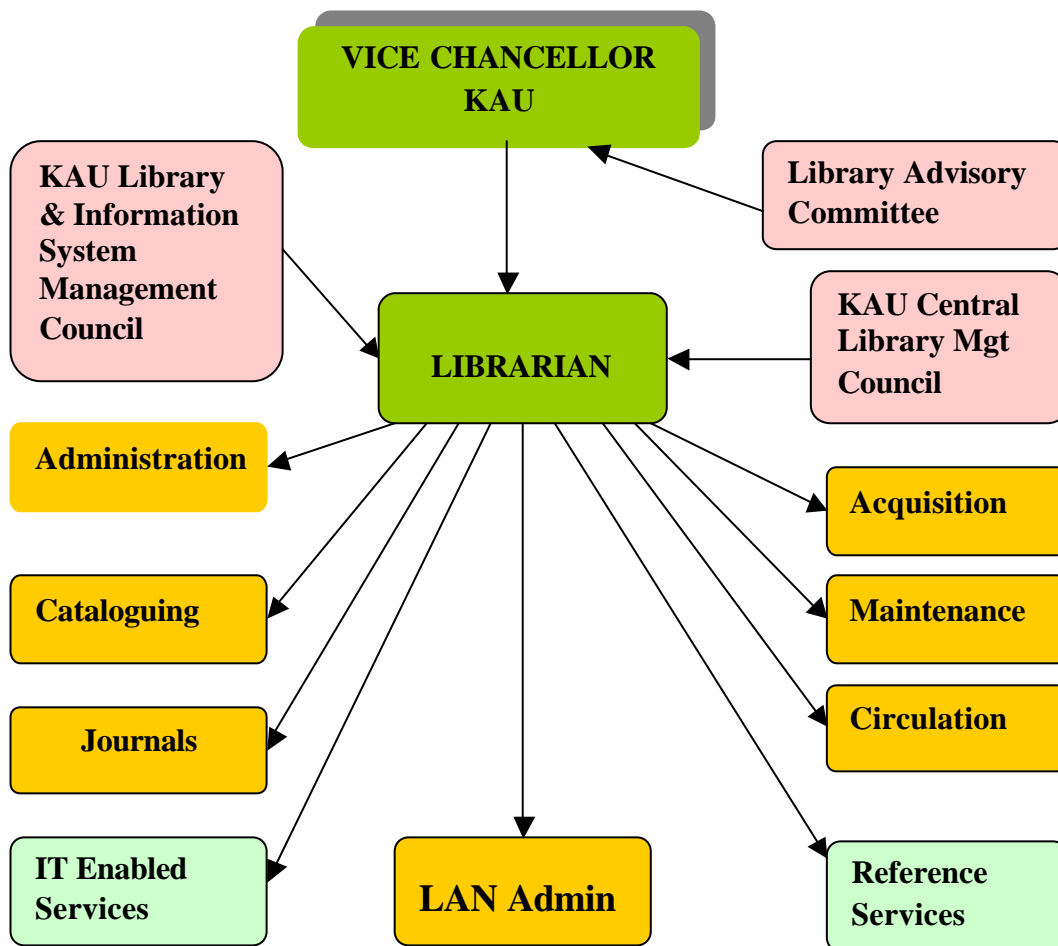


Figure 4.5: Organizational Chart of KAU Central Library, Vellanikkara, Thrissur

Table 4.1: Functional Divisions Available at Major Agricultural Libraries

Institution	AD	AC	CA	JO	RE	CI	MA	IT	PU
COAT	Y	Y	Y	Y	Y	Y	N	Y	N
DAG	Y	Y	N	Y	N	Y	N	N	N
RGCB	Y	Y	Y	Y	Y	Y	N	Y	N
FIB	Y	N	N	N	N	N	N	N	Y
CWRD	Y	Y	Y	Y	Y	Y	N	N	Y
IISR	Y	Y	Y	Y	Y	Y	N	Y	N
CPCRI	Y	Y	Y	Y	Y	Y	Y	Y	Y
TBGRI	Y	Y	Y	Y	Y	Y	N	N	N
KAUC	Y	Y	Y	Y	Y	Y	Y	Y	Y
COH	Y	Y	Y	Y	Y	Y	N	N	N
CTCRI	Y	Y	Y	Y	Y	Y	N	N	N
KFRI	Y	Y	Y	Y	Y	Y	Y	Y	N
COF	Y	Y	N	Y	Y	Y	N	Y	N
DFW	Y	Y	Y	Y	Y	N	N	N	N
CESS	Y	Y	Y	Y	Y	Y	N	N	Y
KSLU	Y	Y	N	Y	N	Y	N	N	N
CDS	Y	Y	Y	Y	Y	Y	Y	Y	Y
CCBM	Y	Y	Y	Y	Y	Y	N	Y	N
SPB	Y	Y	Y	Y	Y	Y	N	Y	N
DES	Y	N	N	Y	Y	Y	N	N	N
CFISH	Y	Y	Y	Y	Y	Y	N	Y	N
CIFT	Y	Y	Y	Y	Y	Y	N	Y	N
CMFRI	Y	Y	Y	Y	Y	Y	N	Y	N
PCOC	Y	Y	Y	Y	Y	Y	N	Y	Y
CVA	Y	Y	Y	Y	Y	Y	N	N	N
CVAP	Y	Y	N	Y	Y	N	N	N	N
CDIA	Y	Y	N	Y	Y	N	N	N	N
DAN	Y	Y	N	Y	Y	N	N	N	N
CAE	Y	Y	Y	Y	Y	Y	Y	Y	N
CAGI	Y	Y	N	Y	Y	N	N	N	Y

Y = Available, N = Not Available

4.4.1. Evaluation of Organization and Services

The result of the survey conducted among the user community with the help of a questionnaire to understand their opinion about overall efficiency of the organizational set up and services from different functional divisions is presented in Table 4.2

In the survey 16% of the users who responded to the question on the concerned aspect rated the book collection as excellent, 26% as very good and 31% as good. So in total 73% of the users are satisfied with the book collection. Responding to the question on journal collection 6% of users rated it as excellent, 13% as very good and 16 percent as good. For 35% of the users of journal collections are found to be satisfactory. This is actually an assessment within the limits of their library as well as information requirement of their activities in the respective organizations. Of the 427 users who responded to the questionnaire 13% rated the overall system of the library as excellent, 19% as very good, 29% as good, 18% as average and 7% as poor.

Table 4.2: Overall Rating of the Library by the Users

Overall Rating	Exce %	VerG %	Good %	Aver %	Poor %	Tot No	R					
Book Coll	71	16.60	110	25.76	132	30.91	56	13.11	35	8.2	404	23
Journals	27	6.32	54	12.65	110	25.76	134	31.38	21	4.92	346	81
Reference Coll	60	14.10	96	22.48	127	29.74	72	16.86	40	9.37	395	32
User's Subject	91	21.30	113	26.46	99	23.19	37	8.665	27	6.32	367	60
Services	37	8.67	59	13.82	140	32.79	86	20.14	22	5.15	344	83
Staff	41	9.60	67	15.69	129	30.21	64	14.99	37	8.67	338	89
Total Average	54.5	12.8	83.17	19.48	122.8	28.77	74.83	17.53	30.3	7.1	427	

The data related Librarians' rating of the overall library system of their own library is presented in Table 4.3. Of the 61 librarians who responded to the questions

of self appraisal of the system during the survey 3.5% rated the library as excellent, 17 % very good, 26% as good, 25% as average and 23% as poor.

Table 4.3: Overall Rating of the Library by the Librarians

Ratings by Staff	Exclt	%	VerG	%	Good	%	Aver	%	Poor	%	Total	N	R
Book Collection	04	6.56	14	22.95	20	32.79	11	18.03	3	4.92	52	9	
Journals Division	02	3.28	09	14.75	14	22.95	15	24.59	19	31.11	59	2	
Reference Coll	01	1.64	19	31.15	22	36.07	10	16.39	8	13.11	60	1	
Services	01	1.64	09	14.75	15	24.59	24	39.34	12	19.70	61	0	
Staff	04	6.56	07	11.48	18	29.51	15	24.59	14	23.00	58	3	
IT Based Services	01	1.64	04	6.55	07	11.48	15	24.59	29	47.50	56	5	
Total Average	2.16	3.55	10.33	16.94	16	26.23	15	24.59	14.2	23.20	61		

A comparison of the ratings of the users and librarians of the libraries is presented in Figure 4.6

4.4.2. Availability of Services at Grassroots Level Institutions

Of the 300 persons working institutions at the grassroots level interviewed 291 (91%) persons reported that their institutions are not having library facilities and 285 (95%) that no library and information service facility is accessible at their institutions. Of this 267 (87%) opined that library service is essential for their work. 288 (96%) reported that Internet facility is not available in their institution and 211 (70%) opined that Internet facility is required. From the respondents 195 (65%) stated that computers are available in their institution and only less than 51(17%) stated that they have required computer literacy to do their work and retrieve information using computers. 268 (88%) stated that computer literacy programmes for those who work in agricultural sector is essential.



Figure 4.6: Comparison of Rating of Overall Library System by Librarians and Users

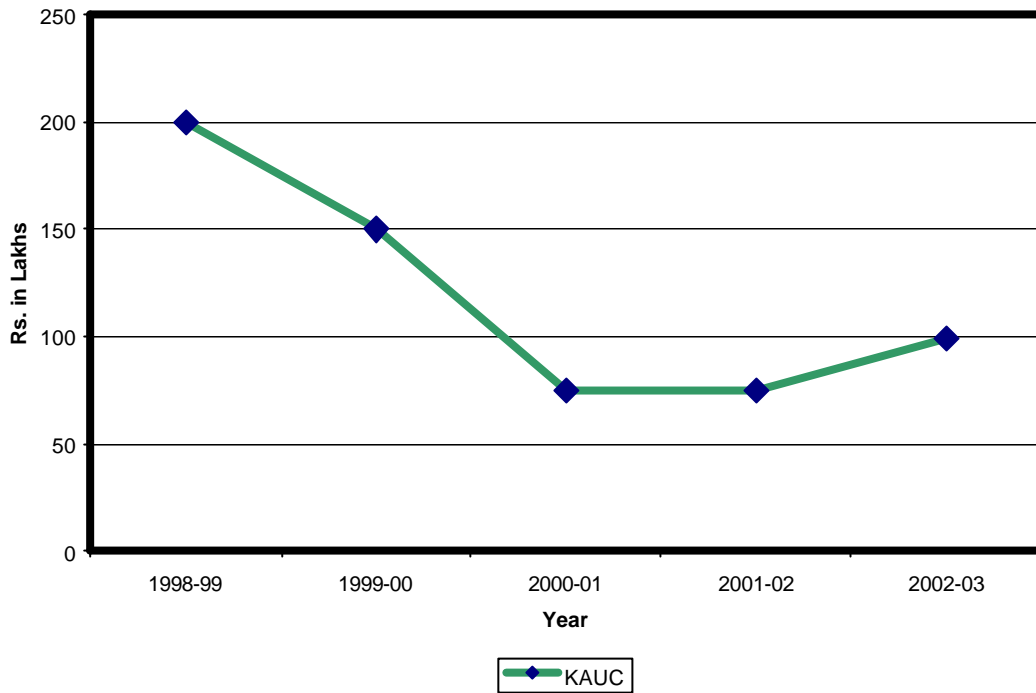
4.5. Finance

For the proper functioning of the library system, finance is as important and necessary as water for production of bumper crops. Already a significant amount from public funds has been used to build up the library and information infrastructure that exist in the agricultural sector. The data on the expenditure already put in at the agricultural university campuses extracted from a concerned report is presented in Table 4.4. When such huge amount from public fund has been utilized it should also be seen that they continue to be maintained properly as well as provide expected returns as services and products. Libraries should be assured with regular and adequate finance to procure books, periodicals, digital and online information, maintain physical infrastructures and staff and also meet other expenses. Library being a growing organism, it requires continuous and proper allotment of funds for looking to its present and future needs and as adequate nurture for its development. ICAR and Agricultural University Library Commission (1967) recommend that library should have at least 6% of the total operating budget of an institution. Data on budget allotted to the libraries collected from the major institutions⁶⁻²⁷ covered by this study is given in Table 4.5

Graphical representation of Library Budget from 1998-1999 to 2002-2003 at KAU and other selected Libraries are presented in Figure 4. 7. The data presented in Table 4.5 and Figure 4.6 reveals that allocation for library development in most of the institutions is fluctuating from year to year. The increase in the institutions budget has also not resulted in a subsequent increase in the library budget. The projects undertaken by the institutions and subsequently the demands of the users as well as the cost of books and journals have increased during the period. But the allocation of fund has decreased in many instances, which reveals the fact that the resources for information services have gone down. Allocation to library has become a matter of discretion of the authorities

The budgets of the institutions for the year 2002-2003, the allotment for library development and the percentage of allotment are presented in Table 4.6.

Library Budget in KAU Libraries 1998-99 to 2002-2003



Library Budget at CPCRI, CDS, CIFT, CVA, CAE and KFRI

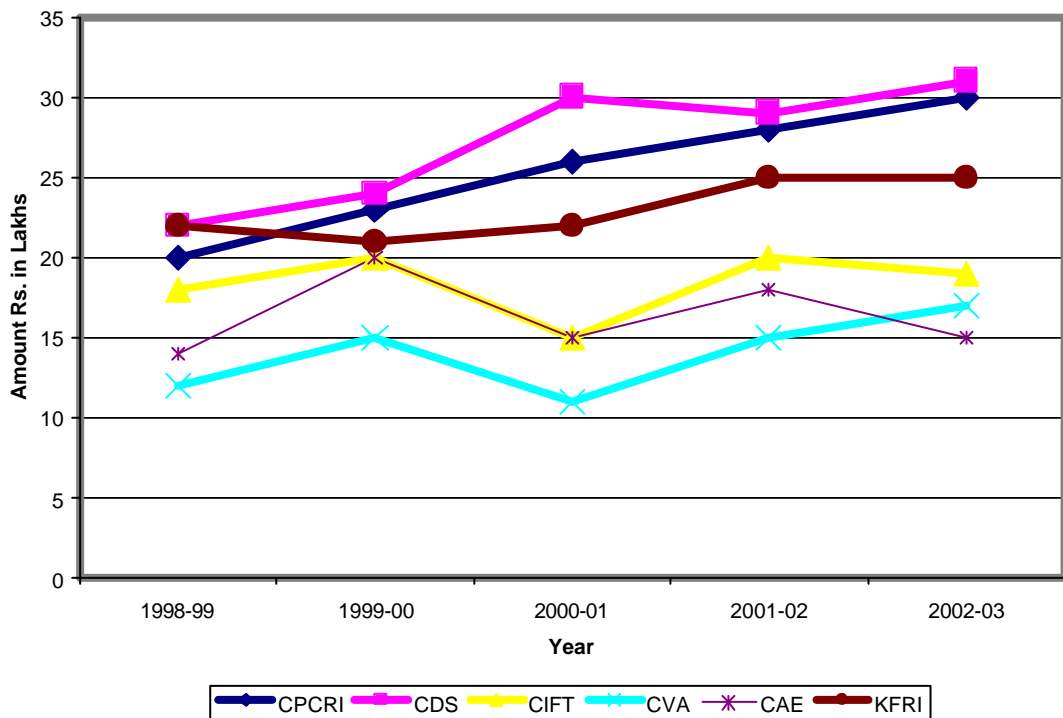


Figure 4.7: Library Budget in Selected Major Institutions 1998-99 to 2002 -03

Table 4.4: Total Present Value of Investments Made for Library and Information System of KAU (Approximate Estimated Amount in Lakhs of Rupees)

SN	Colleges/Stations/Other Information Centres	Building	Furniture/Equipments	Books/Jnls Docs	Total
01	Unit Headquarters, Vellanikkara, Thrissur	100.00	10.00	00.00	110.00
02	University Library (KAUC) Vellanikkara, Thrissur	400.00	145.00	95.00	640.00
03	College of Veterinary & Animal Sciences, Mannuthy, Thrissur	20.00	18.00	80.00	118.00
04	College of Agriculture, Vellayani, Thiruvananthapuram	27.00	28.00	55.00	110.00
05	College of Fisheries, Panangad, Cochin	15.00	08.00	27.00	50.00
06	Kelappji College of Agricultural Engineering, Thavanur,	13.00	12.00	40.00	65.00
07	College of Horticulture, Vellanikkara, Thrissur	15.00	12.00	70.00	97.00
08	College of Cooperation, Banking and Management Vellanikkara	07.00	06.00	15.00	28.00
09	College of Forestry, Vellanikkara, Thrissur	05.00	02.00	6.00	13.00
10	College of Agriculture, Pilicode, Kasaragod	15.00	15.00	6.00	36.00
11	RARSs (Four Nos.) at for Zones in the State	08.00	6.00	24.00	38.00
12	Other Stations/Information Units/Networks	24.00	260.00	30.00	314.00
	Total	649.00	522.00	448.00	1619.00

Source: Report of the Expert Committee on Staff Pattern for Kerala Agricultural University Library and Information System, 1999. Published by KAU.

Table 4.5: Library Budget During 1998-99 to 2002-03

Institute	1998-99	1999-00	2000-01	2001-02	2002-03	---Institute	1998-99	1999-00	2000-01	2001-02	2002-03
COAT	13	23	20	25	23	KSLU	02	02	02	02	04
DAG	02	02	02	02	06	CDS	22	24	30	29	34
RGCB	15	17	22	24	31	CCBM	08	08	09	09	13
FIB	10	10	12	15	11	SPB	04	04	04	05	08
CWRD	09	08	07	08	14	DES	02	02	02	02	05
IISR	15	18	18	20	25	CFISH	14	15	13	14	18
CPCRI	20	23	26	28	36	CIFT	18	20	15	20	27
TBGRI	05	04	05	04	12	CMFRI	12	14	10	12	16
KAUC	200	150	75	75	101	PCOC	02	02	02	02	04
COH	12	07	08	10	11	CVA	12	15	11	15	19
CTCRI	16	22	18	09	15	CVAP	01	03	03	03	06
KFRI	22	21	22	25	35	CDIA	00	01	02	02	03
COF	03	05	05	02	10	DAN	02	02	02	02	04
DFW	12	13	13	17	20	CAE	04	20	15	18	20
CESS	03	03	04	05	08	CAGI	00	00	02	03	04

Amount in lakhs of rupees.

Table 4.6: Budget of Institutions and Allotment for Library Development During 2002-03

Institution	Total	Library	%	Collection	%	Staff	%	Other Ex	%
COAT	540.00	23.00	4.26	10.30	44.78	8.00	34.78	4.70	20.43
DAG	4000.00	6.50	0.16	4.01	61.69	1.00	15.38	1.49	22.92
RGCB	650.00	31.00	4.77	23.85	76.94	3.00	9.68	4.15	13.39
FIB	280.00	11.00	3.93	5.10	46.36	3.00	27.27	2.90	26.36
CWRD	325.00	14.00	4.31	9.50	67.86	3.00	21.43	1.50	10.71
IISR	490.00	25.00	5.10	20.40	81.60	4.00	16.00	0.60	2.40
CPCRI	620.00	43.00	6.94	36.20	100.56	6.00	16.67	0.80	1.86
TBGRI	325.00	12.00	3.69	8.30	69.17	2.00	16.67	1.70	14.17
KAUC	3500.00	101.00	2.89	90.25	91.34	8.50	13.86	2.25	2.23
COH	375.00	11.00	2.93	7.47	67.91	2.00	18.18	1.53	13.91
CTCRI	375.00	15.00	4.00	11.75	78.33	3.00	20.00	0.25	1.67
KFRI	605.00	35.00	5.79	23.52	67.20	10.00	28.57	1.48	4.23
COF	310.00	10.00	3.23	8.12	81.20	1.00	10.00	0.88	8.80
DFW	2500.00	20.00	0.80	10.35	51.75	3.00	15.00	6.65	33.25
CESS	300.00	8.00	2.67	4.05	50.63	3.00	37.50	0.95	11.88
KSLU	200.00	4.00	2.00	2.25	56.25	1.00	25.00	0.75	18.75
CDS	585.00	34.00	5.81	21.77	64.03	9.00	26.47	3.23	9.50
CCBM	295.00	13.00	4.41	7.01	53.92	3.00	23.08	2.99	23.00
SPB	250.00	8.00	3.20	5.05	63.13	2.00	25.00	0.95	11.88
DES	175.00	5.00	2.86	3.11	62.20	1.00	20.00	0.89	17.80
CFISH	385.00	18.00	4.68	12.90	71.67	4.00	22.22	1.10	6.11
CIFT	565.00	27.00	4.78	20.30	75.19	4.00	14.81	2.70	10.00
CMFRI	325.00	16.00	4.92	11.35	70.94	3.00	18.75	1.65	10.31
PCOC	105.00	4.00	3.81	2.10	52.50	1.00	25.00	0.90	22.50
CVA	400.00	19.00	4.75	13.00	68.42	4.00	21.05	2.00	10.53
CVAP	300.00	6.00	2.00	4.00	66.67	1.00	16.67	1.00	16.67
CDIA	275.00	3.00	1.09	2.00	66.67	0.00	0.00	1.00	33.33
DAN	1000.00	4.00	0.40	2.00	50.00	1.00	0.00	1.00	25.00
CAE	425.00	20.00	4.71	12.50	62.50	4.00	20.00	3.50	17.50
CAGI	6.00	4.00	66.67	3.11	77.75	0.00	0.00	0.89	22.25
Total	20486.00	550.50	2.69	395.62	71.87	98.50	17.89	56.38	10.24

Of the total allotment to the libraries an average of 71.87% goes to collection development, 17.89% goes to staff and 10% for other expenses. The available data reveals that; the allotment to the libraries in most of the departments and institutions in agriculture sector is insufficient. The case of institutions under KAU and ICAR is an exception. The percentage of the amount allotted to the libraries is lower than the percentage recommended by Agricultural University Library Commission (1967), which is 6% of the institutions budget. Even though KAU spends the largest amount for library development which comes to approximately one crore it is also less than 3% of the total allotment for the university. CPCRI spends 6.91 and CDS spend 5.81 %, which are near the optimum amount. KFRI and IISR have used 5.79% and 5.10 % respectively during the year. The allotment to other ICAR institutes varies between 3 to 6.91 %. When the available data for the total budget of the institutions in agricultural sector is taken the library budget comes to 2.69% which will be less than that if we add the budget of Government's Departments of Agriculture, Dairy Science, Veterinary Science, Fisheries etc in full to the total budget amount. Institutions under minor group use only less than 1% for the library development.

4.5.1. Media and Type and Item-wise Distribution of Budget

The spread of the amount for collection development among various types of materials like books, journals, maps, etc and among different media like printed books, digital documents, and microforms during the year 2002-2003 is presented in Table 4.7. From the allotment for Library Rs. 395.62 lakhs (71.87%) is spent for collection development. The percentage of the amount meant for collection development spread through different types of materials and different media have wide variation among the institutions. At KAUC 27.70 % of amount for collection development is used for books, 38.78% for journals and 35.46 % for electronic documents, which may consist of books, journals and databases in CDROM and other computer readable media. At KFRI 29.76 % of allotment for collection development is used for books, 59.52 % for journals and 10.63 % for electronic documents. At Department of Agriculture (DAG) no amount is used for journals or electronic documents. Only two libraries, KAUC and CPCRI have spent any significant amount

Table 4.7: Spread of Amount for Collection Development Among Various Media, 2002-03

Institution	Lib	Collectn	%	Books	%	Journl	%	EleD	%	AV	%
COAT	23.00	10.30	44.78	4.00	38.83	6.00	58.25	0.25	2.43	0.05	0.49
DAG	6.50	4.01	61.69	2.00	49.88	2.00	49.88	0.00	0.00	0.01	0.25
RGCB	31.00	23.85	76.94	6.00	25.16	17.00	71.28	0.35	1.47	0.50	2.10
FIB	11.00	5.10	46.36	2.00	39.22	3.00	58.82	0.00	0.00	0.10	1.96
CWRD	14.00	9.50	67.86	2.00	21.05	7.00	73.68	0.00	0.00	0.50	5.26
IISR	25.00	20.40	81.60	4.00	19.61	15.00	73.53	1.25	6.13	0.15	0.74
CPCRI	43.00	36.20	84.19	11.00	30.39	17.00	46.96	8.00	22.10	0.20	0.55
TBGRI	12.00	8.30	69.17	3.00	36.14	5.00	60.24	0.10	1.20	0.20	2.41
KAUC	101.00	90.25	89.36	25.00	27.70	35.00	38.78	32.00	35.46	0.25	0.28
COH	11.00	7.47	67.91	3.00	40.16	4.00	53.55	0.45	6.02	0.02	0.27
CTCRI	15.00	11.75	78.33	4.00	34.04	6.00	51.06	1.50	12.77	0.25	2.13
KFRI	35.00	23.52	67.20	7.00	29.76	14.00	59.52	2.50	10.63	0.02	0.09
COF	10.00	8.12	81.20	4.00	49.26	4.00	49.26	0.10	1.23	0.02	0.25
DFW	20.00	10.35	51.75	7.00	67.63	3.00	28.99	0.25	2.42	0.10	0.97
CESS	8.00	4.05	50.63	2.00	49.38	2.00	49.38	0.00	0.00	0.05	1.23
KSLU	4.00	2.25	56.25	1.00	44.44	1.00	44.44	0.05	2.22	0.20	8.89
CDS	34.00	21.77	64.03	6.00	27.56	14.00	64.31	1.75	8.04	0.02	0.09
CCBM	13.00	7.01	53.92	4.00	57.06	3.00	42.80	0.00	0.00	0.01	0.14
SPB	8.00	5.05	63.13	3.00	59.41	2.00	39.60	0.03	0.59	0.02	0.40
DES	5.00	3.11	62.20	2.00	64.31	1.00	32.15	0.01	0.32	0.10	3.22
CFISH	18.00	12.90	71.67	5.00	38.76	7.00	54.26	0.75	5.81	0.15	1.16
CIFT	27.00	20.30	75.19	8.00	39.41	11.00	54.19	1.25	6.16	0.05	0.25
CMFRI	16.00	11.35	70.94	4.00	35.24	7.00	61.67	0.25	2.20	0.10	0.88
PCOC	4.00	2.10	52.50	1.00	47.62	1.00	47.62	0.05	2.38	0.05	2.38
CVA	19.00	13.00	68.42	5.00	38.46	8.00	61.54	0.00	0.00	0.00	0.00
CVAP	6.00	4.00	66.67	2.00	50.00	2.00	50.00	0.00	0.00	0.00	0.00
CDIA	3.00	2.00	66.67	1.00	50.00	1.00	50.00	0.00	0.00	0.00	0.00
DAN	4.00	2.00	50.00	1.00	50.00	1.00	50.00	0.00	0.00	0.00	0.00
CAE	20.00	12.50	62.50	5.00	40.00	7.00	56.00	0.50	4.00	0.00	0.00
CAGI	4.00	3.11	77.75	1.00	32.15	2.00	64.31	0.10	3.22	0.01	0.32
Total	550.50	395.62	71.87	135.00	34.12	208.00	52.58	51.49	13.02	3.13	0.79

Table 4.8: Staff Strength and Qualifications

Institution	Total	Professionals	Others	MLISc	BLISc	Agri Sc	CLISc
COAT	06	05	01	03	02	00	00
DAG	01	00	01	00	00	00	01
RGCB	01	01	01	01	00	00	00
FIB	01	00	00	00	00	01	00
CWRD	03	02	02	02	00	00	00
IISR	03	02	01	02	00	00	00
CPCRI	04	02	02	02	00	00	00
TBGRI	04	01	03	01	00	00	00
KAUC	16	07	09	03	04	00	00
COH	02	01	01	01	00	00	00
CTCRI	02	01	01	01	00	00	00
KFRI	06	04	02	03	01	00	00
COF	02	01	01	00	00	00	00
DFW	04	03	01	02	01	00	00
CESS	03	01	02	01	00	00	00
KSLU	01	01	00	00	00	00	00
CDS	17	14	03	07	06	00	00
CCBM	02	01	01	01	00	00	00
SPB	03	01	02	01	00	00	00
DES	01	01	00	00	01	00	00
CFISH	04	03	01	02	01	00	00
CIFT	05	03	02	02	01	00	00
CMFRI	03	02	01	01	01	00	00
PCOC	01	00	01	00	00	00	00
CVA	05	03	02	01	02	00	00
CVAP	01	00	01	00	00	00	00
CDIA	01	00	01	00	00	01	00
DAN	01	00	00	00	00	00	00
CAE	03	02	01	01	01	00	00
CAGI	01	01	00	01	00	00	00
Total	106	62	44	38	21	02	01

Table 4.9: Distribution of Staff As per Qualification.

Institution	Total	PhD	MLISc	BLISc	MSc Agr	Other
ICAR Institutes	21	00	08	02	00	11
KAU Institutions	36	00	12	10	00	14
Kerala Gov Instns	11	00	02	02	02	05
Other Institutions	52	00	17	07	00	29
	121	00	39	21	02	59

for electronic documents. Among them KAUC spend approximately Rs 32 lakhs and CPCRI Rs 8 lakhs for electronic documents which also covers subscriptions to online databases and journals.

All the institutions together utilize 34.12 % for printed books from the allotment for collection development, 52.58 % for journals and 13.2 % for electronic documents. In total 0.79 % percent of the amount for collection development only is used for audiovisual documents, maps, posters, etc in agricultural libraries. In most of the libraries journals take the major share of expenditure for collection development.

4.6. Staff

Present staff strength of the selected agricultural libraries is shown in Table 4.8. The available data reveals that KAU libraries are strong in quality and quantity of staff²⁸. Most of the other libraries are having only one staff for looking after the libraries and in many such institutions the staff is unqualified. Presently no standards or norms for provision of library staff exist in most of the organizations with KAU and ICAR institute as exceptions. But in KAU also a few big libraries and all research stations libraries are lacking professional staff. The post of University Librarian who is to give leadership was vacant from 1971- 1995. Again from 2000 it is vacant.

4.6.1. Qualifications

The survey revealed that of the total 106 professional staff in the 30 major libraries in agricultural sector 21 has BLISc and 38 have MLISc. Of the 30 major libraries covered by the survey 5 are totally managed by non-professional staff. The Table 4.8 shows that out of a total of 121 staff in the selected 30 libraries 62 (58.49%) are professionals and of this 39 hold MLISc degree, 21 hold BLISc degree and 2 MSc in Agriculture and the remaining 59 have no qualification in Library Science. Classification of library staff of ICAR, KAU and other institutions as per their qualifications is given in Table- 4.9. The Designation and Scale of pay of the library Staff in the selected institutions are given in Table 4.10.

Table 4.10: Designation and Scale of Pay of Librarians of Major Institutions

Institution	Designation	Scale of Pay
COAT	Assistant Librarian	10000-15500
DAG	Clerical Asst	NA
RGCB	Asst Lib & Information Officer	6675-10550
FIB	Assistant Campaign Officer	6675-10550
CWRD	Library Officer	12000-16000
IISR	Technical Officer (Library)	8000-13500
CPCRI	Librarian Cum Doc Officer	8000-10500
TBGRI	Librarian	6675-10550
KAUC	Librarian	16400-22500
COH	Assistant Librarian	8000-13500
CTCRI	Librarian	10000-10500
KFRI	Librarian	10000-15500
COF	Library Assistant	NA
DFW	Librarian Grade II	5500-9075
CESS	Librarian	12000-16500
KSLU	Assistant	NA
CDS	Librarian	10000-15500
CCBM	Assistant Librarian	8000-10500
SPB	Sr Gr Librarian	7800-12975
DES	Librarian Gr IV	NA
CFISH	Assistant Librarian	10000-15500
CIFT	Technical Officer (Library)	8000-13500
CMFRI	Librarian	10000-10500
PCOC	Technical Assistant	NA
CVA	Assistant Librarian	10000-10500
CVAP	Associate Professor i/c	10000-10500
CDIA	Associate Professor i/c	10000-10500
DAN	Assistant	NA
CAE	Assistant Librarian	8000-10500
CAGI	Head LIS	Honorary

Data presented in Table 4.10 shows that different institutions follow different patterns. The librarian of Kerala Agricultural University is in the status of a Professor with equivalent scale of pay. The librarians in colleges under KAU are equated to the status of Assistant Professors with equivalent scale of pay. The librarians in ICAR Institutes are in grades of Technical Officers of Central Government with scale of pay equivalent to 8000-13500, 10000-10500 etc applicable to scientists also. In departments under government the professional librarians are not equated to scientists or academic staff. In most of the institutions unqualified staff from lower categories in service is posted to look after the libraries.

4.6.2. User's Evaluation of Library Staff

Data on users' ratings of the staff of the libraries is presented in Table 4.11. Of the 427 users 26% rated staff as excellent, 24% as good, 26% percent as average and 18% as poor.

Table 4.11: Rating of the Quality of Staff by the Users

Journal Col	Excel %	Good %	Aver %	Poor %	Total No	R	Re %
Attitude	27 6.32	116 27.17	125 29.27	94 22.00	362	65	15.22
Knowledge	11 2.58	127 29.74	140 32.79	73 17.10	351	76	17.80
Discipline	65 15.20	140 32.79	45 10.54	37 8.67	287	140	32.79
Knowl of User's Subj	9 2.11	57 13.35	95 22.25	110 25.80	271	156	36.53
Communication Skill	19 4.45	70 16.39	140 32.79	64 15.00	293	134	31.38
Total Average	26.2 6.14	102 23.89	109 25.53	75.6 17.70	427		

4.7. Collection

In any information system the most important resource or input for services is collection. It is the relevant recorded knowledge in the form of books, journals, reports, microfiche, cassettes, floppy discs, CDROMS, video films etc. They form the basic resource for providing services in an information system. In agricultural

libraries the collections contain a wide variety of materials like, books, video films, CDROMs, posters, theses maps etc. The collections are assessed in terms of quality and quantity. There is an explosive growth of information in agricultural sector also which results in flooding of documents. The information needs of the users have also become more and more complex. The financial resources available for the libraries are limited and its growth is not parallel to the growth of number of documents or their cost. So libraries have to resort to cost effective policies in regard to selection of information as well as selection of the media in which information is to be acquired.

The major part of the collections in agricultural libraries is added year after year through purchase. The libraries also receive books and journals as gift or through exchange from various organizations. For purchase the selection is made from various sources. The faculty, the scientists, the extension activist and researchers suggest books to be acquired. The librarians also select items to be acquired from various sources like current catalogues, book reviews, etc. The list of the items selected from such sources is placed before the LAC and the titles approved are acquired. This is the method followed by most of the libraries in agricultural sector.

The resources available at the major Institutions covered by the study are presented in Table 4.12. Scientists, who include extension workers and teachers, are also to be considered as information resource in agricultural sector. They act as a major source of information to administrators, planners and farmers. Hence their strength is also listed as resources.

Size of the collection of agricultural information recorded in various media vary in quantity from less than a 100 to above 20 000 books in the agricultural libraries of Kerala. The General Data of the Resources available at the 30 major institutions presented in Table 4.12 reveals that there are 3956 agricultural scientists, 174863 books on different areas of agriculture and 1545 journals, which may include many duplicates also. There are also 1433 electronic documents, 16 online journals access facilities, 649 video films and a total of 7636 theses, reports, maps and microform documents. These together cover all the areas of agricultural sciences.

Table 4.12: Resources in Major Agricultural Institutions

Institution	Scientists	Books	Journals	Online Subsn	Electro Docs	Audio VR	Theses /Rp/Mp/	
COAT	170	22645	64	00	00	30	00	1400
DAG	1028	4256	17	00	00	00	00	45
RGCB	73	1080	35	00	00	05	00	27
FIB	31	1065	15	00	00	00	05	40
CWRD	39	1622	54	00	00	00	00	58
IISR	45	3575	91	00	00	27	02	40
CPCRI	80	6385	63	00	00	300	15	150
TBGRI	150	2300	27	05	05	07	00	25
KAUC		13381	320	04	04	520	600	1200
COH	140	13004	29	00	00	00	00	1400
CTCRI	60	7210	110	00	00	70	00	75
KFRI	55	12175	76	02	02	30	00	200
COF	24	5502	19	00	00	05	02	40
DFW	500	12000	27	00	00	50	05	230
CESS	56	1125	30	00	00	00	00	20
KSLU	14	615	21	00	00	00	00	1500
CDS	28	14230	38	02	02	120	00	570
CCBM	15	7760	54	00	00	04	00	21
SPB	27	3808	23	00	00	100	00	58
DES	28	1213	9	00	00	00	00	60
CFISH	40	4014	31	00	00	28	00	39
CIFT	42	4127	70	01	01	30	00	65
CMFRI	27	2899	55	00	00	20	00	00
PCOC	20	2733	35	00	00	15	07	140
CVA	160	15848	97	00	00	00	00	45
CVAP	14	1870	15	00	00	00	00	00
CDIA	17	2227	27	00	00	00	00	00
DAN	1028	406	26	00	00	00	00	34
CAE	42	5113	60	00	00	47	00	128
CAGI	03	675	07	02	02	25	13	26
Total	3956	174863	1545	16	16	1433	649	7636

Table 4.13: Resources at Minor Agricultural Institutions

Institution	Scient	Electro	Books	Journal	Instn	Scient	Electro	Books	Journals
DAS	20	0	535	42	SUGAT	2	0	107	4
CSRC	2	0	765	3	PIGP	1	0	97	2
SUGA	2	0	395	4	POUL	4	0	97	5
RRSP	7	3	1872	21	PATH	4	0	188	7
PEPE	4	0	130	5	VHM	2	0	34	3
AMPR	6	0	1750	26	LRST	4	0	116	12
CRSB	3	0	764	7	CBFT	2	0	59	4
PINE	2	0	79	11	CIRK	1	0	42	4
NARPS	4	0	0	0	VHK	2	0	25	5
IFCV	3	0	66	2	LFFR	2	0	47	5
FSRS	4	0	221	14	MEAT	4	0	126	11
SCRS	2	0	143	5	DAN	1028	0	150	7
CRSA	3	0	153	9	OILP	2	0	148	4
ARSM	2	0	94	4	AICD	2	0	53	11
ARSC	2	0	178	7	AICS	4	0	223	6
CSRW	NA	0	112	NA	AICT	4	0	116	3
BANA	2	0	194	8	AICW	2	0	56	14
IFCH	NA	0	101	NA	AICM	4	0	190	0
RRSA	3	0	152	15	AICB	2	0	90	11
CARD	4	0	178	12	AICP	2	0	113	5
RRSK	7	0	412	28	RUBB	NA	0	943	NA
RICE	2	0	177	4	SPIB	NA	0	521	NA
RRSO	4	0	219	25	SNRF	3	0	359	17
RICEV	2	0	128	6		1171	3	12718	398

The resources available at minor institutions in agricultural sector surveyed are presented in Table 4.13. There are 1171 scientists, 12718 books and 398 journals in these institutions. The financial resources available at the disposal of such institutions being very limited they have acquired only very few documents after serious selection. These are related to the crop/commodity or agro climatic region in which the institute specializes and hence their collections are very important for agricultural research. The books on agriculture available at various institutions are presented in Figure 4.8. The graphical representation shows that COAT has the biggest collection of agricultural related books. The graph also reveals that total collection at the control of the minor group of institutions is also significant. Their collections in total come to fourth position as per the data available.

4.7.1. Subject Representation in Collections

Data related to the representation of major subjects under agriculture and related areas in the collections of major and minor groups of institutions in agricultural sector and also randomly selected institutions outside the agricultural stream are presented in Tables 14, 15 and 16. Data related to specific agricultural subjects represented in the book collections of the 30 major institutions surveyed are presented in Table 4.14. The survey revealed that, of the books available in 30 agricultural institutions 24.36% is general agricultural books. Books on Horticulture comes to 11.51%, Books on spices 0.56 %, Tuber crops 2.92%, Plantation crops 3.27 %, Plant Breeding 1.30 %, Fertilizers 0.91 %, Forestry 14.83%, Food Sciences 2.92%, Irrigation 1.14%, veterinary and animal sciences 8.91%, Dairy sciences 2.58%, Fisheries 7.54%, Biotechnology 1.47%, Management 4.2%, Agricultural Engineering 1.44%, Agricultural Economics 6.89% and other related subjects 3.08%.

Data related to subject representation in minor institutions in agricultural sector is presented in Table 4.15. The data reveals that when considered in the light of documents on commodity/crop/ region specific topics their collection is important due to the specialization as well as the nearness of the libraries to areas where the information is to be applied.

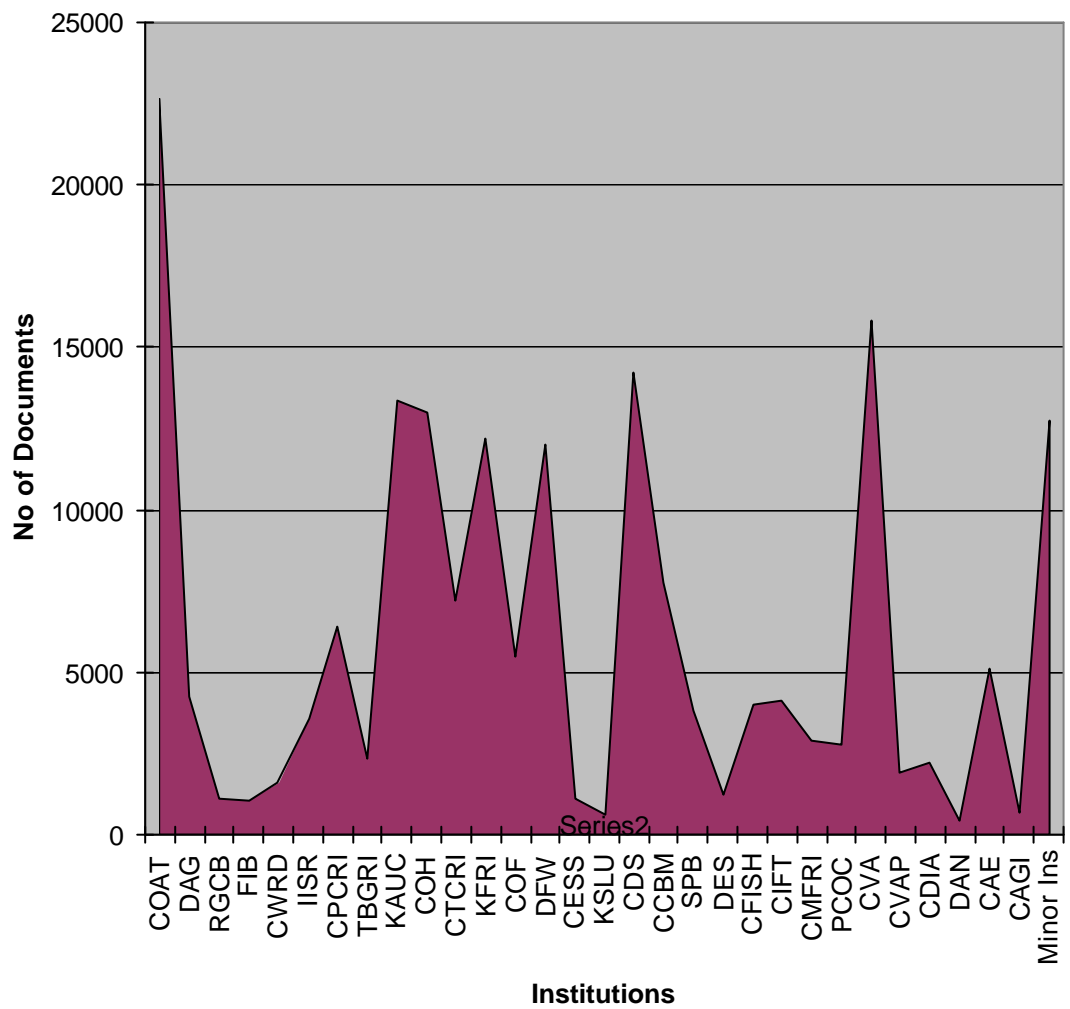


Figure 4.8: Strength of Agricultural Books in Selected Institutions

Table 4.14: Detailed Subject Representation in Major Institutions

Institution	AG	HC	SP	TC	PC	PB	FZ	FO	FS	IR	VA	DS	FA	BT	MG	AT	AE	Or	Total
COAT	10500	7250	50	375	450	275	225	250	1025	380	400	140	25	130	290	110	450	320	22645
DAG	3000	550	30	125	150	40	50	10	75	05	10	05	05	25	35	20	50	71	4256
RGCB	25	15	10	10	15	50	05	05	00	00	00	00	25	850	5	15	25	25	1080
FIB	475	50	25	50	100	25	25	15	25	50	75	25	00	05	20	15	35	50	1065
CWRD	900	50	10	15	25	10	15	05	05	250	10	10	05	10	25	225	25	27	1622
IISR	1260	650	180	120	400	75	50	75	50	25	00	00	00	175	125	25	325	40	3575
CPCRI	2000	500	50	225	2500	200	100	25	25	75	25	25	25	200	25	50	250	85	6385
TBGRI	500	600	50	25	75	125	25	200	75	25	00	00	00	350	25	25	25	175	2300
KAUC	5700	4000	40	200	240	75	120	500	372	40	125	40	32	37	270	40	350	1200	13381
COH	6000	4500	45	275	315	160	112	57	720	115	35	20	15	45	150	45	170	225	13004
CTCRI	1250	1025	75	3250	275	300	150	50	225	75	50	25	10	125	40	50	125	110	7210
KFRI	150	50	50	50	75	175	50	10250	50	75	50	25	50	325	175	50	275	250	12175
COF	141	37	24	17	35	61	14	4700	47	34	45	07	18	43	55	15	31	178	5502
DFW	1500	125	75	100	175	500	75	8500	225	25	50	50	50	25	125	25	150	225	12000
CESS	25	10	10	05	15	05	15	150	10	25	05	05	05	10	75	25	30	700	1125
KSLU	200	15	10	05	25	05	15	15	00	50	00	00	00	00	25	25	15	210	615
CDS	5000	150	50	75	200	0	300	500	1200	450	25	30	500	75	1750	250	3500	175	14230
CCBM	575	25	25	75	35	15	25	25	50	00	25	25	25	0	3750	0	3000	85	7760
SPB	1250	150	50	50	100	00	150	300	50	40	25	20	40	50	250	5	1250	28	3808
DES	75	05	11	14	35	04	17	28	04	05	07	04	03	01	27	3	850	120	1213
CFISH	125	15	02	03	05	02	01	10	121	05	07	04	3492	27	40	15	57	83	4014
CIFT	50	05	07	02	04	02	05	07	74	07	05	02	3751	00	27	25	79	75	4127
CMFRI	20	02	05	01	02	00	07	05	45	03	02	01	2786	00	00	00	00	20	2899
PCOC	30	11	07	02	08	03	11	27	64	05	14	03	2300	05	35	23	40	145	2733
CVA	325	04	02	03	02	03	02	125	450	4	12000	2500	03	25	25	25	100	250	15848
CVAP	25	01	01	01	02	01	01	34	40	01	1241	325	02	07	04	02	62	120	1870
CDIA	17	02	01	03	01	02	01	07	12	00	970	1140	02	04	02	01	21	41	2227
DAN	04	01	01	02	01	01	01	03	05	02	325	40	01	01	01	01	05	11	406
CAE	1240	320	70	30	450	167	27	50	64	220	70	50	25	21	94	1120	750	345	5113
CAGI	250	10	15	10	10	05	05	15	05	05	00	00	00	05	25	300	05	10	675
Total	42612	20128	981	5118	5725	2286	1599	25943	5113	1996	15596	4521	13195	2576	7495	2530	12050	5399	174863
%	24.37	11.51	0.56	2.93	3.27	1.31	0.91	14.84	2.92	1.14	8.92	2.59	7.55	1.47	4.29	1.45	6.89	3.09	100

AG: General Agriculture, BT: HC: Horticulture, SP: Spices, TC: Tuber Crops, PC: Plantation Crops, PB: Plant Breeding, FZ: Fertilizers, FO: Forestry, FS: Food Science, IR: Irrigation, VA: Veterinary and Animal Science, DS: Dairy Science, FA: Fisheries and Aquatic Sciences, BT: Biotechnology, MG: Management, AT: Agricultural Engineering, AE: Agricultural Economics, O; Other

Table 4.15: Detailed Subject Representation in Minor Institutions

Institution	AG	HC	SP	TC	PC	PB	FZ	FO	FS	IR	VA	DS	FA	BTMG	AT	AE	O	Total	
DAS	175	125	25	00	75	25	25	00	15	10	00	00	00	10	15	25	10	535	
CSRC	450	65	00	00	00	10	100	00	00	00	00	00	00	25	50	25	25	15	765
SUGA	150	50	05	15	05	25	25	05	25	15	00	00	00	15	10	05	25	20	395
RRSP	825	140	10	150	250	75	25	10	40	25	50	25	0	25	50	25	125	22	1872
PEPE	30	05	50	00	10	15	05	10	00	00	00	00	00	00	00	00	00	05	130
AMPR	800	325	25	50	100	50	50	75	50	25	00	00	00	25	25	10	15	125	1750
CRSB	250	50	25	25	200	25	25	05	20	50	00	00	00	25	10	15	25	14	764
PINE	15	50	00	00	00	00	05	00	00	05	00	00	00	00	00	00	00	04	79
NARPS	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
IFCV	07	11	02	06	08	07	03	00	00	04	00	00	00	02	00	04	00	12	66
FSRS	78	21	07	14	05	09	08	01	11	06	02	01	00	04	05	02	12	35	221
SCRS	37	14	03	06	08	03	05	02	00	09	00	00	00	01	02	02	04	47	143
CRSA	27	17	03	02	21	09	07	02	08	06	00	00	00	08	05	03	11	24	153
ARSM	19	05	02	07	03	08	09	01	02	05	00	00	00	05	02	03	06	17	94
ARSC	61	12	03	11	12	06	07	02	04	07	00	00	00	11	04	04	06	28	178
CSRW	19	27	03	06	05	07	04	02	01	04	00	00	00	06	09	02	05	12	112
BANA	28	37	05	07	14	05	04	09	07	05	00	00	00	12	05	02	08	46	194
IFCH	07	21	05	09	11	14	03	00	00	08	00	00	00	02	00	04	00	17	101
RRSA	31	09	03	08	01	09	02	03	05	04	00	00	00	07	11	03	14	42	152
CARD	24	15	19	07	12	08	05	19	14	04	00	00	00	07	09	02	05	28	178
RRSK	129	41	08	09	12	14	13	04	21	12	00	00	14	11	15	05	24	80	412
RICE	35	22	03	04	03	09	11	02	15	09	00	00	11	05	07	02	14	25	177
RRSO	39	21	05	11	14	16	08	05	15	09	00	00	00	15	08	03	12	38	219
RICEV	23	12	03	05	04	12	09	02	05	09	00	00	00	06	05	02	07	24	128
SUGAT	25	17	02	02	03	05	04	01	03	02	00	00	00	08	05	09	02	19	107
PIGP	11	00	00	00	00	00	00	00	11	00	38	12	00	00	00	07	04	14	97
POUL	21	00	00	00	00	00	00	00	14	00	31	00	00	00	06	01	09	15	97
PATH	17	00	00	00	00	00	00	00	02	00	28	09	03	04	07	92	09	17	188
VHM	12	00	00	00	00	00	00	00	00	00	07	05	00	00	00	00	01	09	34
LRST	27	00	00	00	00	00	00	00	12	00	28	14	02	05	04	01	08	15	116
CBFT	09	00	00	00	00	00	00	00	03	00	13	07	03	05	02	01	04	12	59
CIRK	05	00	00	00	00	00	00	00	00	00	14	05	00	02	01	03	05	07	42
VHK	04	00	00	00	00	00	00	00	00	00	09	03	00	02	01	01	02	03	25
LFFR	07	02	00	00	00	00	00	00	02	00	09	08	00	01	02	04	06	06	47
MEAT	09	00	00	00	00	00	00	00	28	00	35	11	00	02	14	02	11	14	126
DAN	18	00	00	00	00	00	00	00	12	00	41	15	00	01	03	01	48	11	150
OILP	21	15	01	14	03	11	04	09	17	08	00	00	00	09	12	02	07	15	148
AICD	14	01	00	00	00	00	02	01	00	14	00	00	00	00	03	07	05	06	53
AICS	61	15	26	04	11	09	12	19	21	06	00	00	00	05	04	01	07	22	223
AICT	09	06	02	27	05	09	08	05	04	07	00	00	00	05	04	02	09	14	116
AICW	14	04	01	03	02	00	05	03	00	04	00	00	00	00	02	03	12	03	56

Institution	AG	HC	SP	TC	PC	PB	FZ	FO	FS	IR	VA	DS	FA	BT	MG	AT	AE	O	Total
AICM	41	27	11	03	08	21	06	14	02	05	00	00	00	24	04	04	08	12	190
AICB	32	14	03	06	08	07	01	02	00	02	00	00	00	01	03	02	03	06	90
AICP	32	07	03	04	21	04	07	04	06	04	00	00	00	04	02	01	05	09	113
RUBB	430	20	02	03	221	08	12	21	08	08	00	00	00	14	24	04	27	141	943
SPIB	128	30	48	42	71	21	09	34	29	06	00	00	00	16	12	04	14	57	521
SNRF	78	41	20	21	28	17	04	41	18	04	04	01	07	21	07	02	09	36	359
Total	4284	1294	333	481	1154	473	432	313	450	301	309	116	40	356	369	277	583	1153	12718

Table 4.16: Detailed Subject Representation in Outstream Institutions

Instn	AG	HC	SP	TC	PC	PB	FZ	FO	FS	IR	VA	DS	FA	BT	MG	AT	AE	O	Total
KLS	2000	400	50	10	125	05	20	250	150	75	30	35	150	12	250	10	1200	720	5492
UKL	150	100	15	75	60	50	50	125	350	50	550	120	75	75	150	20	200	300	2515
UKB	150	50	25	50	25	75	25	100	00	00	00	00	00	50	00	10	15	30	605
UKZ	01	00	00	00	00	00	00	35	10	00	125	15	25	25	00	00	00	15	251
UKBC	25	00	00	00	00	00	25	00	25	00	200	25	25	50	00	00	1475	15	1865
KUC	30	17	02	04	04	09	01	13	27	02	05	01	03	11	41	02	23	27	222
KUE	07	00	01	00	05	00	02	04	03	00	02	03	04	00	15	00	24	15	85
UCB	125	50	10	45	30	140	15	35	05	10	00	00	00	40	00	00	05	11	521
UCE	02	00	02	00	05	00	03	07	05	00	00	00	01	00	24	00	31	15	95
CAU	275	50	10	75	100	05	15	75	500	05	275	05	05	10	25	00	00	21	1451
CET	25	05	00	00	00	00	05	00	25	500	00	00	05	10	75	25	20	125	820
CLT	300	25	05	05	15	00	45	50	40	08	02	02	13	08	42	00	75	120	755
SCTC	25	15	05	05	10	15	10	05	10	05	05	05	00	300	25	50	20	10	520
KSAH	325	125	10	40	50	05	25	90	45	15	50	10	25	10	50	05	10	50	940
SCL	1100	75	25	10	25	15	15	50	35	15	825	10	15	35	300	10	250	150	2960
ATSG	120	07	04	03	06	03	01	14	21	02	16	03	01	04	45	02	127	20	399
SCTG	275	15	05	05	10	05	05	25	50	05	25	05	05	05	50	05	250	50	795
GWE	12	00	01	00	04	00	01	03	04	00	01	02	05	00	17	00	31	12	93
GWH	02	00	07	01	00	00	00	00	1570	00	00	11	01	00	07	00	02	14	1615
GWB	09	03	04	05	11	21	02	09	01	04	00	00	00	30	00	00	00	15	114
GBE	20	02	03	01	11	00	04	02	07	00	00	01	02	00	21	00	35	15	124
GBB	17	21	04	08	14	17	02	15	02	03	00	00	00	21	02	00	00	25	151
VPTS	87	02	01	01	03	02	00	07	19	00	08	01	00	02	16	00	43	17	209
BMVS	41	00	00	00	02	00	00	04	10	00	05	00	00	01	07	00	14	10	94
TELL	85	04	02	01	03	02	00	07	11	00	05	02	00	01	34	00	04	15	176
Total	5208	966	191	344	518	369	271	925	2925	699	2129	256	360	700	1196	139	3854	1817	22867

AG: General Agriculture, BT: HC: Horticulture, SP: Spices, TC: Tuber Crops, PC: Plantation Crops, PB: Plant Breeding, FZ: Fertilizes, FO: Forestry, FS: Food Science, IR: Irrigation, VA: Veterinary and Animal Science, DS: Dairy Science, FA: Fisheries and Aquatic Sciences, BT: Biotechnology, MG: Management, AT: Agricultural Engineering, AE: Agricultural Economics, O; Other

Data of books in different subjects in agricultural sciences available at 25 randomly selected institutions outside agricultural sector is presented in Table 4.16. In most of the topics covered by the agricultural institutions, books are available in these outside institutions also. When compared with the 50 minor intuitions in agricultural sector the collection of these libraries outside the sector become very significant. Another important aspect noted is that in most of the institutions books on agriculture are available in regional language. Hence for providing information services to farmers these collections become equally important like those of specialized or other institutions in agricultural sector. There are thousands of such institutions in the State with information on agriculture. They hold considerable number of documents on agriculture and related areas mainly in regional language and are near the farms.

Horticulture, tuber crops, forestry, food science, veterinary and animal sciences, fisheries, management and agricultural economics are fairly represented in the collections of major institutions. According to the specialization of the concerned institute the one or more subjects get more coverage and the collection becomes a more reliable source of information for that subject. The data shows that in terms of strength in book collection the College of Agriculture is rich for general agriculture books, horticulture, and food science. College of Veterinary and Animal Sciences for veterinary and animal sciences and diary science, KFRI for forestry, CDS and CCBM for agricultural economics, CPCRI for plantation crops, CAE for agricultural engineering, and the like. Books on general agriculture dominate the total collection. Forestry, horticulture, veterinary and animal sciences, fisheries and agricultural economics have got good representation in the collections. Spices form the smallest group of documents in agricultural libraries.

The subject representation in collections is presented graphically in Figure 4.9. The graph reveals that books in general agriculture - the group in which crop protection, plant breeding, crop production, bio deterioration and bio degradation, horticulture and miscellaneous subjects related to agriculture are included forms the major group with 49% of the total books coming under it. Forestry, the group in which books on forest products agro forestry and soil sciences come forms the second

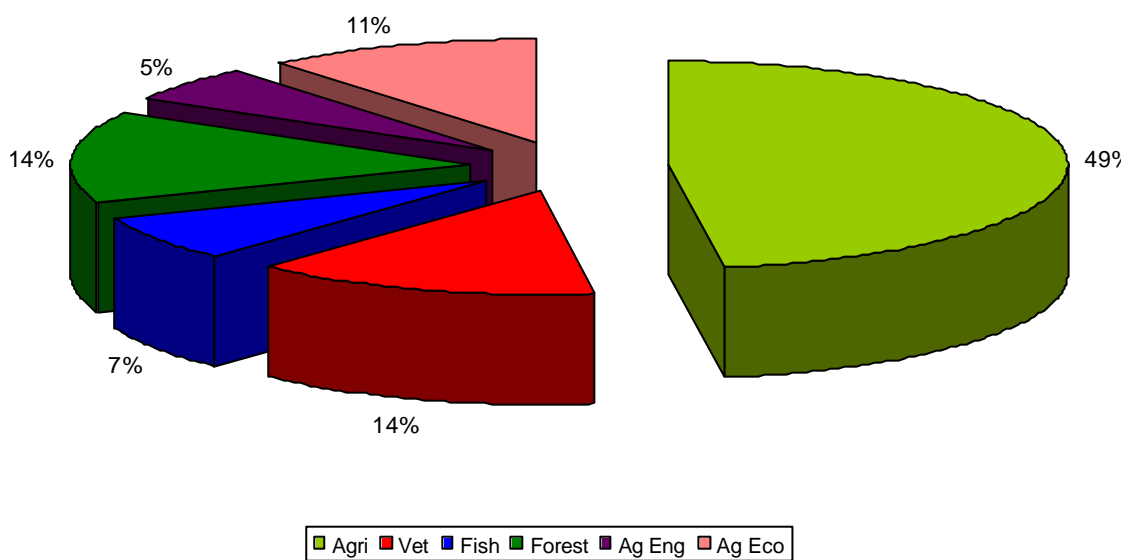


Figure 4.9: Representation of Sub fields of Agriculture in Major Book Collections

largest collection (14%) on strength of books. Veterinary and animal sciences, the group in which books on veterinary parasitology, dairy science, veterinary medicine, food science, human nutrition etc are included also ranks second along with 14% of the books of Agricultural economics the group in which books on management, natural resources, and agricultural and environmental economics are included comes to 11% of the total collection. Fisheries and related areas cover 7% of the whole collection. Agricultural engineering, the group in which fertilizer technology, irrigation technology, and biotechnology etc are included comes to 5% of the entire collection.

All the institutions outside the stream of agriculture are found to be rich in collection of Malayalam books on agriculture. Even as publisher of books intended for farmers State Institute of Languages, Kerala was second to none of the agricultural institutions in Kerala. The survey at 25 institutions outside the stream of agriculture proves their strength to provide agricultural information services to farmers. They are major expected user groups of agricultural information as well for whose benefit all these systems exist. Hence the document collections at these out of stream institutions are also very significant.

When quantity of collection is considered libraries under KAU and ICAR tops the list. The collections in most of the institutions under KAU and ICAR are found to be adequate to serve the user community of those organizations. But the collections in other institutions especially under Government Departments are highly inadequate. The libraries in Government Departments have to serve a user community ten times more in quantity than all other institutions. But it is having a collection of the size, which is not even equal to five percent of the collection, that KAU, and ICAR institutions are having.

4.7.2. Farmer Oriented Collections

KAUC is having a Farmer's Division with approximately 700 books on different crops and various aspects of agriculture, animal rearing etc as well as about

600 video films most of them highly relevant to educate the farmer. It has also a few interactive multimedia programmes intended for the farmers, excellent exhibition facilities, TV, VCP, Multimedia Computer and Video presentation facilities etc. But the documents, films etc require a little customizing by translating into regional language. The facility presently remains under utilized. CPCRI has also some resources on this line.

But the survey at selected Krishi Bhavans and libraries of institutions outside the stream of agriculture revealed that agricultural research and educational institutions are not having much document resources in the regional language packaged for the farmer, Krishi Bhavans are not having any document resources, but village libraries are rich in this aspect when compared to the others.

The findings of the survey on resources available at institutions outside the stream of agriculture revealed very important facts. Libraries outside the stream of agriculture hold very important and otherwise not available information on agriculture, which is original, traditional and sustainable. This will be of great use to agricultural research for developing sustainable methods of farming, animal rearing and fishing. Village libraries generally have a good collection of agriculture books in Malayalam dealing the subject in a simple manner without technical jargon apt for the farmer.

The study very clearly revealed that village libraries contained substantial quantity of agricultural information materials produced for the use of the farmers and non-specialists. This is in regional language and script. These documents deal with the situations and crops of the region. Psychological barriers are absent among farmers in approaching village libraries and in using these materials. Timings and location is also convenient to the farmer.

Krishi Bhavans/FIB etc exist to satisfy the agricultural information needs of the farmer. But they do not consider library and information services as a tool for disseminating information and knowledge on new agricultural techniques. So are not

having any document collection on agriculture meant for the farmer. Agricultural research institutes, university and colleges and libraries of agriculture related departments of government are presently not useful to farmers and the public.

Of the expected users of agricultural information systems less than 1% are scientists and administrators (who exist to serve the farmers) and 99% are farmers²⁹. But presently the systems are not accessible or inviting to the farmers whom they have to serve directly and indirectly. The privilege of information availability remains with the scientist who may use it for the benefit of the farmer. But this is according to his will.

4.7.3. Collections: Document-wise Breakup

The data presented in Table 4.12 shows that agricultural libraries of Kerala have a significant collection of digitized documents and audio visual resources like journals and books in CDRoms, back files of abstracting journals in CDRom, theses in CDRom, video lectures in video tapes, video lectures in CDRom, various rare films in tapes and CD, microfilms and fiche, maps, posters etc. Many libraries have also access to online journals and databases kept in the servers of the publishers. Of the 30 institutions 15 subscribe to 30 databases and 16 online journals and databases in total. The major group of institutions together has 649 video films on different aspects of agriculture and related areas. Of this approximately 600 is in the collection of KAUC. All the thirty institutions together have a total collection of 7636 theses, reports, microforms and maps. Of this the major theses/dissertation collection is with institutions coming under KAU and the total theses collection with them comes to approximately 3500, which includes duplicates also. KSLU is having one of the biggest collections of maps in paper as well as digitized form, which comes to approximately 1200 and is highly relevant to agricultural sector. Internally generated reports of the 30 institutions come to approximately 1800.

It is the status of the collection in agricultural libraries as on the end of the financial year 2002-03 as revealed by data given in Tables 4.12 to 4.13 above. The

media wise split up of the documents is provided in Table 4.17. The total document collection on agriculture in various media excluding journals at the institutions in agricultural sector as on 31st March 2003 comes to 197800. Of these 1436 coming to 0.75% of the total collection is electronic documents. They are mainly documents in CDROM. Audiovisual documents come to 1046, which is 0.55 percent of the total collection.

Table 4.17: Media wise Break up of the Document Collection

Item	Electro D	Books	Audio V	The/Re/Mp/Mi	Total
Major Gr	1433	174863	649	7636	
Minor Gr	03	12718	398	NA	
Total	1436	187581	1047	7636	197800
Percentage	0.75	94.85	0.55	3.85	

In collections of KAUC, DFW etc we find considerable amount of interactive multimedia programmes in CDROMs as well as video films, which are very important for agricultural extension activities, and CBT programmes. The graphical representation of the electronic documents (mainly in CDROMs) and audiovisual resources (mainly video films containing lectures and demonstrations as well as those meant for extension activities) is presented in Figure 4.10. It reveals that of the total collection of electronic documents and audiovisual resources 1120 coming to 53% is possessed by KAUC. CPCRI has 15% (315) of the total collection. The collections at other institutes are CDS 120 (6%), SPB 100 (5%), CAGI 78 (4%), CTCRI 70 (3%), DFW 55 (3%), CAE 47 (2%), and all other institutions in Kerala together 217 (10%). The biggest collection is at KAUC. Also of the 673 audiovisual documents that is a very important media for agricultural extension activity approximately 600 is possessed by KAUC. The digital documents also contain data and information, which is many times more than that, is in the traditional document collections. KAUC has the facility to electronically share these resources also, which places the library into a dominant position in agricultural information sector of Kerala.

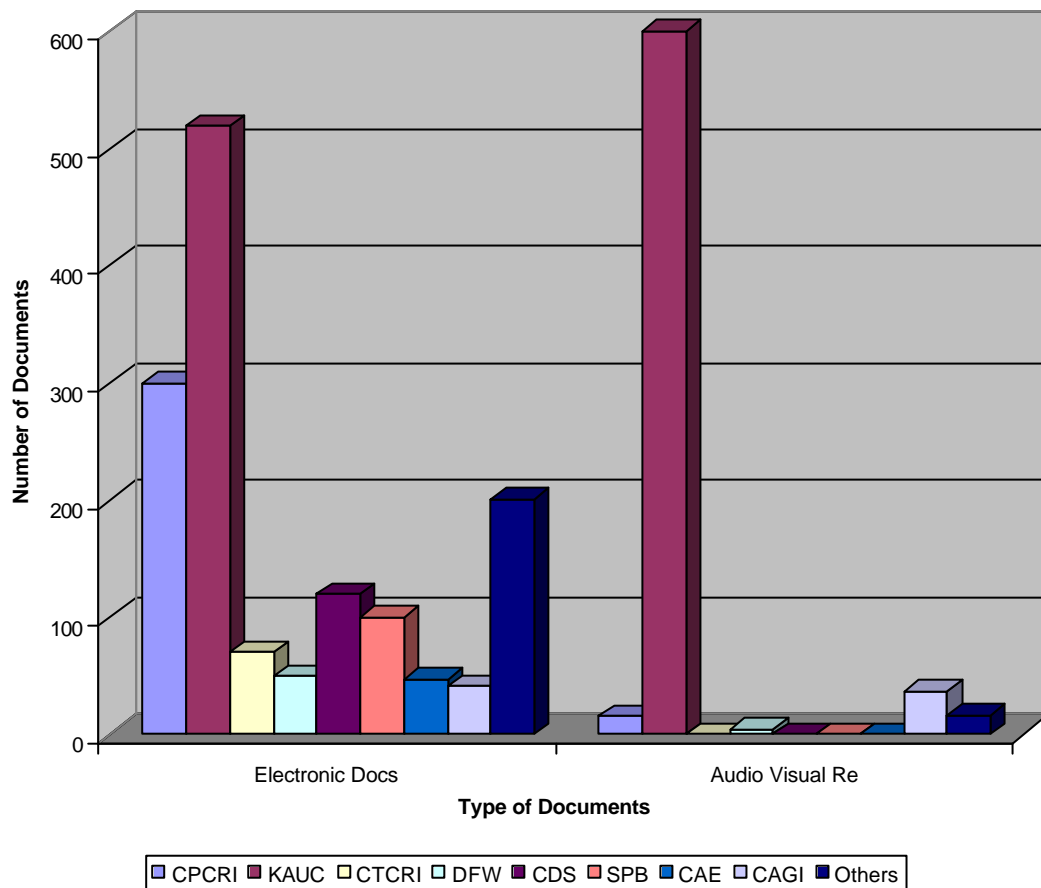


Figure 4.10: Electronic Documents on Agriculture in Major Collections

Theses, reports, maps, microforms etc together comes to 7636 documents, which is 3.85 % of the collections. Even with the IT revolution and onslaught of computers, CDROM publications and online access to libraries and journals through Internet the traditional printed book dominates the collections. In the agricultural sector of the State 94.85% of the collection that is 187581 documents are printed documents. But only by their number we cannot assess the electronic documents. An example is the CAB abstracts in CDROM, which comes to less than twenty numbers available at KAUC. The twenty volumes together cost about 20 lakhs and their content is full content of about twenty abstracting journals over a period of 30 years that is 1971 to 2003. The abstracts consist of millions of papers in different languages published in approximately 9000 journals during the period of coverage. The cost of printed volumes may come to ten times more than their digital version. The size of printed volumes may run to thousands of volumes. Even the complete collections of selected International Libraries are contained in the CDROM collections available in the institutions surveyed. An Example the CARL Digital Library in KAUC, which consists of the complete publications of, the following eighteen institutions up to the year 1985 converted into digital form.

Centre International de Agricultural Tropical
Centre for International Forestry Research
Centre International de Mejoramiento de Maiz y Trigo
Centre International de la Papa
International Centre for Agricultural Research in the Dry Areas
International Centre for Research in Agro forestry
International Crops Res Institute for the Semi- Arid Tropics
International Food Policy Research Institute
International Irrigation Management Institute
International Institute of Tropical Institute Agriculture
International Livestock Research Institute
International Plant Genetic Resources Institute
International Rice Research Institute
International Service for National Agricultural Research
West Africa Rice Development Association

This electronic Library runs into millions of pages consisting of text and graphics and is considered as one of the biggest digital libraries in agriculture in the world.

In addition to this KAUC has Digital Library Publishing facility and has started in 1998 digitizing the PhD dissertations approved/accepted by KAU since 1971. By 2000 it has completed the digitization of 40 of the approximately 300 PhD dissertations accepted by the University. A search Engine specifically meant for this Dissertation Collection has also been developed.

4.7.4. Annual Additions

The rate of annual additions made to the collections at selected Libraries during the five-year period from 1998-2003 is presented in Table 4.18. The average addition per year at these institutions ranges from 35 to 1500. Only KAUC and CDS have an annual average acquisition of more than 1000 documents. But these two libraries acquire books outside agriculture also and hence the average annual acquisition at these institutions cannot be considered as agricultural books. When the other major institutes are considered their acquisition is below 75 books.

Table 4.18: Annual Addition of Books in Selected Institutions

Year	COAT	CPCRI	KAUC	KFRI	DOF	CDS	CFIS	CVA	CAE
1998-99	60	24	2200	NA	100	1555	95	105	175
1999-00	82	30	1470	147	300	1537	120	140	130
2000-01	50	25	585	140	240	1658	67	125	75
2001-02	35	20	400	177	345	1580	45	78	56
2002-03	24	70	378	180	190	1609	50	140	42
	50	34	1006	128	235	1588	75	116	95

When considered with the international and Indian publishers' statistics and annual additions at ICAR library it comes to light that the book collection strength in agricultural libraries is not strong. As per *Books in Print 2000, Indian Books in Print* etc and similar other sources books published throughout the world on agriculture related topics per year comes to approximately 5400.

Books on agriculture published in India itself on agriculture come to about 1250 per year in English and Malayalam. The average annual addition of ICAR library and Indian Agricultural Research Institute (IARI) library is in the range from 2500 to 3000. When considered in such a scenario the additions to Kerala's agricultural libraries even taken as a whole is very low. This means that a major portion of the information generated in the field of agriculture and even information on current research in India itself fails to reach these institutions in our agricultural sector. This will surely affect the quality, and speed of development. But considered in the light of the financial resources that will be available to these libraries we cannot expect drastic changes or improvement in our resource allocations for collection development. The options available to these libraries will be subject specialization in collection development by each institute. It should be supplemented by facilitating of access to the resources available in the State under resource sharing programmes to meet the information requirements on other area in which each institution is not specializing.

4.7.5. Assessment of Collection by Users

The rating of the subject books in the collection by users is presented in the Table 4.19. Details of responses on assessment to each subject are presented in the Table. Of 427 users 15% rated the collection as excellent, 19% as very good, 24% as good, 11 % as average and 12% as poor.

4.7.6. Journals

The data related to the journals subscribed by 30 selected agricultural libraries in the State is presented in Table 4.20. In March 2003 agricultural libraries in the State together subscribed to 1545 periodicals in agriculture and related subject areas. Of these 648 are Foreign periodicals and 897 are Indian periodicals.

Table 4.19: Rating of the Collection on Different Subjects in Agriculture by the Users

Overall Rating	Excel	%	VeryG	%	Good	%	Aver	%	Poor	%	Total No	R
Agriculture	119	33.30	105	29.41	83	23.25	30	8.40	20	5.6	357	70
Horticulture	60	16.90	85	23.88	111	31.18	57	16.01	43	12.1	356	71
Crops/Com	30	10.50	26	9.123	62	21.75	72	25.26	95	33.3	285	142
Bio Technology	41	10.80	46	12.14	95	25.07	87	22.96	110	29	379	48
Food Sc. Nutri	80	20.30	115	29.19	124	31.47	43	10.91	32	8.12	394	33
Vet and AnSc	87	23.60	103	27.91	117	31.71	35	9.485	27	7.32	369	58
Diary Sciences	55	14.60	71	18.88	59	15.69	45	11.97	146	38.8	376	51
Fisheries	44	14.60	57	18.94	81	26.91	49	16.28	70	23.3	301	126
Forestry	90	25.60	95	26.99	120	34.09	32	9.091	15	4.26	352	75
Agri Eng	67	21.70	84	27.18	115	37.22	31	10.03	12	3.88	309	118
Agri Eco	40	12.50	95	29.69	127	39.69	37	11.56	21	6.56	320	107
	64.81	15.20	80.18	18.78	99.45	23.29	47.09	11.03	53.7	12.6	427	

Table 4.20: Agricultural Journals: Number and Cost

Institution	Indian	Foreign	Total	Cost*	Institution	Indian	Foreign	Total	Cost*
COAT	60	04	64	06	KSLU	18	03	21	01
DAG	17	00	17	02	CDS	20	21	41	14
RGCB	26	20	46	17	CCBM	37	17	54	03
FIB	15	00	15	03	SPB	02	27	29	02
CWRD	33	21	54	07	DES	09	00	09	01
IISR	51	40	91	15	CFISH	17	13	30	07
CPCRI	27	48	75	17	CIFT	39	31	70	11
TBGRI	14	13	27	05	CMFRI	40	15	55	07
KAUC	121	199	320	35	PCOC	20	15	35	01
COH	22	07	29	04	CVA	79	18	97	08
CTCRI	62	48	110	06	CVAP	08	07	15	02
KFRI	46	30	76	14	CDIA	25	02	27	01
COF	12	07	19	04	DAN	26	00	26	01
DFW	19	08	27	03	CAE	18	10	28	07
CESS	12	18	30	02	CAGI	02	06	08	02
					Total	897	648	1545	208

*Rs in lakhs

The journals subscribed consist of duplication of hundreds of titles between institutions. Total annual subscription cost of the agricultural journals in 30 selected institutions comes to Rupees Two hundred and eight lakhs.

Data on subject specialization of journals subscribed in the major institutions covered by the survey is presented in Table 4.21.

The subject specialization of the journals is graphically presented in Figure 4.11. Of the 1545 titles including duplicates subscribed by the libraries 39 % comes under the group general agriculture. This covers topics of general nature as well as crops, commodities, processes etc like spices, tuber crops and plant breeding. Topics like soil science, natural resources and ecology, pathogen resistance, pesticides, weed management, plant science etc are also contained in this group. Representation of other major topics is biotechnology 5%, agricultural economics 10%, food science 4%, forestry, agro forestry etc 9%, animal science 13%, fisheries 7% and agricultural engineering 3%.

4.7.7. Assessment of Journal Collection by Users

Users rating of the journal collections in the libraries based on the user's survey conducted are presented in Table 4.22.

Table 4.22: User's Rating of the Journal Collection in the Library

Journal Col	Exel%	VeryG%	Good %	Aver %	Poor %	Total No	R
Journal Coll	11 02.58	32 7.49	47 11.01	132 30.91	70 16.40	292	135
Primary Jnls	45 10.50	51 11.94	87 20.37	65 20.97	62 14.05	310	117
Secondary Jnls	27 06.32	35 8.19	91 21.31	112 30.35	104 24.40	369	58
Pop Agricultural M	14 03.28	20 4.68	47 11.01	91 29.17	140 32.80	312	115
Agri Mag in Regl L	08 01.87	17 3.98	51 11.94	120 34.99	147 34.40	343	84
Total Average	17.2 04.03	19.38 4.53	40.38 9.45	65 15.22	65.4 15.3	427	

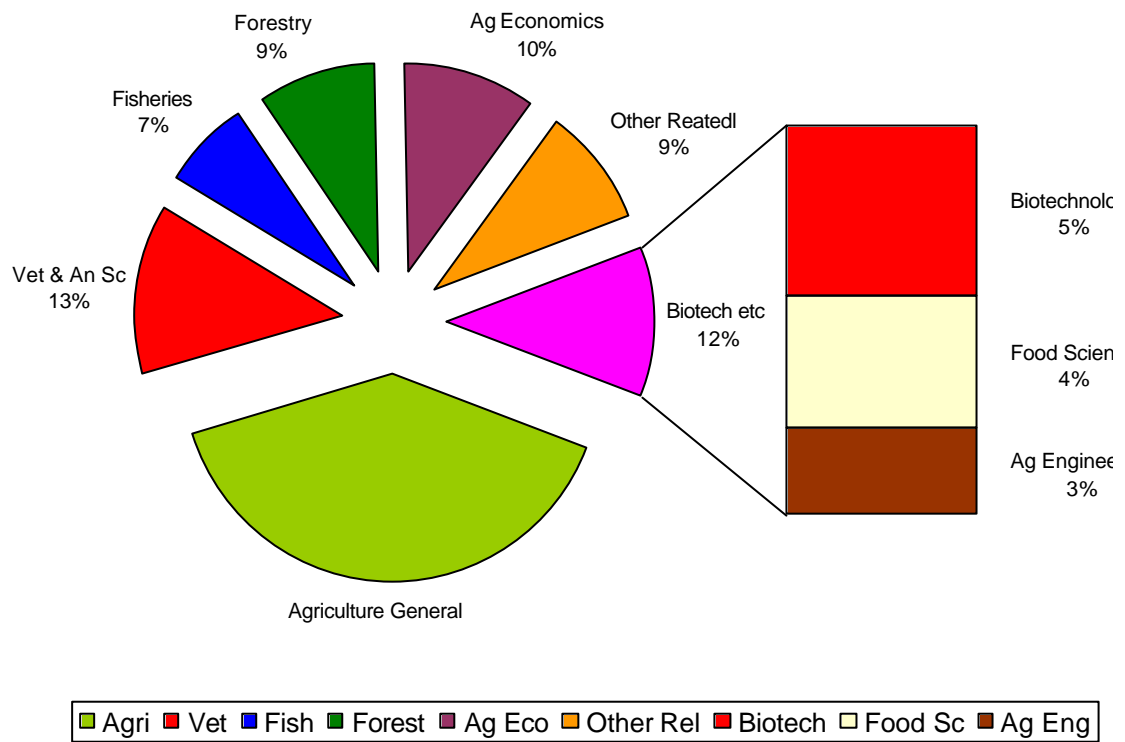


Figure 4.11: Representation of Major Sub fields of Agriculture in Journal Collections

Table 4.21: Subject Representation in Journals Subscribed by Major Agricultural Research Institutions

Institution	Journals	Agri	%Biote	%	Vet	%	Fish	%Forest	%Ag E	%Ag Ec	%FoS	%Other	%						
COAT	64.00	35.00	54.69	1.00	1.56	7.00	10.94	2.00	3.13	3.00	4.69	1.00	1.56	8.00	12.50	6.00	9.38	1.00	1.56
DAG	17.00	13.00	92.86	0.00	0.00	0.00	0.00	0.00	0.00	1.00	7.14	0.00	0.00	0.00	0.00	0.00	0.00	3.00	0.00
RGCB	46.00	13.00	28.89	21.00	46.70	1.00	2.22	1.00	2.22	5.00	11.10	0.00	0.00	4.00	8.89	0.00	0.00	1.00	0.00
FIB	15.00	12.00	80.00	0.00	0.00	1.00	6.66	1.00	6.67	0.00	0.00	0.00	0.00	1.00	6.67	0.00	0.00	0.00	0.00
CWRD	54.00	18.00	33.33	0.00	0.00	0.00	0.00	1.00	1.85	3.00	5.56	4.00	7.41	10.00	18.50	0.00	0.00	18.00	33.30
IISR	91.00	52.00	57.14	9.00	9.89	1.00	1.09	0.00	0.00	8.00	8.79	2.00	2.20	9.00	9.89	5.00	5.49	5.00	5.49
CPCRI	75.00	41.00	65.08	5.00	7.94	1.00	1.58	0.00	0.00	4.00	6.35	1.00	1.59	6.00	9.52	3.00	4.76	14.00	3.17
TBGRI	27.00	18.00	66.67	3.00	11.10	0.00	0.00	0.00	0.00	4.00	14.80	0.00	0.00	2.00	7.41	0.00	0.00	0.00	0.00
KAUC	308.00	161.00	50.31	6.00	1.88	37.00	11.56	14.00	4.38	19.00	5.94	4.00	1.25	16.00	5.00	7.00	2.19	44.00	17.50
COH	29.00	17.00	62.96	3.00	11.10	0.00	0.00	0.00	0.00	2.00	7.41	0.00	0.00	2.00	7.41	0.00	0.00	5.00	11.10
CTCRI	110.00	71.00	64.55	9.00	8.18	1.00	0.90	0.00	0.00	7.00	6.36	2.00	1.82	9.00	8.18	4.00	3.64	7.00	6.36
KFRI	76.00	23.00	30.26	5.00	6.58	4.00	5.26	2.00	2.63	36.00	47.40	1.00	1.32	3.00	3.95	1.00	1.32	1.00	1.32
COF	20.00	5.00	25.00	2.00	10.00	0.00	0.00	0.00	0.00	12.00	60.00	0.00	0.00	1.00	5.00	0.00	0.00	0.00	0.00
DFW	27.00	10.00	37.04	1.00	3.70	0.00	0.00	0.00	0.00	9.00	33.30	1.00	3.70	4.00	14.80	1.00	3.70	1.00	3.70
CESS	30.00	16.00	53.33	3.00	10.00	0.00	0.00	1.00	3.33	2.00	6.67	1.00	3.33	5.00	16.70	0.00	0.00	2.00	6.67
KSLU	20.00	10.00	50.00	0.00	0.00	0.00	0.00	0.00	0.00	5.00	25.00	1.00	5.00	4.00	20.00	0.00	0.00	0.00	0.00
CDS	41.00	9.00	23.68	0.00	0.00	2.00	5.26	2.00	5.26	2.00	5.26	0.00	0.00	19.00	50.00	4.00	10.50	3.00	0.00
CCBM	54.00	22.00	40.74	0.00	0.00	2.00	3.70	2.00	3.70	4.00	7.41	0.00	0.00	19.00	35.20	5.00	9.26	0.00	0.00
SPB	29.00	9.00	39.13	0.00	0.00	2.00	8.69	1.00	4.35	2.00	8.70	0.00	0.00	8.00	34.80	1.00	4.35	6.00	0.00
DES	9.00	2.00	22.22	0.00	0.00	1.00	11.11	0.00	0.00	2.00	22.20	0.00	0.00	3.00	33.30	0.00	0.00	1.00	11.10
CFISH	30.00	2.00	6.45	2.00	6.45	1.00	3.22	14.00	45.20	2.00	6.45	1.00	3.23	5.00	16.10	3.00	9.68	0.00	3.23
CIFT	65.00	3.00	4.28	4.00	5.71	4.00	5.71	27.00	38.60	4.00	5.71	3.00	4.29	10.00	14.30	5.00	7.14	5.00	14.30
CMFRI	55.00	5.00	9.09	2.00	3.64	4.00	7.27	22.00	40.00	6.00	10.90	1.00	1.82	6.00	10.90	5.00	9.09	4.00	7.27
PCOC	35.00	3.00	8.57	0.00	0.00	2.00	5.71	16.00	45.70	2.00	5.71	0.00	0.00	0.00	0.00	4.00	11.40	8.00	22.90
CVA	86.00	3.00	3.09	1.00	1.03	68.00	70.10	2.00	2.06	0.00	0.00	1.00	1.03	2.00	2.06	5.00	5.15	4.00	15.50
CVAP	15.00	1.00	6.66	0.00	0.00	14.00	93.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CDIA	27.00	1.00	3.70	0.00	0.00	26.00	96.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DAN	29.00	2.00	6.90	0.00	0.00	27.00	93.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAE	54.00	31.00	51.67	2.00	3.33	0.00	0.00	0.00	0.00	1.00	1.67	16.00	26.70	3.00	5.00	1.00	1.67	0.00	10.00
CAGI	7.00	1.00	14.29	0.00	0.00	0.00	0.00	0.00	0.00	3.00	42.90	2.00	28.60	0.00	0.00	1.00	14.30	0.00	0.00
Total	1545.00	608.00	79.00	206.00	108.00	145.00	40.00	159.00	60.00	98.80	141.00								
%		39.33	5.11	13.32	6.99	9.38	2.59	10.28	3.88	9.12									

About journals in the agricultural libraries; 4% rated them as excellent. Another 5 % as very good, 9% as good and 15% as average. Another 15% rated journal collection as poor. Approximately 15% of the users have not responded to questions related to journals.

4.7.8. Computers and Other Equipments

Computers, communication equipments, reprographic equipments and network hardware have become very important for any information service system. Table 4.23 presents the data on IT equipments available at the libraries of the institutions covered by this study. The data in Table reveals that most of the libraries are having computers and modems required for a minimum connectivity to Internet so that information from out side sources also can be accessed at the libraries concerned.

Some libraries are also having highly sophisticated systems like juke boxes, CD Servers, hubs, Internet servers, and other LAN equipments. With this they have the power to provide web-based services through a wide geographical area where divisions and stations of the parent organization are spread through. These libraries have Library LANs, Internet Servers, and VSats or leased line connections for Internet, and IT training facilities. The libraries are fully automated with integrated library system software, CD networking solutions etc. The Table 4.24 gives the list of equipments for such a high-tech system available at KAU Central Library.

KAU Library and information System is planned with the University Central Library (KAUC) as central hub. KAUC consist of the Digital Library, IT Training Facilities and a Building LAN connected to the main campus network. Automated libraries in distant campuses of the university are connected to concerned campus networks. These campus LANs are interconnected to form a Wide Area Network and are linked to the outside world using satellite technology. KAU Central Library project as per the 1995 Plan consists of independent 256 kbps VSats for distant campuses. Once this connection is provided it will give to the distant campuses the communication capabilities to access information from KAU Digital library.

Table 4.23: IT Equipments and Related Resources

Institution	Srvr	JB/CD Srvr	Comp	CD/ DVD	Scan	Print	Modm	Photo Copier	TV/ VCR	LCD	UPS
COAT	02	00	11	02	01	02	00	01	00	00	2
DAG	00	00	00	00	00	00	00	01	00	00	0
RGCB	00	00	01	01	00	01	01	01	00	00	01
FIB	02	00	06	02	01	02	01	01	01	01	01
CWRD	00	00	01	00	00	01	00	01	00	00	01
IISR	01	00	05	01	01	01	00	02	00	00	01
CPCRI	02	02	07	10	01	02	01	01	00	00	03
TBGRI	00	00	01	01	00	00	00	01	00	00	01
KAUC	02	02	70	20	01	07	03	01	01	01	03
COH	00	00	01	00	00	00	00	01	00	00	01
CTCRI	00	00	04	00	01	01	00	01	00	00	01
KFRI	00	01	05	03	01	05	01	01	00	01	02
COF	00	00	01	01	00	01	00	01	00	01	01
DFW	01	00	05	01	00	02	01	00	01	00	02
CESS	00	00	01	01	00	01	00	00	00	00	01
KSLU	00	00	01	01	00	01	00	01	00	00	01
CDS	00	00	10	01	01	04	00	01	01	00	00
CCBM	00	00	01	00	00	00	00	01	00	00	01
SPB	00	00	02	02	00	01	01	01	00	00	01
DES	00	00	00	00	00	00	00	01	00	00	00
CFISH	00	00	02	00	00	01	00	01	00	00	01
CIFT	00	00	05	02	01	03	00	01	00	00	01
CMFRI	00	00	02	01	00	02	01	01	00	00	01
PCOC	00	01	01	01	00	00	00	00	00	00	01
CVA	00	00	03	00	00	01	00	01	00	00	01
CVAP	00	00	00	00	00	00	00	00	00	00	00
CDIA	00	00	00	00	00	00	00	00	00	00	00
DAN	00	00	00	00	00	00	00	00	00	00	00
CAE	00	00	02	02	00	02	00	01	00	00	01
CAGI	00	00	02	02	02	02	01	00	01	00	02

Table 24: List of Equipments for High-tech Library and Information System Available at KAU Central Library.

Equipment /Component Description	Quantity
DEC hub 900 Power supply	01
DEC Repeater 900 TM 32 Port Ethernet Module (UTP)	01
DEC server 900 TM Remote Access Server(32 ports)	01
DEC Route About Access EW with Multi protocol software	02
Clear VISN Multi-Chasis Manager with Router Configurator	01
Digital Venturis FX Workstations	25
Other Workstations	10
Digital Prioris 5150 LX	01
Other Servers	03
Alpha Station 1000 A 5/300 Base System Bundle (base configuration attached): 64 MB Memory, 2 MB ECC cache, 600 MB CD ROM drive, UNIX base (2 user) licence, Integrated Graphics Card, UNIX Keyboard and 3 button Mouse (detailed specification in Section B below) with 15" Colour Monitor, 4 GB Wide SCI Hard Disc for Alpha 1000A	01
Table-top 8 GB DAT Drive, with SCSI Cable	01
UNIX with 24 Users License	01
NT with License 50-Users	01
VXL 4310 ASCII VT220 Dumb terminals	25
CD Server with 50 drives	01
Jukebox for 500 CDs	01
CD Networking Software	01
Digital Library Solutions	01
DL CDROM Based Web Hosting Solutions	01
Library Housekeeping Package	01
Davis Multimedia LCD Projector	01
Reference Manager	01
IDRISI GIS Package	01
RAD ASM-20 V35.64 kbps Modem.	02
Power Tel Boca MV 34 ED V34 28.8 kbps MNP-10 Modems	04
19 Inch Industry Rack President systems with two fans: -1.	01
Barcode Scanner	01
Data Capturing Unit	01
Barcode Printing Software	01

The KAUC has a Building LAN. About 260 points spread horizontally and vertically over the building of 4000 Sq Meter area has provision for plugging in workstations for the use of staff, library users, trainees, lecturers during presentation etc. Plug in points and computer furniture is provided at all the points where such requirement can be expected. Through these, users can at the same time access textual and multimedia information stored in the electronic libraries of KAU and also from databases of outside sources through Internet. They can read the text or see the video on their topic or hear the talk by experts. Through the campus network to be established at main campus under ARIS programme any student or staff member in the colleges and other buildings and lecture/seminar halls in the main campus can access library from the terminal in their table. As per the KAULIS project report terminals will be provided at student's hostels for day and night online access to the library and Internet.

KAULIS includes an Electronic Library also. The electronic library storage systems available here can manage storage in a cost effective way and disseminate information efficiently. They consist of three types of hardware, meant for highly used information, middle level usage information and less or rarely used information. In this Electronic Library the storage systems with Alpha Server 1000 A; under high security stores very costly specialised software and databases. It also contains agricultural research information worth about approximately Rs. 2.87 crore received and downloaded under various MOUs and licenses. The PhD theses of KAU are available in this electronic library. The Electronic Library has a storage capacity of approximately 6.5 crore printed pages. It already has full text libraries copied under various MOUs and books and other documents acquired in electronic medium consisting of 5.5 crore pages. About hundred and twenty hours video/ audio files are also kept in its storage systems. The KAUC has all the facilities for hosting a virtual university on agriculture.

The software collection include those provided by Information and Library Network Programme (INFLIBNET), NIC etc for library management as well as for

developing digital library of full text databases. Solutions are also available for developing interactive multimedia programmes. Web server modules of various DBMS packages, CD Networking and publishing solutions etc are also available at KAUC.

Of the 77 libraries that responded to the survey 15 are using computers for various library operations. Among these 11 are using computers for book acquisition works, 9 for periodical acquisition, 4 for circulation, 14 for cataloguing, 4 for Library LAN, 3 for CD Networking, 15 for office works and 2 for digital library and web based services. 1 library has digital version of classification scheme, which enables partial automation of that work.

Most of the libraries in agricultural sector covered by the survey, which are not presently having computers, have also started efforts to acquire computer systems, Internet connectivity and library automation solutions.

If standardization of hardware and software to be used by the libraries can be effected it will smoothen the attempts for resource sharing and networking without which libraries can not exist as reliable sources of information.

4.7.9. Physical Facilities

The physical facilities available to the libraries vary from one or two shelf in a corner of a room or very small room of less than 250 square feet to very large buildings with 4500-square meter and furniture and facilities of international standard. Of the 77 libraries, which responded to the questionnaire 4 have, separate building. Another 73 have space attached to other buildings. Of the libraries 42 have less than 100 sq mt for library purpose. 11 have 100 to 500 sq mt, 7 have 500 to 1000 sq mt and one library have 4500 sq mt space for library purpose. The Table 4.25 provides the data collected on space/building available to libraries in different major institutions.

Table 4.25: Physical Facilities at Selected Institutions

Details	COAT	FIB	CPCR	IISR	KAUC	KFRI	DFW	CDS	CFIS	CVA
Readg Space	400	050	150	050	1250	300	100	400	100	150
Stock Area	400	150	400	200	2250	650	200	1950	5500	750
Staff& other	050	050	075	050	1250	060	075	150	040	075
Bldg Total	850	250	750	350	4500	1010	500	2500	750	1000

Area in squire meters

Of the space and facility available to agricultural libraries in Kerala the facility at KAUC is very important. Similar facility is not available even to the national agricultural library at IARI. The famous architect Mr. Koragaonker designed Kerala Agricultural University Central Library building. It is located in the most prominent site in the main campus at Vellanikkara in Trichur. It has a unique building of Kerala's traditional design, which can utilize natural air and ventilation to the maximum hours of the day. It faces a serene and beautiful landscape and provides comfortable and peaceful environment for the seekers of knowledge. The physical facilities provided are of international standard. The four-storey building has a total plinth area of 4500 sq.mt.

The furniture and equipments provided in this library are of international standards. They are designed with a view to accommodate the developments in current information technology. As per the opinion of experts the physical facilities can remain functional and modern for at least the next two decades. The computer and communication system used is also of an emerging technology, which can be further scaled in accordance with future developments in ITC.

The University Library has a Local Area Network (LAN), covering the building. During the construction stage of the library building itself LAN cabling was also done. Approximately 260 points spread horizontally and vertically over the building were identified for plugging in workstations for the use of staff, library users, trainees, and lecturers during presentation etc. Plug in points and computer furniture was provided at all these points in the building.

The library building houses an IT Lab, digital library, premises LAN, exhibition facilities and a high-tech seminar hall. Library Campus has conference facilities for conducting big national and international conferences. There is a fully air conditioned high-tech auditorium with all modern facilities. As per the plan of the library cum auditorium complex the Library LAN will cover the auditorium also. The video and sound files of all conference proceedings will be recorded directly from the venue to the digital library. The conference can be viewed at all stations of the university and will be available in the Internet.

For sophisticated library equipment that needs high power protection continuous centralised UPS backups are available. A back up generator is also available for the library and the auditorium. The libraries at CTCRI, CPCRI, CIFT, CDS, COAT, etc also have excellent physical facilities and computer and communication systems.

4.8. Information and Documentation Services

The libraries in agricultural sector offer different types of services to the students, teaches, scientists, extension workers, administrators and farmers. The user strength of the libraries in agricultural sector is presented in Table 4.26. Users, which include all the categories of scientists and students of the concerned institutions as well as the other visitors to these libraries, come to a total of 10954. Of these 47.72% are scientists 31.76% are students and 20.52 are other visitors to the libraries which may also include, scientists and students from outside institutions as well as public searching for information. The total agricultural population of the State is to be considered as expected users of agricultural information services. Actually they are to be the major group of information users in agricultural sector. But the farmers using any services from the research libraries are rarely noted even though KAUC, CPCRI etc have very good facilities intended for them.

Table 4.26: User Strength of Agricultural Libraries

Institution	Scientists	%	Students	%	Others	%	Total Users
COAT	170	24.11	365	51.77	170	24.11	705
DAG	40	11.43	00	00	310	88.57	350
RGCB	73	40.78	40	22.35	66	36.87	179
FIB	2247	93.74	10	0.41	140	5.84	2397
CWRD	39	22.54	39	22.54	95	54.91	173
IISR	45	42.86	40	38.10	20	19.05	105
CPCRI	80	20.00	10	2.50	310	77.50	400
TBGRI	150	60.00	20	8.00	80	32.00	250
KAUC	180	24.00	500	66.67	70	9.33	750
COH	140	24.56	400	70.18	30	5.26	570
CTCRI	60	68.18	10	11.36	18	20.45	88
KFRI	55	22.92	40	16.67	145	60.42	240
COF	24	32.43	40	54.05	10	13.51	74
DFW	500	86.21	30	5.172	50	8.62	580
CESS	56	21.05	10	3.75	200	75.19	266
KSLU	14	16.67	70	83.33	00	00	84
CDS	28	31.82	45	51.14	15	17.05	88
CCBM	15	8.72	100	58.14	57	33.14	172
SPB	15	12.30	80	65.57	27	22.13	122
DES	28	19.58	40	27.97	75	52.45	143
CFISH	40	12.50	250	78.13	30	9.37	320
CIFT	42	33.07	60	47.24	25	19.69	127
CMFRI	27	35.06	10	12.99	40	51.95	77
PCOC	20	16.67	30	25	70	58.33	120
CVA	35	4.26	745	90.85	40	4.87	820
CVAP	14	14.89	70	74.47	10	10.64	94
CDIA	17	23.61	40	55.56	15	20.83	72
DAN	1028	95.36	20	1.85	30	2.78	1078
CAE	42	9.29	340	75.22	70	15.49	452
CAGI	03	5.17	25	43.10	30	51.72	58
Total	5227	47.72	3479	31.76	2248	20.52	10954

Table 4.27: Specialized Services Provided in the Libraries

Institution	CP	NP	BS	RS	AS	SD	IT
COAT	N	N	Y	y	N	Y	Y
DAG	N	N	N	Y	N	N	N
RGCB	Y	Y	Y	Y	N	Y	Y
FIB	N	N	Y	Y	N	N	Y
CWRD	N	N	Y	Y	N	Y	N
IISR	Y	Y	Y	Y	N	Y	Y
CPCRI	Y	Y	Y	Y	Y	Y	Y
TBGRI	N	N	Y	Y	N	Y	N
KAUC	Y	Y	Y	y	Y	Y	Y
COH	N	N	Y	Y	N	Y	N
CTCRI	N	N	N	Y	N	Y	N
KFRI	Y	N	Y	Y	N	Y	Y
COF	N	N	N	Y	N	Y	Y
DFW	N	N	N	Y	N	Y	Y
CESS	N	N	N	Y	N	Y	N
KSLU	N	N	N	Y	N	N	N
CDS	Y	Y	Y	Y	N	y	Y
CCBM	N	N	N	Y	N	Y	N
SPB	Y	Y	Y	Y	Y	Y	Y
DES	N	N	N	Y	N	Y	N
CFISH	N	N	N	Y	N	Y	Y
CIFT	Y	Y	Y	Y	N	Y	Y
CMFRI	N	N	Y	Y	N	Y	Y
PCOC	Y	Y	Y	Y	Y	Y	Y
CVA	N	N	Y	y	N	Y	N
CVAP	N	N	N	Y	N	N	N
CDIA	N	N	N	Y	N	N	N
DAN	N	N	N	Y	N	N	N
CAE	Y	Y	Y	Y	N	Y	Y
CAGI	N	N	Y	Y	Y	Y	Y

Y= available, N= not available.

Among the 77 libraries, which responded to the survey 48 follow, open access system. All provide normal library services like reference, loan, photocopying and Selective Dissemination of Information (SDI) in an informal way. Libraries under KAU, ICAR and a few others provide various types of Current Awareness Services (CAS), SDI, bibliographic services etc as listed below. Details of the services at the selected libraries is presented in Table 4.27

Contents Page of Periodicals (CP)

Newspaper Clippings Services (NP)

Bibliographical services (BS)

Reference services (RS)

Abstracting Services (AS)

Selective Dissemination of Information (SD)

IT Enabled Services (IT)

A few of the libraries provide other specialized services and products not listed here. They include preparation of background materials for legislators, publication of news letters and journals, web based services, marketing of information services and products, preparation and publication various subject specific bibliographies etc. The KAU central library is also engaged in marketing of information services and products it generates.

4.8.1. Working Hours and Access

The libraries except a few work from 10 A.M to 5 PM on all working days. From the 71 libraries 61 have reported that the use of library during working hours is high. 3 libraries have also reported that the use during extended hours is high and one that use during holidays is high. But as these libraries are not normally providing services after office hours and on holidays it is not possible to assess the use during such periods. The interview with users revealed that most preferred the libraries offering services during after office hours and holidays.

4.8.2. Facilities for Resource Sharing

The survey revealed that no resource sharing programmes exist among any group of libraries functioning in the agricultural sector of Kerala. Of the 77 libraries 71 have reported that they do not facilitate use of books, papers, journals, dissertations or databases in CDROM from other libraries. 69 have reported that the libraries are not participating in any resource sharing or networking activity like cooperative acquisition, cooperative cataloguing, cooperative common storage, cooperative conservation activities, cooperative technical processing, interlibrary loans, etc. This reveals that the rich resources available at various institutions are not becoming useful to those beyond a small group inside each institution. The agricultural sector fails to extract even minimum utility of the costly information resources built up by the sector.

4.8.3. Resource Awareness and Usage

Detailed data on the user's awareness and use of the document resources in the libraries is presented in Table 4.28. Of the users 24% reported that they were fully aware of the resources of the library and 9% stated that they were making full utilization of the resources.

Table 4.28: Awareness and Use of the Document Resources

Item	Fully	%	Limited	%	Not	%	Total	No R	
BOOKS	100%	75%	50%	25%	0%				
Books Awareness	103.0		214.0		72.0		389	38	
Books Use	42.0		235.0		07.0		284	143	
JOURNALS									
Journals Awareness	19.0	46.0	70.0	120.0	04.0		259	168	
Journals Use	05.0	35.0	116.0	209.0	31.0		396	31	
Total Awareness	24.4	09.2	07.86	56.8	24.0	18.92	15.2	03.56	427
Total Use	09.4	07.0	03.84	70.2	41.8	26.23	07.6	01.78	

The survey showed that 8% of the scientists, students and other users were fully aware of the resources available in the libraries and 4% was utilizing the

resources at least up to 75%. Only 15 users from 427 coming to 3.56% reported that they were not at all aware of the resources of the library. 24% users stated that they are aware of the resources of the library in a limited sense. 41% users stated that they are utilizing the library in a limited sense. This reveals that major source of information for the work of users is their respective libraries. For most of their libraries fully met their information requirements.

4.8.4. Use of Information by Farmers

Farmers form the major expected user group of agricultural information. Of the people who use agricultural information, student, scientists, extension workers and administrators in total will come to less than 1%. Farmers and the public who needs agricultural information will come to 99%. The information systems as well as the first category of users themselves exist to serve the second user category. But the major information resources in the agricultural sector remain for use of the first category and even the information if any generated by the first category for the sake of the second never reach the second category, the farmers and the public.

A survey was conducted among randomly selected farmers and public living near the regions of the major agricultural institutions. The survey was intended to check the sources they use for agricultural information, its accessibility and use. Result is presented in Table 4.29. The responses from users are presented in graphical form in Figure 4.12. The table and the figure reveals various important factors related to accessibility of agricultural information services to farmers as well as the apt place for extending agricultural information service to the farm.

Table 4.29: Assessment of Facilities by Farmers

Institution	Aware	%	Appr	%	Sati	%	NotSat	%	Psyc	%	AptPl	%
Agri Res In	37	16.82	17	7.727	1	0.45	10	4.55	70	31.82	27	12.27
Krishi Bhav	170	77.27	31	14.09	7	3.18	20	9.09	16	7.273	142	64.55
Village Lib	205	93.18	70	31.82	40	18.2	12	5.45	2	0.909	130	59.09

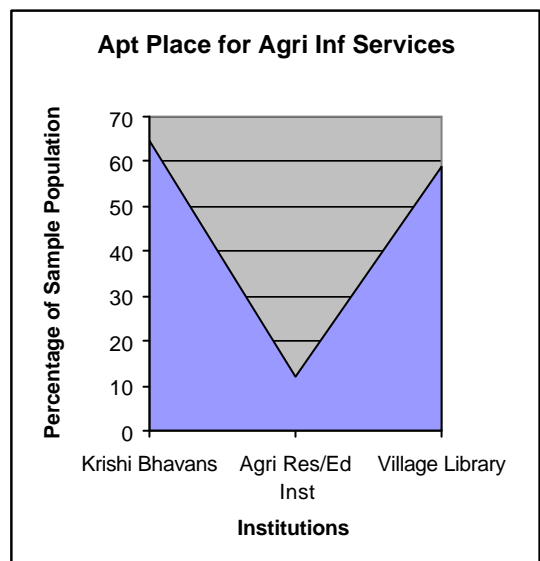
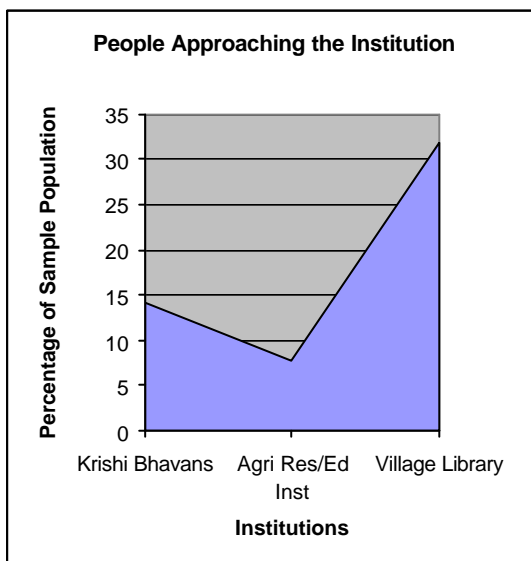
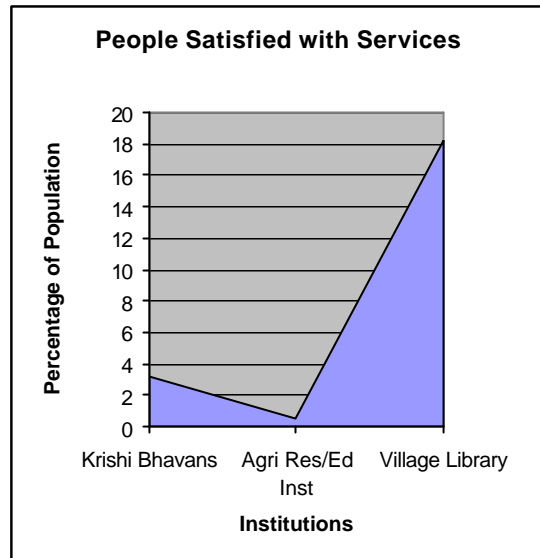
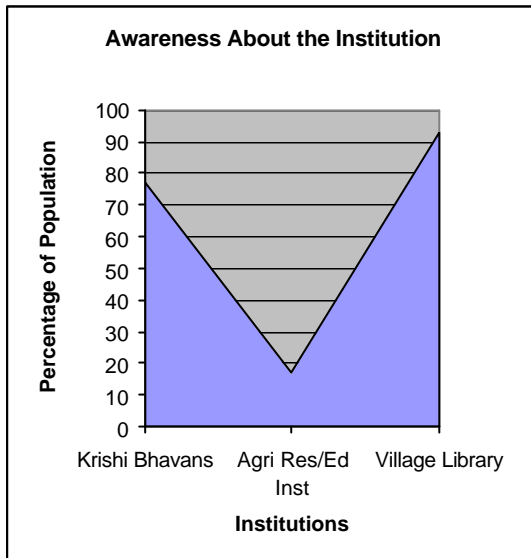


Figure 4.12: Accessibility, Use and Aptness of the System for Farmers

Of the 220 persons who responded to the questionnaire 37 persons (17%) only stated that they were aware of the agricultural research or educational institution existing near them and of this 17 persons coming to 8% of the total responses stated that they approach those institutions for information. From this 10 persons stated that the information service is not satisfactory or relevant to them. Only less than 1% stated that they get satisfactory service. 70 persons coming to 32% of the respondents stated that the procedural difficulties and the psychological barriers prevented them from using the services of educational and research institutions in agriculture.

Of those who responded 170 persons (77%) stated that they were aware of the Krishi Bhavans existing nearby and of this 31 persons coming to 14% of the total responses stated that they approach Krishi Bhavans for information. From this 7 persons stated that the information service is satisfactory. 20 persons stated that the information services from Krishi Bhavans are not satisfactory.

Of the responses 205 persons (93%) stated that they were aware of the village library existing in their locality and of this 70 persons coming to 32% of the total responses stated that they approach village library for agricultural information. From this 40 persons stated that the information service is satisfactory. 12 persons stated that the information services from village libraries are not satisfactory.

The survey revealed that village library was the most sought after institution by farmers, and that procedures and psychological barriers in using those collections were less in regard to the village library. But of the 220 persons surveyed 65% stated that Krishi Bhavans are the apt place for providing agricultural information services to the farmers, 59% stated that village libraries are the apt place and 12% stated that agricultural research institutes are the apt place.

4.9. Conclusion

An analysis of the resources available at the 30 major libraries covered in comparison reveals that the resources at the disposal of the libraries taken together are sufficient for reliable services. But when individual libraries are taken resources at their disposal are not adequate, full or reliable even for major libraries. For the institutions coming under minor group surveyed the resources are far from satisfactory. The libraries in the agricultural sector of Kerala face various constraints in providing efficient information services. Most of the collections are not scientifically organized. They lack arrangement according to some classification. Non-availability of standard catalogues forms major hindrance for document retrieval in most of the libraries. This makes difficult the location of available document and information with speed and efficiency. The libraries, which have to serve the majority of user community that is farmers and the public that is Krishi Bhavans, village libraries, etc in total possess only less than 1% of the information resources available in the State. There is no provision for this majority groups or their libraries to access the information stored in resource rich institutions for the sake of the farming community.

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Chapter 5

DATA ANALYSIS -II: POSSIBILITIES FOR RESOURCE SHARING

5.0. Introduction

Agricultural information systems access, store, organize and disseminate the knowledge generated by research, to the extension worker and the farming community. The knowledge is also made available for further research as well as for education. As a consequence of rapid developments taking place in science and technology related to agriculture and biosciences, there is a virtual information explosion. For achieving an optimal utilization of these developments, the agricultural scientists, extension activists, teachers, administrators, students and farmers should get quick access to information at local, national and international levels¹. The Global Village, Shrinking World, Digital Revolution etc are some of the terms being used to describe the importance of Information and Communication Technology (ICT). In the fast developing world, time is a crucial factor and availability of timely information is necessary to provide cutting edge to the success of any research or development programme in agriculture. Hence the institutions in the sector are in constant need of information about the trends and developments in agricultural sciences and technology at the regional, national and world level. They also need current information about agricultural prices, market trends, loans, supports, subsidies and other aspects.

Information is a very costly resource. The processing and repackaging of information also is very expensive. The creation of information systems is further more costly. The agricultural libraries with their limited resources face great difficulties in managing reliable services in the midst of the flooding of information in various media. As it is happening in other spheres of activity it has become necessary for libraries in agricultural sector also to modernize their systems, share their resources and organize services on a cooperative basis to satisfy collectively the information needs of their respective user groups. The phenomenal developments in

ICT helped remarkably in mitigating the need. Developments in ICT enable to accomplish the task of networking and resource sharing among geographically dispersed and remotely located agricultural institutions. So information available everywhere can be integrated; disseminated and shared without hindrances that existed earlier.

5.1. Resources in Sub Sectors of Agriculture

Resource Sharing is to be based on specializations in a sector like agriculture. So planning of any resource-sharing programme needs a preliminary analysis of information resources in detail available in major subject areas coming under agriculture. Resources and development activities in the agricultural sector of the State of Kerala can be grouped under the following major sub sectors.

- a) Crop Sciences and Horticulture
- b) Veterinary and Animal Sciences
- c) Fisheries and Marine Sciences
- d) Forestry, Soil Sciences and Water
- e) Agricultural Economics, Statistics and Marketing
- f) Agricultural Engineering and Technology AND
- g) Agricultural Information and Extension

There are various organizations in Kerala, which have one or more of the above subject areas as their mandate. They are engaged in education, research, extension and development activities as discussed in detail in Chapter 3. These institutions have at their disposal, along with various physical and technology related facilities; information resources. This aspect has been discussed in detail in Para 4.7.

5.2. Types of Information Resource

The present chapter comparatively analyses in detail the information resources on agriculture under different subject areas available at 30 resource rich institutions. The intention is to suggest a resource-sharing programme that can achieve the

optimum utility of the total expenses put for developing concerned information systems and services.

Information sources on agriculture, biosciences and related areas held by institutions in agricultural sector of Kerala are of various types. They consist of books, journals, reports, thesis, and working papers, video films, interactive multimedia programmes, CDROM databases and web pages. Scientists and extension activists specializing in concerned subject area also forms a source of information. Data given in Table 4.17 shows that 97 percent of the information resources available in the libraries of agricultural institutions are books, reports, theses and journals.

Table 4.7 shows that libraries in 30 major institutions together spend approximately Rs. 135 lakhs for the purchase of books and Rs.208 lakhs for journals every year. The subscription of current journals alone takes 52.31 % of the total expenditure on collection development.

The annual expenses for books and journals in major agricultural institutions during 1998-99 to 2003-04 are presented in Section A of Table: 5.1.

5.2.1. Book Collections

The survey conducted for the study revealed that in the collections, books acquired by the agricultural institutions form a major group of reading and reference materials when considered with regard to number and cost. The data presented in Table 4.17 reveals that approximately 95% of the total collection in libraries of agricultural sector is books. The libraries together spend 33.95 % of the amount meant for collection development to acquire books.

The survey revealed the presence of only less than 100 reference titles costing more than Rs. 20000 in the agricultural libraries. Of this many are general encyclopedias required for day-to-day reference. Only less than a dozen titles are related to agriculture. The agricultural titles are duplicated only in the case of two titles. Hence it is to be assumed that the books related to agriculture acquired by the

Table 5.1 A: Expenditure for Journals and Books During 1998-99 to 2002-03

Institution	1998-99		1999-00		2000-01		2001-02		2002-03	
	Journal	Books	Journal	Books	Journal	Books	Journal	Books	Journal	Books
COAT	05	01	05	02	06	03	07	05	06	04
DAG	00	00	00	00	00	00	00	00	02	02
RGCB	03	05	04	06	05	04	12	07	17	06
FIB	00	00	00	00	00	00	01	01	03	02
CWRD	03	01	04	01	04	01	04	01	07	02
IISR	06	02	09	03	09	07	11	04	15	04
CPCRI	07	07	06	07	08	06	13	10	17	11
TBGRI	03	01	01	01	02	01	04	01	05	03
KAUC	29	08	30	09	32	11	35	11	35	25
COH	05	02	02	03	02	03	05	02	04	03
CTCRI	07	01	06	03	07	04	06	04	06	04
KFRI	05	06	07	07	08	05	09	06	14	07
COF	01	01	02	02	01	03	04	02	04	04
DFW	00	05	00	07	00	05	02	06	03	07
CESS	01	01	01	01	01	00	01	01	02	02
KSLU	00	00	00	00	00	00	00	00	01	01
CDS	08	04	09	04	10	09	14	11	14	06
CCBM	02	01	03	02	02	03	02	02	03	04
SPB	01	02	01	02	01	02	01	03	02	03
DES	00	01	00	01	00	00	00	00	01	02
CFISH	03	02	03	03	03	04	06	03	07	05
CIFT	05	05	06	06	09	06	09	08	11	08
CMFRI	05	03	04	04	05	03	07	03	07	04
PCOC	00	00	00	00	00	00	01	00	01	01
CVA	04	04	04	05	04	03	06	05	08	05
CVAP	00	00	00	00	00	00	00	00	02	02
CDIA	00	00	00	00	00	00	00	00	01	01
DAN	00	00	00	00	00	00	00	00	01	01
CAE	04	03	03	03	05	02	06	06	07	05
CAGI	00	00	00	00	00	00	02	01	02	01
Total Cost	107	66	110	82	124	85	168	103	208	135

Table 5.1 B: Increase / Decrease in No of Journals and Cost 1998-99 to 2002-03

Year	1998-99	1999-00	2000-01	2001-02	2002-2003	Difference
Number	1731	1670	1576	1561	1545	-11.70%
Journals	107	110	124	168	208	+94.00%

libraries normally cost less than Rs. 20000. It is difficult to assess the extent to which duplication occurs in the case of acquisition of such books. The day today requirement of each institution necessitates the availability of many books in-house. Hence in the case of books duplication cannot be avoided. It is also not costly as in the case of journals, for book titles do not have recurring expenses. What can be done is avoiding duplication within an institution. In different libraries existing in the same campus within a walkable distance duplication of costly reference sources can be avoided. Examples are colleges, departments and research divisions inside the same campuses under Agricultural University as well as department libraries and central libraries in the same campus of university, colleges etc. To prevent such duplication circulation of printed catalogues of available reference sources, annual or monthly addition lists or online catalogues of institutes as well as union catalogue of holdings are essential. As such tools are not available in most of the institutions avoiding duplication has become very difficult.

Hence the institutions in agricultural sector should under a resource-sharing programme prepare a union catalogue of books available so that unnecessary duplication in regard to book acquisitions can be avoided. The available resources will also become useful beyond the walls of an institution and to the whole agricultural sector.

5.2.2. Journal Subscription

The data on journals subscribed by institutions under ICAR and KAU as well as other major agricultural organizations in Kerala was gathered for the study.

This item causes a recurring expenditure of considerable portion of the allotment for collection development (52.58 %). Even with that expenditure the sector fails to provide accessibility to most of the important journals at many institutions. Hence the need to avoid duplication and employ cost-effective methods to provide access to maximum number of journals has become very important.

The number of journals subscribed every year and their annual expenditure during 1998-99 to 2002-03 are presented in Section B of Table 5.1. It can be seen

from the data that the number of periodicals subscribed is declining year after year. But the total expense towards subscription for the decreased number of journals is increasing. Even though the cost of the journals is increasing year after year library budget is not increasing parallel to that. This results in discontinuation of the titles every year. National and international institutions and private groups launch new journals in agriculture from time to time. So total number of periodicals published in agriculture increase year after year. At the same time number of journals subscribed decreases from what was subscribed earlier. This means that, not only the journals available earlier goes beyond reach but the new journals dealing newly emerging subjects and current developments in agriculture also goes out of reach. In this situation it is very important to devise some method to make more journals (at least the journals subscribed in Kerala) accessible to all institutions at lesser cost. Table 5.1 B reveals that during the periods from 1998-99 to 2002-2003 the periodicals subscribed in agricultural sector in Kerala has gone down by 10.70 %. But at the same time total expenditure on journals has gone up by 94 %.

Figure 5.1 graphically presents the annual expenditure for journals and books at the major institutions during the years from 1998-99 to 2002-03. It also presents number of journals subscribed each year during the period covered.

5.3. Existing Subject Specialization in Collections

In the collections, journals form the very important group when considered in the context of their cost as well as their primary nature of reporting of result of current research.

The increasing cost of journals, decreasing number of journals subscribed and the emerging of new specializations and new journals on such subjects point towards the need for specialization in collection development. Specialization will enable institutes to give leadership in resource sharing on specific areas of agriculture. This can improve efficiency of the programme and make more journals accessible to more

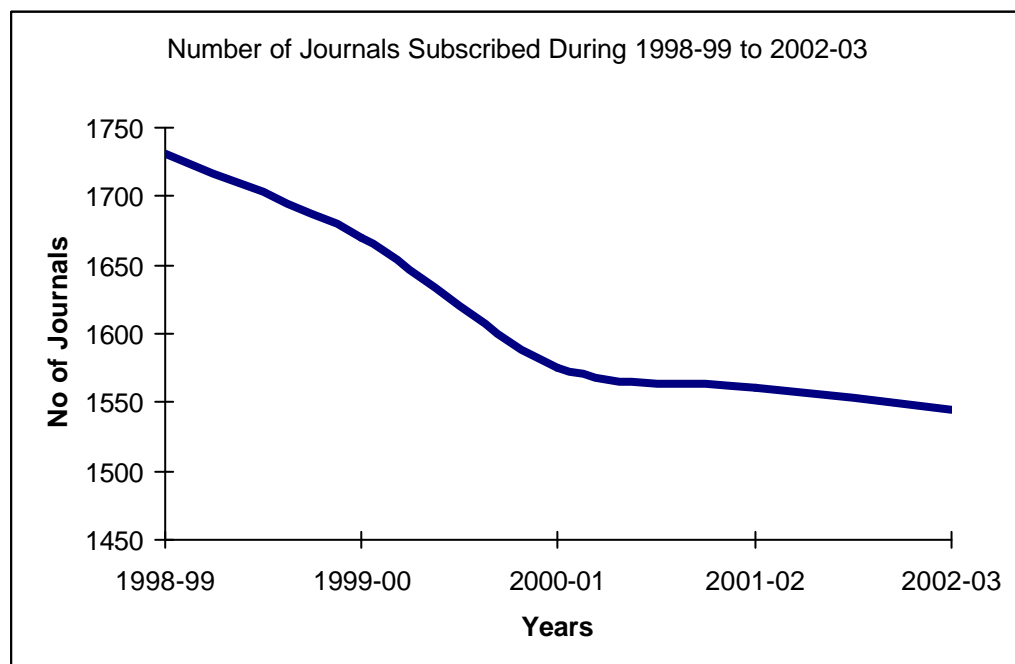
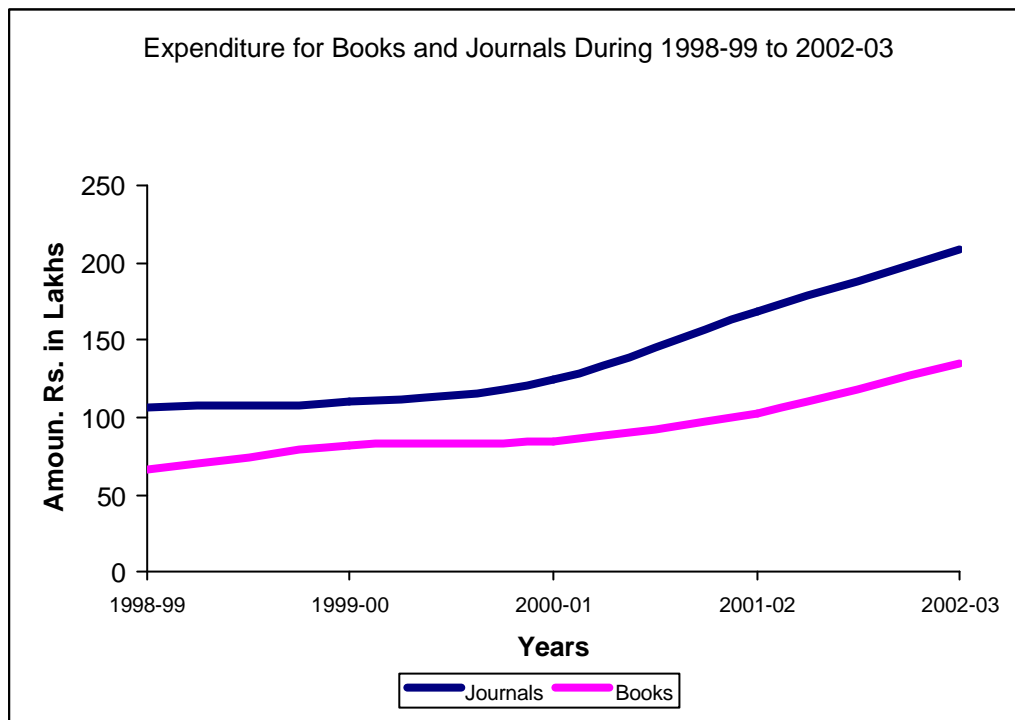


Figure 5.1: Expenditure for Journals and Books and Number of Journals Subscribed During 1998-99 to 2002-2003

institutions/users without increasing the expenditure presently incurred. Hence the present study attempts to identify the appropriate institutions, which can specialize in collection development on various sub sectors of agriculture as well as give leadership for resource sharing on that area.

Books and journals form the major collections in libraries of agricultural institutions, which the users seek regularly. Hence the books and journals collection are taken as the main aspect for specialization. The collections are analyzed during the study under six different sub sectors of agriculture mentioned at the beginning of this chapter. This was done with the objective of understanding the possibilities for subject specialization by institutions for giving leadership and resource sharing. The results of the study on each sector are presented below.

5.3.1. Crop Sciences and Horticulture

Important institutions specializing in crop sciences and horticulture in Kerala having library and information systems and services come under KAU and ICAR. A few also are run by Department of Agriculture of the State as well as other organization. In the area of crop sciences and horticulture there are three colleges dealing mainly with agriculture and horticulture, run by KAU. They are College of Agriculture (COAT), Thiruvananthapuram, College of Horticulture (COH), Thrissur and College of Agriculture (COAP), Kasaragod². There are three ICAR Institutes dealing with crop science, horticulture and related areas. They are Central Plantation Crops Research Institute (CPCRI), Kasaragod³, Indian Institute Of Spices Research (IISR)⁴, Calicut and Central Tuber Crops Research Institute (CTCRI), Thiruvananthapuram⁵. There are also Government Departments and a few autonomous institutions supported by the State and Union Government, which are directly or indirectly related to crop sciences and horticulture.

The books and current journals available in 8 institutions specializing in the concerned subject selected from the 30 major institutions are presented in Table 5.2A. COAT possessing 22% of total books on this subject area available in total at all the major institutions in Kerala has largest collection of books (18900) with COH (12779)

Table 5.2: Collections in Specialized Areas of Agriculture at Major Institutions

A: Crop Science and Horticulture

Institution	Books	% Journals	%
COAT	18900	22	35 05
DAG	3895	05	13 02
IISR	2685	03	52 07
CPCRI	5475	06	41 05
KAUC	10255	12	161 22
COH	12779	15	17 02
CTCRI	6175	07	71 10
DFW	2475	03	10 01

D: Fisheries and Marine Sciences

Institution	Books	% Journals	%
KAUC	32	00	02 02
KFRI	50	00	02 02
DFW	50	00	00 00
CDS	500	04	02 02
CFISH	3492	26	14 13
CIFT	3751	28	27 25
CMFRI	2786	21	22 20
PCOC	2300	17	16 15

B: Forestry and Soil Sciences

Institution	Books	% Journals	%
COAT	250	01	03 02
TBGRI	200	01	04 03
KAUC	500	02	19 13
KFRI	10250	39	36 25
COF	4700	18	12 08
DFW	8500	32	09 06
CDS	500	02	02 01
SPB	300	01	02 01

E: Agricultural Economics

Institution	Books	% Journals	%
IISR	450	02	09 06
KAUC	620	03	16 10
KFRI	450	02	03 02
CDS	5250	26	19 12
CCBM	6750	33	19 12
SPB	1500	07	08 05
DES	877	04	03 02
CAE	844	04	03 02

C: Veterinary and Animal Sciences

Institution	Books	% Journals	%
COAT	1565	06	07 03
DAG	90	00	00 00
FIB	725	03	01 0.5
KAUC	537	02	37 18
CVA	14950	56	68 33
CVAP	1606	06	14 07
CDIA	2122	08	26 13
DAN	370	01	27 13

F: Agricultural Engineering

Institution	Books	% Journals	%
COA	845	08	01 03
CWR	500	05	04 10
IISR	275	03	02 05
CPCR	425	04	01 03
KAU	237	02	04 10
CTCR	400	04	02 05
CAE	1388	14	16 40
CAG	315	03	02 05

G: Total Collection in Different Subjects

Subject	Agriculture	Vet & An	Fisheries	Forestry	Ag Eng	Ag Econ	Total
Journals	747	206	108	145	40	159	1405
Books	86353	26655	13235	26256	10067	20487	183053

in second and KAUC (10255) in third position. The books in crop science, horticulture, general agriculture and related areas available at these institutions specializing on that subject area are graphically presented in Figure 5.2.

Table 5.2 A also presents the journals in general agriculture, crop science and horticulture subscribed by 8 major institutions specializing in crop science and related areas. KAUC subscribes to 161 journals which is the largest group coming under crop science and horticulture (22 %) of the total journals in crop science subscribed in agricultural sector. The Journals in crop science, horticulture and related areas subscribed by institutions specializing on that subject area is graphically presented in Figure 5.2.

5.3.2. Forestry

Kerala Forest Research Institute (KFRI) is the major organization having information resources and services on forestry and related areas⁶. Department of Forest and Wild Life (DFW), Government of Kerala has very good library at the campus of the office of the Conservator of Forests in Thiruvananthapuram⁷. Then KAU has a Colleges of Forestry (COF) at its main campus in Thrissur. Tropical Botanical Garden and Research Institute (TBGRI), Palode; Kerala State Land Use Board (KSLB), Thiruvananthapuram and Centre for Development Studies (CDS) have very valuable document collections on forestry, agro forestry, soil science, water and irrigation, meteorology, and related fields. Details of the book collection available at the above institutions are presented in Table 5.2 B. KFRI (39%), DFW (32%) and COF (18%) have the largest collections of books on this subject and among them KFRI ranks first.

Journals in Forestry subscribed by major institutions specializing in forestry and related areas are also presented in Table 5.2 B. KFRI subscribes to 36 journals which is the largest group (25 %) of the total journals in forestry related areas.

The books and current journals in forestry related topics available at the institutions specializing on that subject area is graphically presented in Figure 5.3.

Crop Science and Horticulture

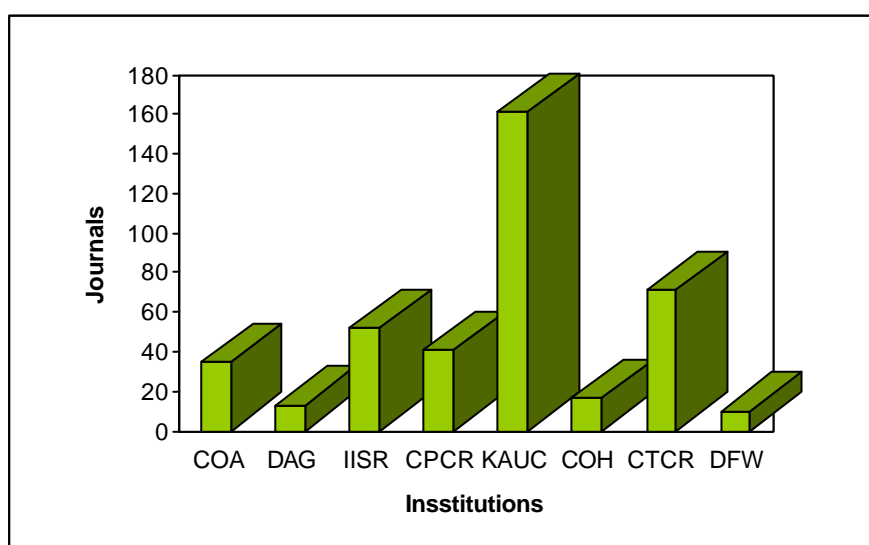
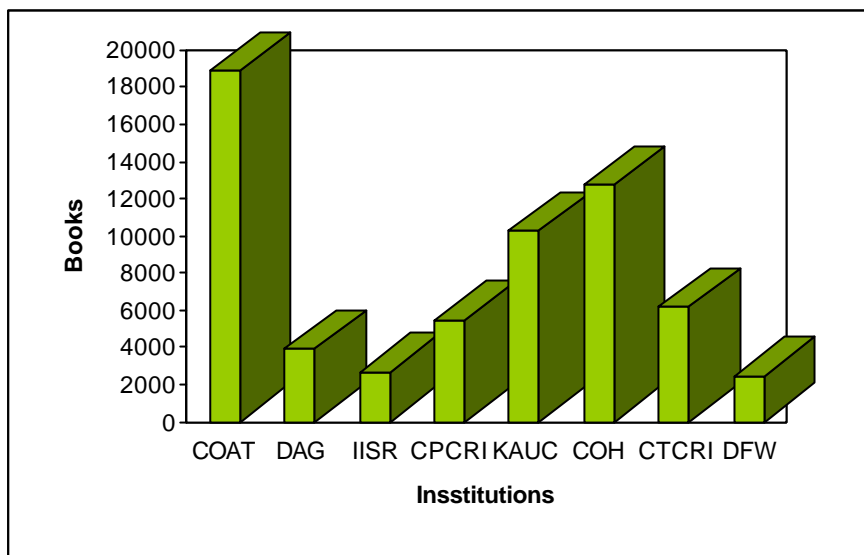


Figure: 5.2: Information Resources on Crop Science and Horticulture in Major Collections

Forestry, Soil Sciences and Water

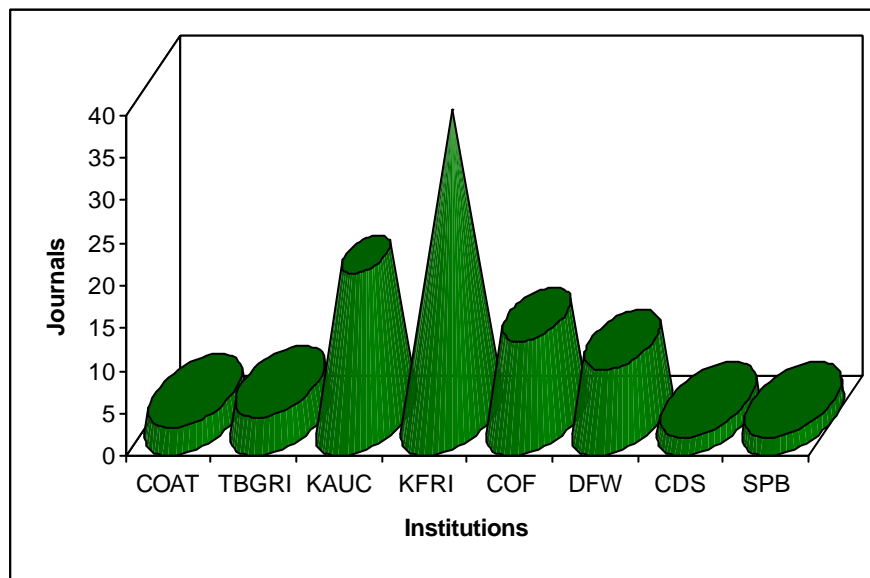
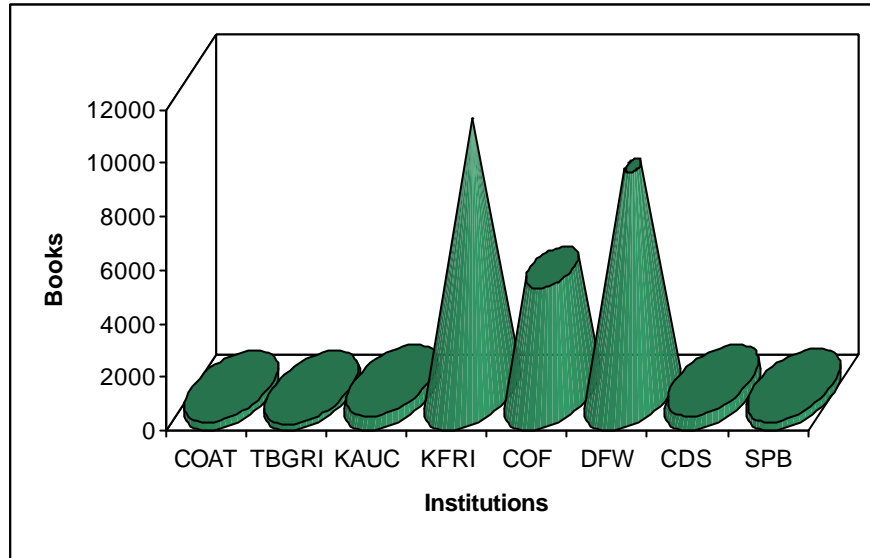


Figure: 5.3: Information Resources on Forestry, Soil Sciences and Water in Major Collections

5.3.3. Veterinary and Animal Sciences

KAU has three colleges conducting education, and research in veterinary and animal sciences and related areas. They are Colleges of Veterinary & Animal Sciences (CVA), at Mannuthy in Thrissur as well as at Pookode in Wayanad and the College of Dairy Sciences and Technology at Idukky. There are also a few research stations of the KAU related to animal sciences with information resources⁸. Department of Animal Husbandry (DAH) of Government of Kerala also has a small library and book/document collections at various divisions under it. The details of the information resources available at 8 selected institutions are presented in Table 5.2 C. CVA has the largest collection of books on veterinary & animal sciences that is 14950 books coming to 56 % of the total collection.

Journals in veterinary and animal sciences, diary sciences etc subscribed by the 8 major concerned institutions is also presented in Table 5.2 C. CVA subscribes to 68 journals which is the largest group coming under veterinary and animal sciences consisting of (33%) of the total journals in veterinary and animal science related topics. The book collections in veterinary sciences and allied areas as well as the current journals in veterinary and animal sciences, diary science etc subscribed by 8 institutions specializing on that subject area is graphically presented in Figure 5.4.

5.3.4. Fisheries

In the areas of fisheries also major institutions in Kerala are run by KAU and ICAR. College of Fisheries (CFIS) at Panangad, Cochin comes under KAU. Two other institutions in the area are Central Institute of Fisheries Technology (CIFT)⁹ and Central Marine Fisheries Research Institute (CMFRI) at Kochi coming under ICAR¹⁰. Government of Kerala has a Directorate of Fisheries, which also has a library and book collections at some divisions/offices. Then there is an NGO named Programme for Community Organization (PCO), which has a Fisheries Research Cell having a strong information resource base on fisheries in Kerala. Information resource on

Veterinary and Animal Sciences

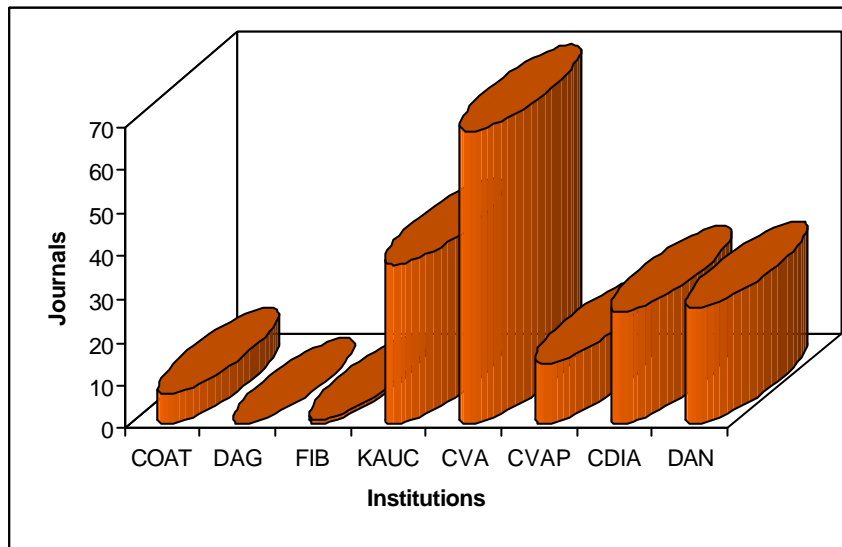
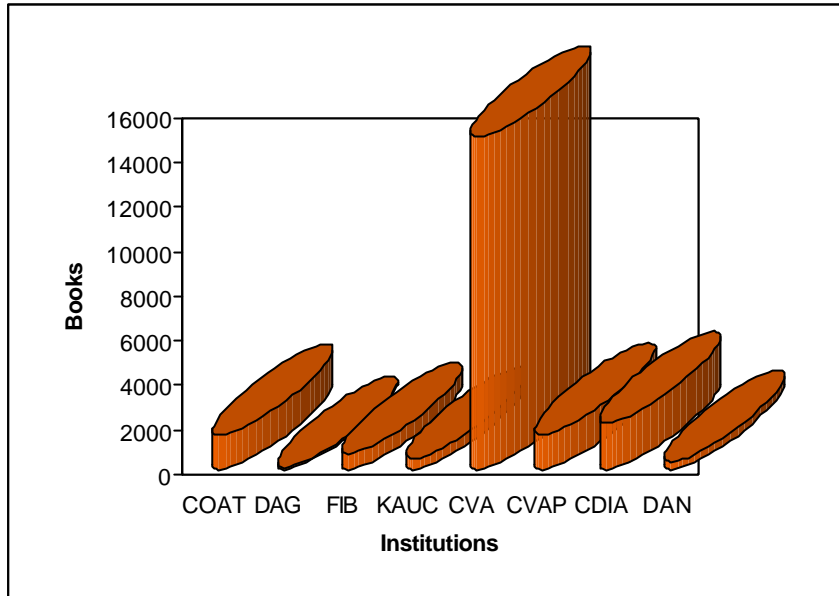


Figure: 5.4: Information Resources on Veterinary and Animal Sciences in Major Collections

fisheries and allied areas available at the 8 major institutions is presented in Table 5.2 D. CIFT holds the largest collection of books (3751) on fisheries and allied areas which comes to 28% of the total collection.

As per the data presented in Table 5.2D among the 8 major institutions dealing with fisheries and related areas CIFT subscribes to 27 journals which is the largest group coming under fisheries (25 %) of the total journals in fisheries in agricultural sector.

The book collections on fisheries as well as journals in fisheries and related areas subscribed by 8 institutions specializing on fisheries related areas are graphically presented in Figure 5.5.

5.3.5. Agricultural Economics

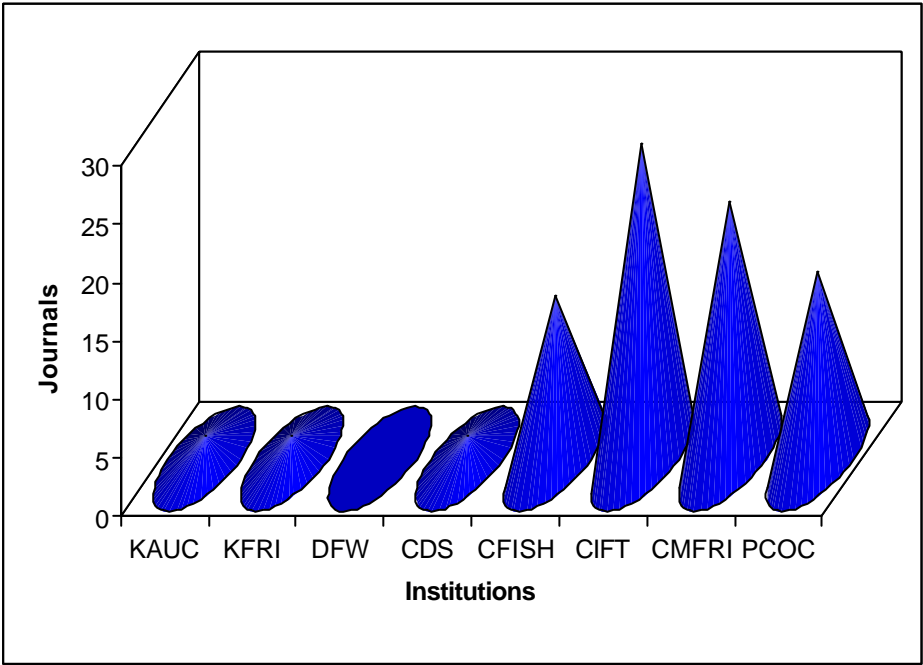
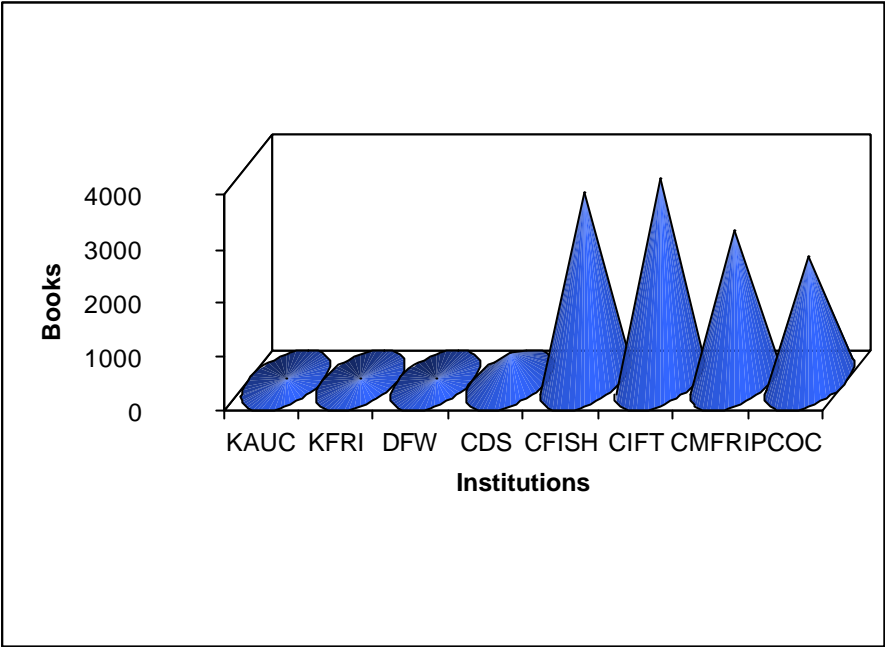
College of Co-operation, Banking & Management at Thrissur functioning under KAU has the largest collection of documents on agricultural economics consisting of 6750 books coming to 33% of total collection in agricultural sector and 33 journals coming to 12% of current journals subscribed on agricultural sector. Centre for Development Studies has also got an information resource base on agricultural economics, marketing, banking, cooperation and related areas¹¹. Then State Planning Board, Department of Economics and Statistics etc under Government of Kerala also have very good information collection on the subject areas. A tabulated statement of the available resources is given in Table 5.2 F

The books and journals on agricultural economics and related areas subscribed by 8 major institutions specializing on that subject area is graphically presented in Figure 5.6.

5.3.6. Agricultural Engineering

The only major institution having a considerable collection of information resources on agricultural engineering is the College of Agricultural Engineering &

Fisheries and Marine Biology



Agricultural Economics, Statistics and Marketing

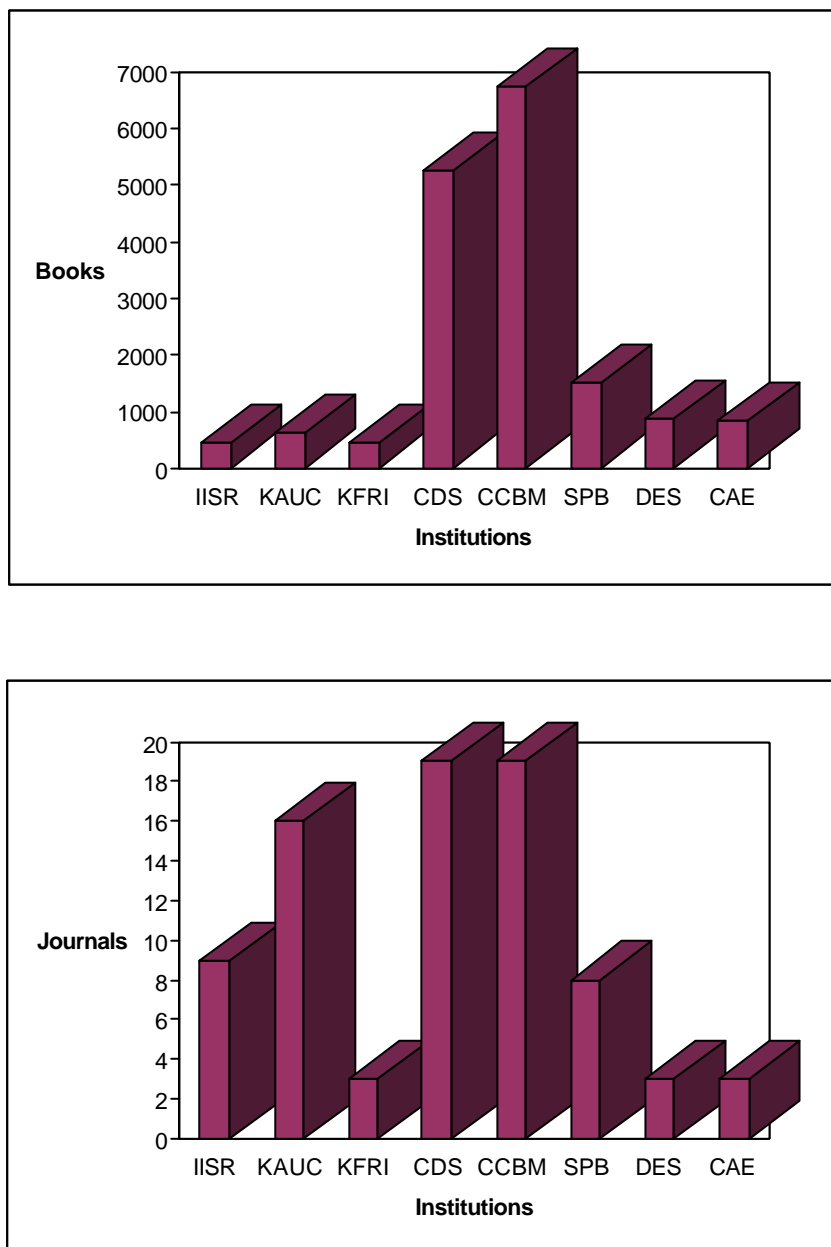


Figure: 5.6: Information Resources on Agricultural Economics Statistics and Marketing in Major Collections

Technology (CAE) at Thavanur coming under KAU. Then Kerala Agro Machineries Corporation (KAMC) also has a small collection of books and journals on related areas. Many of the institutions under KAU, ICAR etc also hold collections on agricultural engineering. The book and current resources available at 8 major institutions are presented in Table 5.2 E.

CAE subscribes to 16 journals, which is the largest group (40%) among the total journals in agricultural engineering subscribed in Kerala. The books and journals in agricultural engineering and related areas subscribed by various institutions concerned with that subject is graphically presented in Figure 5.7.

5.3.7. Agricultural Informatics and Extension

Agricultural Informatics is emerging as an important subject area under agricultural sciences. In general all institutions engaged in collection, organization, storage, repackaging, and dissemination of agricultural information as well as the institutions doing research and development on the technologies for handling agricultural information are concerned with this subject of current importance. Even the present study comes under the purview of agricultural informatics.

Being an area of recent origin even though various activities have been initiated, institutions and resources on this subject area are very limited. ICAR or any SAU have not yet taken initiative for the establishment of an institution specializing in agricultural informatics in India. But there are some institutions coming under its sub fields like ICAR Institute for Agricultural Statistics. Presently only one organization in India specializes in this area. It is Centre for Agricultural Informatics (CAGI), which is an NGO based in Kannur. KAUC also has facilities and resources on agricultural informatics. The resources available in Kerala being very scanty it is covered under the class agricultural engineering and technology for the present study.

Agricultural Engineering and Technology

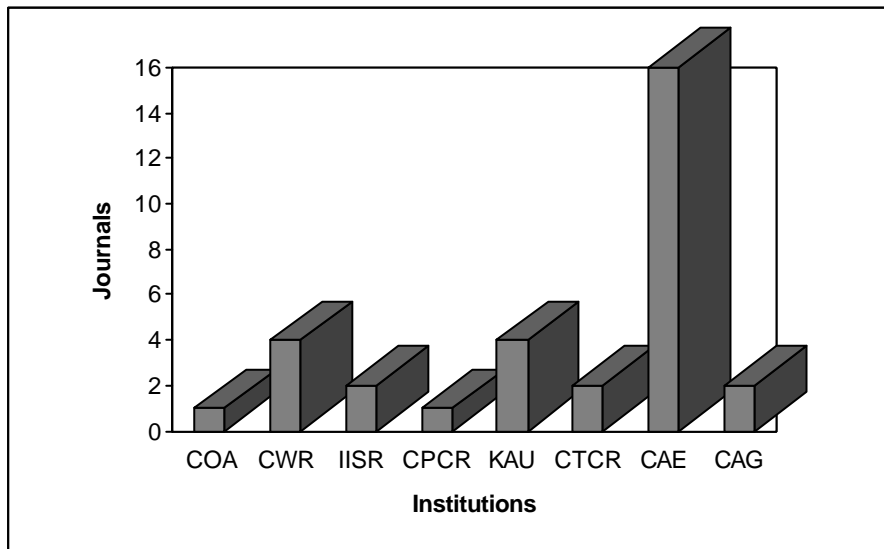
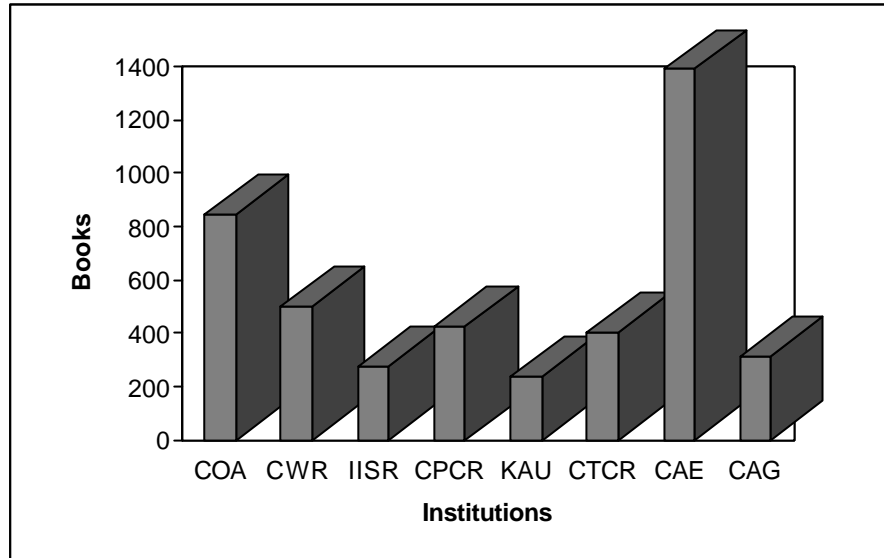


Figure: 5.7: Information Resources on Agricultural Engineering and Technology in Major Collections

5.4. Duplication in Journal Subscriptions

Details of the journals subscribed by 30 major institutions in the agricultural sector of Kerala were used to study their cost effectiveness and optimum utilization. Table 5.3 shows the duplication in journals subscribed by the major institutions during the year 2002-2003. They together subscribed 1545 journals. Among them 659 are foreign. But all these institutions together received only 891 different titles, which include 360 foreign titles also. This means that more than one copy of these 891 journals is subscribed in Kerala. So 654 subscriptions pertain to duplicate copies.

Table 5.3: Journals Subscribed by the 30 major Agricultural Institutions in 2002-2003 Showing Extent of Duplication

	<i>No of Titles</i>	<i>Indian</i>	<i>Foreign</i>
Total Subscriptions	1545	886	659
Total Titles	891	531	360
Duplication	654	355	299

5.4.1. Foreign Journals Duplicated

Data on foreign journals subscribed by the 30 major institutions collected for the study showed that even though these institutions together subscribed 659 foreign journals they received only 360 titles. Of these 202 journals have only one subscription. But the remaining 158 foreign journals are subscribed at more than one institution. Details of the journals duplicated at more than one institution are presented the Appendix – 7. So, for the 158 titles, there are 457 subscriptions. Duplication goes up to 8 copies for many titles.

5.4.2. Cost of Duplication in Foreign Journals

Details of two sample groups of journals duplicated are presented below to show the nature of wastage of resources due to duplication. The first group consists of journals costing Rs.1 lakh or more duplicated in two or more institutions. Second

group consists of journals costing Rs.50000 or more duplicated in two or more institutions.

Of the 158 foreign journals duplicated 12 titles costing more than Rs.1 lakh are subscribed in 2 or more copies. Table 5.4 presents the cost per single annual subscriptions of the 12 journals subscribed in the agricultural sector. It also presents the total cost for each title including cost of the duplication that is presently met.

Table 5.4: Details of Journals Costing more than Rs.1 Lakh Duplicated.

Title	Institutions	No	Cost	Total Cost
Theoretical and Applied Genetics	KAUC, COAV	2	239400	478800
Journal of Hydrology	CWRD, CAE	2	232000	464000
Aquatic Sc and Fisheries Abstracts	CUSA, CIFT, CMFRI	3	227000	681000
Chemical Abstracts	KU, CUSA, CIFT	3	225000	675000
Biological Abstracts	CMFRI, KU, KAUC	3	225000	675000
Current Contents – Agri, Bio & Envi Sc	CTCR, CPCRI, CUSA, KAUC, KFRI	5	215000	1075000
Analytical Biochemistry	KAUC, COHV, COAV	3	200300	600900
Analytical Biochemistry	KAUC, COHV, COAV	3	200300	600900
Current Contents - Life Science	CUSA, RGCB,	2	175000	350000
Aquaculture	CFIS, CIFT, CMFR	3	154850	464550
Biotechnology Citation Index	RGCB, CUSA	2	112750	225500
Euphytica	IISR, CPCRI, CTCR, KAUC, COAV	5	110800	554000
		36	2317400	6844650

The total cost of single subscription for the 12 journals comes to Rs.23, 17, 400. But the total expense towards subscription of these journals including their duplicate copies is Rs.68, 44,650. The expense towards subscribing duplicate copies comes to Rs.45, 27,250.

Among foreign journals 14 titles costing between Rs.50, 000 to Rs 1,00,000 are subscribed in more than one copy. Table 5.5 presents the cost per single annual subscription of the 14 journals as well as total cost including cost of the duplication of each title presently subscribed.

Table 5.5: Journals Costing Rs.50000 to Rs. 1,00,000 Subscribed by Five or More Institutions

Title	Institutions	No	Cost	Total Cost
Plant Breeding Abstracts	KAUC, CPCRI, CTCR, COAV	4	74800	299200
Scientia Horticulturae	KAUC, CPCRI, COAV, COAP,	4	74050	296200
Agricultural Water Management	CWRD, COAP, CAE, CPCR	4	71800	287200
Plant Cell Tissue and Organ Culture	TBGR, CPCRI, IISR, CTCR, KAUC	5	68342	341710
Field Crop Abstract	KAUC, CTCR	2	64800	129600
Journal of Fish Disease	CFIS, CIFT, CMFR	3	64720	194160
Plant Cell Reports	IISR, TBGR, COAV, CPCRI, KAUC	5	61088	305440
Journal of Applied Entomology	IISR, CPCRI	2	59950	119900
Journal of Ethno Pharmacology	TBGR, RGCB	2	55499	110998
Marine Pollution Bulletin	CIFT, CUSA	2	54921	109842
International Journal of Food Sc and Tech	CIFT, CUSA	2	53506	107012
Agroforestry Systems	COF, KFRI	2	51690	103380
Aquaculture Research	CFIS, CIFT, CMFR	3	50719	152157
Journal of Insect Physiology (2003)	KAUC, COAT	2	99850	199700
		42	905735	2756499

The total cost of one copy each of the 14 journals comes to Rs.9, 05,735. But the total expense towards subscription of these journals by 14 institutions is Rs.27, 56,499. The expense towards subscribing duplicate copies comes to Rs.18, 50,764.

It is seen that 22 foreign journals costing between Rs 25,000 and Rs 50,000 are subscribed in more than one copy that is from 2 to 8 copies. The total cost of one copy each of the 22 journals comes to Rs.7, 33,914. But the total expense towards subscription of these journals in more than one copy is Rs.23, 98,170. The expense towards subscribing duplicate copies of these 22 journals comes to Rs.16, 64, 256.

A group of another 54 foreign journals costing between Rs 10,000 and Rs 25,000 are subscribed in more than one copy. The total cost of one copy each of the 54 journals comes to Rs.8, 91,082. But the total expense towards subscription of these journals in more than one copy is Rs.25, 81,637. The expense towards subscribing duplicate copies of these 54 journals comes to Rs.16, 90,555.

The total cost of subscription of the above 158 journals without duplication is Rs.51, 59,103. But total amount spend by the agricultural sector of the State for this

158 journals is Rs.154, 51,613. Out of this Rs.102, 92,510 per year go for duplicate copies of the 158 foreign journals.

5.4.3. Quantum of Duplication in Foreign Journals

The data collected reveals that 1 journal costing more than two lakhs rupees per year is duplicated at 5 institutions, 5 journals each costing more than two lakhs per year are subscribed at 3 institutions, another 2 journals each costing more than two lakhs rupees per year are duplicated in 2 institutions. 4 journals each costing between one lakh to two lakh rupees each per year is duplicated in 2 to 5 institutions.

It is seen that 2 journals each costing Rs 50000 to 100,000 each per year is duplicated in 5 institutions. 11 journals of the same cost range are duplicated in 2 to 5 institutions.

The above facts reveals that that the 158 foreign journals costing Rs.1000 to Rs.2, 50,000 per title are duplicated in 2 to 8 copies in the agricultural sector of the State.

5.4.4. Need to Avoid Duplication

Most of the institutions subscribing the same title have similar functions related to education, research, extension, and development, which require these journals. But most of these journals are very costly and their price is going up year after year. More than that they cost our foreign exchange. Library budget also shrinks making even the journals subscribed last year out of reach in the current year. But number of journals reporting research and development in agriculture increase day by day. In such circumstances it is very important to examine critically each and every costly journal procured in more than one institution in the State. A resource-sharing programme, which may not cause any loss in available information service facilities, is to be devised. Unless such a resource-sharing programme is implemented even with improved allotment for journal subscriptions the institutions cannot continue all journals subscribed at present.

The analysis of data on cost of current subscriptions points to the need for a resource sharing program as suggested above especially for the foreign journals presently subscribed by more than one institution.

It is found that 1545 journals subscribed in 30 institutions costs a total of (Table 4.20) Rs. 208 lakhs. From this subscription paid by the major institutions for 158 foreign journals having a total of 459 subscriptions costs Rs.155 lakhs. Out of these Rs. 155 lakhs Rs. 103 lakhs per year goes only to the subscription of duplicate copies of 158 foreign journals. But subscription without duplication will cost only Rs. 52 lakhs. The duplication of these 158 journals wastes an amount of Rs.103 lakhs. This comes to 49 % of the total budget (Rs.208) available to the major institutions of the agricultural sector for journals.

This is because each institution operates in isolation and it attempts to become self-reliant in providing information support to its users. But in these days of information explosion, flooding of documents and use of different media to record information as well as different methods of information storage and dissemination, self reliance is only a myth

Instead of spending this huge amount for duplication, these institutions can come to an agreement on cooperation for use of these journals. If so the institutions can spend the amount of Rs.103 lakhs of duplicate subscriptions for meeting the escalating journal cost which results in stopping currently subscribed journals. For the remaining amount new journals in emerging fields of agriculture like biotechnology, agricultural informatics etc also can be subscribed. So instead of foreign journal titles worth Rs. 98 lakhs made available presently for the users of 30 institutions, they will be able to have foreign titles worth Rs.155 lakhs at their disposal under a resource-sharing programme.

As the institutions in agricultural sector together utilize 72 % (Table 4.7) of their allotment for collection development and as a major part of this is wasted on duplication of foreign journals the important area for specialization and resource sharing in agricultural sector is journal subscriptions.

The data proves that a resource-sharing programme on foreign journals subscribed, at least by institutions under ICAR and KAU functioning in the region will be a meaningful and cost effective exercise.

5.5. Databases in CD ROM

The next area where resource sharing is to be considered is databases in agriculture, biosciences and allied areas. These databases are mainly published in CDROM by international organizations or other agencies mainly from foreign countries and are subscribed by a few of the institutions in agricultural sector. They have also their printed equivalents in full or as different sub subject sets. In institutions like KAUC (35%) and CPCRI (26%) considerable portion of allotment for collection development is utilized for such electronic publications.

Table 5.6: Agricultural Databases in CDROM Subscribed in Duplicates in Kerala

Databases in CDROM	Institutions	No	Cost	Total Cost
AGRICOLA	KAUC, CPCRI, RGCB, COAT	4	24000	96000
AGRIS	KAUC, CTCRI, CPCRI, COAT	4	30000	120000
Current Contents – Agri Biology and Env Sc	KAUC, CTCR, CPCRI, KFRI	4	125000	500000
Aquatic Biology, Aquaculture & Fisheries Resources	KAUC, CIFT, CFIS,	3	175000	525000
ASFA -Aquatic Sciences & Fisheries Abstracts:	KAUC, CIFT, CFIS,	3	215000	645000
Biological Abstracts	CMFRI, KU, KAUC	3	225000	675000
CAB Abstracts Updates	KAUC, COAT, KFRI, IISR	3	250000	750000
Chemical Abstracts	KU, CUSA, CIFT	3	225000	675000
CAB Abstracts: Archives License:1972-2003	KAUC, IISR	2	1200000	2400000
CAB Tree CD	DFW, KFRI	2	45000	90000
Tropag & Rural CD.	CPCR, COAT	2	97000	194000
		33	2611000	6670000

These databases are highly relevant to most of the institutions in agricultural sector. But due to their high cost they are not affordable. Due to official restrictions and lack of facilities such titles subscribed by a few institutions are not presently accessible to users from other institutions. Table 5.6 shows the extent of duplication in subscription to Databases in CDROM.

Against a total of 52 subscriptions of databases costing Rs.107 lakhs the libraries received only 30 titles costing Rs.40 lakhs. Duplicate copies of 11 titles related to agriculture are subscribed in Kerala. There is a net wastage of Rs.67 lakhs due to this duplication. A resource-sharing programme can save this amount. The amount so saved can be utilized to subscribe additional titles so that more information resources will come within the reach of these institutions.

The above databases in agriculture, fisheries and related areas are most important reference sources for agricultural research. They are costly and consume considerable foreign exchange. Purchase of back files of these databases from 1971, which is also essential in research institutions, may cost ten times more than their current subscription or license fee. Most of the libraries in agricultural sector require these reference sources. But of the 30 major institutions only 11 are having these resources. And they can individually provide their clientele access to only two or three of these titles subscribed by the concerned institution. Approximately 50 titles of relevance to agricultural sector are available from major sources¹². Their total cost comes to approximately Rs.60 lakhs. The libraries together spend Rs.99 lakhs, but subscribe only to 30 of the 50 titles actually costing a total of Rs.40 lakhs. Each institution gets access to two or three titles only. By a resource-sharing programme the libraries can subscribe to all the 50 titles at a cost less than that is spent presently to subscribe 30 titles. The savings can also be used to acquire back files of important databases.

5.6. Reference Sources in Digital Form

Various Reference Sources in digital form are available in the libraries of KAUC, CPCRI, IISR, CAGI etc. They include, Reference books, subject book collections, back files of abstracting journals, complete collections of back volumes of primary journals etc. The cost of these materials ranges from Rs.1000 to R.10 lakhs per title. A few of the samples that can be cited are the complete books published by 18 international agricultural institutes under CGIAR up to 1986, full set of back volumes of National Geographic Magazine from 1888 to present, PhD thesis collection of KAUC on agriculture etc. The content of back issues from 1971 to present of 18 abstracting journals listed in Appendix - 8 is also available in digital

form in CAB Abstracts full set available at KAUC. The list of Reference Sources in digital form available at the libraries that could be identified by the present study is listed in Appendix - 9. A resource-sharing programme can publicize the availability of these materials by publishing printed or web based catalogues etc. Sharing these resources with other institutions can effect savings of space and cost of binding, indexing etc of their printed equivalents.

5.7. Agriculture Related Theses Collections in Universities

Theses and dissertations form vehicles transferring information and knowledge generated by the research conducted in our universities for doctoral and other degrees. The major collections of theses are in the Kerala Agricultural University and its colleges. The collection includes PhD theses accepted by the university as well as dissertations resulting from research done for MSc in different branches of agriculture.

The survey for present study revealed that KAU is having a collection of 3870 theses of which 278 are PhD thesis. Visits to libraries of traditional universities also revealed that PhD thesis on subjects relevant to agricultural sector exist in their collections also. The other seven universities may also be having a large number of theses related to agricultural and bioscience related areas.

A detailed evaluation of the PhD theses collection in four major libraries under KAU and four departments under one traditional university, which would have conducted research in areas relevant to agriculture, was done for the present study. The analysis revealed that the four KAU libraries have together 190 PhD dissertations in their collection, which are relevant to agricultural sector. The four departments of one traditional university contained 70 dissertations relevant to agricultural sector. The list of the dissertations in these collections is appended in Appendix – 10.

As revealed by the list in Appendix – 10 the dissertations deals with various aspects of agriculture and biosciences and are useful knowledge sources that can support crop protection, sustainable animal rearing and fisheries and qualitative improvement of farming using improved production technology developed by

research. Knowledge contained in such thesis collections need to be conserved, organized for use, publicized and disseminated. It should be made public and accessible so that the findings may be applied in the agriculture sector.

The theses available in collections of KAU, and other universities in Kerala are presently not easily accessible. They are beset with many problems like lack of systematic acquisition, lack of access, uncertain publication practice etc. Only very few dissertations accepted by our universities get published. Unpublished thesis is filed only in the concerned university or department library, which even, is not having a complete collection of thesis approved by the concerned university. For accessing available ones also there are too many restrictions.

In agricultural sector missing information about completed, ongoing and proposed research is one factor causing delay in development as well as waste of resources. Most of the earlier research work particularly those conducted by traditional universities never comes to the notice of scientists working on the same or related areas in agricultural sector. Theses are little used and little cited. Public money, intellect, efforts and time spent for research fails to get applied and be of any use to the society. The poor documentation and research co-ordination causes research duplication resulting in considerable resource loss to the nation.

Information generated by research is our nation's valuable resource. It should be transparent, available for application/quality assessment as well as for use by our scientific community. Hence it is the duty of concerned organizations to make the findings of agricultural and biosciences research accessible throughout the State and the country for the development of agricultural sector and for extracting the benefit of the resources spent on research.

5.7.1. Audio Visual Collections

Audiovisual materials are very important in the collections of agricultural institutions that have to deal with education, and extensions activities. A few of the organizations in Kerala like CPCRI, CAGI etc also produce audiovisual materials on agriculture. The major collection of audiovisual materials is KAUC. It consists mainly

of video films video lectures etc on different aspects of agriculture, useful for teaching, extension programmes, awareness programmes among farmers, tribal groups and the general public and also for training. A few other institutions also hold collection of audiovisual materials but the collection strength is very meager.

The strength of audiovisual materials available at the libraries having such collections is presented in Table 5.7.

Table 5.7: Audio Visual Documents on Agriculture Related Subjects

Institutions	Collection	No of Titles
KAUC	600	233
CAGI	18	18
CPCRI	15	15
PCOC	07	07
DFW	05	05
FIB	05	05
COF	02	02
Total	683	285

The list of audiovisual materials available at the seven libraries having such collections is presented in Appendix - 11. The list shows that these items are on very important topics related to agriculture, animal rearing, fisheries, environmental conservation, health, food habits, food technology, and sustainable development. The titles can be found to be highly relevant to agricultural education and also extension activities. These titles are rare and may not be available through normal trade channels. This is one reason for their non-availability in other institutions. But the subject coverage denoted by the titles reveal that they are very relevant to the activities of most of the institutions in agricultural sector especially KVKs and Krishi Bhvans which undertake extension programmes and go to the farm. But these institutions building collections of titles relevant to them from this list may not be viable due to the non-availability of these documents. Copying and using them from KAUC or other libraries where they are available is also is not possible due to copyright norms. Hence a resource sharing programme for these audio visual materials only will be possible for providing accessibility to this valuable resource. Such a programme can boost up the extension and educational activities of most agricultural institutions in the State. Hence the institutions holding the collection can

prepare a copy, preferably in digital form with permission of the copyright holders. This can be loaned at a nominal charge, which will meet the expenses of reproduction to other institutions within the restrictions imposed by copyright holders of concerned titles.

5.7.2. Other Collections

The maps prepared in-house by some of the institutions come to about 1925. In addition to the above documents like books, journals, theses, CDROM databases and audiovisual materials the libraries hold significant collections of reports, maps, posters etc. Most of them are in-house generated documents. These documents are prepared at huge expenses and they being unpublished are not available for the use of other institutions.

All these documents are of importance and relevance to the activities of the agricultural institutions in the State. Sharing these resource can really boost up the overall development of the agricultural sector. Hence this is another area where also resource sharing becomes very important so that the public money spent for research and development becomes useful to the State as a whole.

5.8. Other Areas for Resource Sharing

There are also many other areas related to library services, which can be made more productive, and efficient by cooperation. Technical processing works like classification, cataloguing etc, data entry in computers, preparation of union catalogues, OPACs, production of bibliographies and abstracts, HRD etc can be done cost effectively under resource sharing programme.

5.8.1. Technical Processing

In most of the libraries in agricultural sector in Kerala the collection is not classified, catalogued and arranged accordingly. In the major institutions that are processing their collection according to accepted standards the work is costly. The important technical works to be done during the processing of materials in the

collection as well as when new additions are received are classification, cataloguing, and or data entry into some DBMS. The data from various institutions collected for the study as well as personal visits and examination of the book collections revealed that there is a large extant of duplication among various institutions. Two to seven libraries may hold the same title and the same processing is done two to seven times in total by all the libraries involved. So processing of different copies of the same document at different libraries is a waste of resources. To avoid this major library or group of libraries can make available in digital form as per prescribed standards a catalogue of their new additions periodically to all libraries. They can also make available an online public access catalogue of their holdings to libraries participating in a resource-sharing programme. The other libraries can copy the data for their new acquisitions or download the records related to their newly acquired tiles. This will avoid huge waste of human and financial resources caused by the duplication of the work in many libraries. But this will require the following of same standards for cataloguing classification, computerized databases etc by libraries participating in the programme. So a prior agreement on bibliographical and DBMS formats standards and formats is essential.

Table 5.8 Standards Used for Processing and Data Entry

<i>Scheme</i>	<i>Major</i>	<i>Minor</i>
<i>Classification</i>		
DDC	11	02
UDC	02	00
CC	08	04
Own	01	03
None	08	21
<i>Cataloguing</i>		
AACR	07	02
CCC	10	04
Own	02	02
None	09	20
<i>Software</i>		
ISIS	14	04
Other	06	02
None	10	20

Table 5.8 shows the variations in cataloguing, classification and computerized database management system used by various libraries.

For Classification 11 institutions use DDC, 2 institutions UDC, 8 institutions CC and 1 institution their own scheme. 8 institutions have no schemes or standards.

Of the thirty major institutions 9 uses AACR, 10 CCC and 2 their own schemes for cataloguing. 9 have no specific standards or schemes.

Of the 30 institutions 14 uses CDS/ISIS for database development. 6 use other software. 10 institutions have no software for database management.

KAU central Library uses DDC and AACR as well as CDS/ISIS for database management. It also follows CCF formats promoted by UNESCO as well as INFLIBNET.

If resource sharing in regard to technical processing of books and database development is to be made possible all the participating libraries have to follow some uniform standards. As regards to already processed collection this will require huge quantum of work to reprocess the materials. So what can be done in this regard is reprocessing of live collection within a specific period by a team under some resource-sharing programme. The remaining collection is to be reprocessed according to a phased programme.

It is better to use standards prescribed by INFLIBNET. Even though a parallel information system named ARIS is functioning under ICAR they have not yet developed any standards in regard to library. But INFLIBNET has recommended the use of DDC for classification, AACR for cataloguing as well as CCF for database development. Majority of institutions in India uses INFLIBNET standards. It has also developed library automation software ILMS, which can be used by libraries in agricultural sector participating in the resource sharing, programme. KAU and many libraries under it have developed their databases using CDS/ISIS in CCF format. This data can be easily transferred to ILMS. This will make easier a union catalogue of documents available in agricultural sector in Kerala under a resource-sharing programme. Recently KAU has also decided to use the SOUL Software developed by INFLIBNET for their library automation.

5.8.2. Documentation Services

Providing various information services to the user group in agricultural sector using the collection and other facilities available is also very important.

Various specialized information services offered by libraries in agricultural sector are presented in Table 4.27. From the discussion on information needs of the scientists, students, administrators, farmers and others done in Chapter 1 it is clear that all those in agricultural sector require specialized information services.

a) Services Based on Agricultural Databases: Some of the institutions are subscribing to major agricultural databases like CABI, ASFA, MEDLINE, etc. Records related to agro climatic regions relevant to Kerala could be downloaded from these sources at the institutions subscribing them. These records can be transmitted digitally to an institution, which can give leadership in resource sharing of such documents. These items can be organized and prepared into a database for circulation among the institutions participating in the resource-sharing programme.

b) Content Pages of Journals: Due to the increasing cost of journals and static or decreasing library allotments many institutions are discontinuing subscription to various journals. So the only option is to establish a resource-sharing programme in regard to journal subscriptions. In such a resource-sharing programme each library can prepare and circulate a fortnightly or monthly bulletin of content pages of the journals received in those institutions to all participating libraries. It is advisable that an institution takes the leading role in this service and it should receive the content pages from all institutions preferably through e-mail as scanned images on daily basis and prepare copies of bulletin or volume of the content pages and circulate the same to all participating institutions on fortnightly or monthly basis.

c) New Additions List: The institutions can also circulate a union new addition list for books. An institution like KAUC with required facilities can compile the monthly addition list pertaining to the libraries participating in the resource-sharing programme. It should be based on the records received in digital form from participating libraries through e-mail on fortnightly or monthly basis. Circulation of

such a catalogue of monthly additions to collections of all institutions with location specification will become possible only under a resource-sharing programme.

d) Abstracting Services: Monthly abstracts on agriculture and related areas limiting to the agro climatic region of Kerala based on journals and other documents received at participating libraries will also become possible under a resource-sharing programme. Abstracts of items received at each participating institution can be prepared as per some prescribed standards at each institution. This can be edited and entered into a computerized database at an institution that can give leadership for abstracting services. Fortnightly or monthly compilations of these abstracts can be circulated among the participating institutions. The records abstracted being those relevant to the agro climatic region it can serve as a very important tool for development of the region.

e) Subject Bibliographies: A resource-sharing programme has to identify and assign subjects to be specialized by selected institutions as discussed earlier in this chapter. Such institutions can prepare bibliographies on the area of their specialization. This will be very important to the State and nation for controlling the information resources and harnessing it for the development of agricultural sector.

f) Other Services: Resource sharing programme can enable inter library loan between participating institutions, photocopying on mutually agreed terms, maintenance of computerized union catalogues, publication of printed or CDROM versions of union catalogues etc. Establishing common storage facility for less used materials, common preservation labs and, common printing facilities etc also will become possible.

g) Possibilities for Resource Sharing: Documentation services are costly when done by individual institutions. If the services are provided jointly it becomes less expensive and more cost effective. Resource sharing in this regard will, more than lessening the cost, improve the scope, comprehensiveness, coverage, speed, quality and reliability. Now each and every library in agricultural sector in Kerala is trying to provide such specialized services and are attempting their best to meet the information needs of their users individually. But they confining only to internally available resources has become their limitation. In these days of information explosion, which

is true in agriculture sector also no institution can be self sufficient in their information resources. Basing the services to resources available in-house only, is dangerous in terms of quality and speed in research and development.

5.8.3. Human Resource Development

Library Science is one of the fastest changing professions influenced by ICT. Resource sharing programmes also require modernization of libraries and application of ICT. Hence library professionals require continuous up gradation of their knowledge, skills and techniques in information work. Training facilities especially in ICT are costly and each and every institution cannot establish their own training facilities. Hence under the resource sharing programme institutions with facilities for training in IT should take leadership in providing professional training to the librarians.

In the institutions covered by this study, KAU has excellent training facilities for librarians. KAU has a Center for Library and Information Science. The infrastructure available for the HRD programs attached to the center includes physical facilities required for a high-tech information system. The University Library building where the center functions has a plug and play type of Building LAN, digital storage facilities for text, video and sound files. The unit has an IT Laboratory, systems running on Windows NT and Digital Unix platforms, facilities for familiarizing DOS, Windows, NT, Unix, MS Office, Basis Plus, Techlib Plus, CDS/ISIS and various other library packages, CD networking, digital library management etc., The center has also Computer Based Training (CBT) programs on library and information management operations. Electronic library hardware includes Alpha Server for Digital Unix, Windows NT and other applications, Priors for Windows NT Server, Meridian CD Server, JVC Juke box systems and Pentium Workstations. Lecture hall is equipped with latest audiovisual aids, which include multimedia computers, VCR, Television and Davis Multimedia Projector for video and computer projection of presentations and CBT programs. A need based collection on computer application and other IT aspects consisting of textbooks, journals, CBT programs, etc is available at the CLIS for the reference of the participants of the programs.

The Centre has offered the following HRD programmes relevant to agricultural information systems¹³.

- a) Computers Application to Library and Information Services
- b) Modern Information Access Facilities
- c) Information Infrastructure: Concepts, Technology, Applications and Policies
- d) World Wide Web for Managing Agricultural Information
- e) Digital Presentation
- f) Managing Digital Libraries in Agriculture
- g) Library Services for People's Planning
- h) Internet for Education and Research

Hence KAUC can give leadership in HRD under a resource-sharing programme, which will extract the optimum utility of resources developed there.

5.9. Sharing the Resources

The above data reveals that it is very important to chart out some resource sharing programmes between the institutions in agricultural sector in Kerala. The programme should assign subject specializations to apt institutions. It should also define the guidelines on acquisition and sharing of journals, rare and costly reference sources in print, electronic publications, digital versions of databases as well as audiovisual documents, theses and research reports. A resource-sharing programme on this line will lessen the duplication of costly journals, books and databases. It will also ensure access to all the wealth of information resources held by the institutions in agricultural sector in Kerala to each and every institution and user. Teachers, researchers, extension workers, development activists, administrators, farmers and public will be benefited. Availability and accessibility to more resources at less cost by all institutions and to all concerned will become possible.

5.9.1. Factors Influencing Resource Sharing

Many other factors can influence the decision to select an institution to specialize on a specific aspect of the agriculture. The collections of other institutions on related subjects, as well as related subject departments of universities located near the institute can influence collection development and specialization of an institution. In agriculture geographical location of the institute also matters much. Institutes doing research on spices will be located in regions where spice is grown and naturally they will be in the same region. Like that institutions dealing with fisheries will be located near the coast and port. An example is Cochin where two ICAR institutes on fisheries; College of Fisheries of KAU as well as departments of Cochin University dealing with related subject areas are located.

The institutions located in such regions can develop their collections in association with other institutes located in the region under a common programme. By that full resources on that specific aspect of agriculture will become available to all those institutions. The resources through sharing programmes will become available to the whole agricultural sector of the State also. So the development of specialized collections can be made cost effective in all sub sectors of agriculture if undertaken on some logical sound rationale.

Applying the above logics the major collections on each of the six subject divisions of agriculture in about 8 largest holders of such collections are discussed in Section 5.3 above. The suggestions based on the factors identified are presented below.

5.9.2. Findings Relevant to Resource Sharing

When quantity of collection is considered libraries under KAU and ICAR tops the list. The collections in most of the institutions under KAU and ICAR are found to be adequate to serve the user community of those organizations. But the collections in other institutions especially under government departments are highly inadequate. The libraries in government departments have to serve a user community ten times more

in quantity than all other institutions. But it is having a collection of the size which is not even equal to five percent of the collection other institutions are having.

5.9.3. Assigning Subject Specialization

Data on subject representation in book and journal collections in 30 major institutions is presented in Table 4.14 and 4.21. Based on this data 8 institutions ranking one to eight in size of the collections on the concerned subject in each of the six sub fields of agriculture are taken for evaluating their possibilities for subject specialization and giving leadership for resource sharing.

From the data presented in section 5.3 above related to the collection of books and journals on major subjects under agriculture available in selected institutions the following suggestions can be made. Most of the six subject areas of agriculture are fairly represented in the collections of major institutions. According to the specialization of the concerned institute the one or more subjects get more coverage and the collection becomes a more reliable source of information for that subject. The data analyzed in Section 5.3 shows that in terms of strength in book collection the KAUC is rich for crop science and horticulture, CVA for veterinary and animal sciences, KFRI for forestry and related subjects, CIFT for fisheries related area, CCBM for agricultural economics, Marketing etc, CAE for agricultural engineering and technology. Hence these institutions may specialize on the concerned subject. They should give leadership to resource sharing on their subject to other institutions in the agricultural sector, which have to deal with the same subject.

KAUC holds the major collections of agricultural databases. But KAUC, CPCRI and CIFT can share the Titles for subscription in regard to CDROM Databases according to their specialization.

By such a sharing a total savings of Rs.65 lakhs per year can be effected even in the case of 121 foreign journals one of the sample areas taken for study. In CD ROM Databases a savings of Rs.24 lakhs per year is possible. This is considerable savings on recurring expenses for education and research in the agricultural sector of Kerala. In other areas also similar savings is possible. More than that all the

participating institutions will get more resources with less cost than earlier. Information resource worth crores of rupees now remaining under utilized will get their optimum use.

In the case of audiovisual materials, theses, dissertations, reports, maps, digital reference sources etc the cost effectiveness cannot be assessed like that of other materials acquired from outside sources. More than that they are not available in more than one institution. So resource sharing is not going to decrease any cost of collection development, maintenance or recurring expenses as in the case of subscription to journals. These documents being important sources of knowledge generated in-house huge expenses have already been met from public funds for the research and documentation. Being unpublished they never reach other institutes or public for use. Hence resource sharing will enable optimum utilization of the capital investments made for production of this knowledge content. By facilitating their use through resource sharing programmes, the knowledge they contain will become useful to the development of the country.

5.9.4. Requirements for Resource Sharing

To materialize efficient resource sharing programme all the participating libraries should have a collection development policy. Each library should evaluate the strength of the existing collection against the current and future teaching, research, extension and development programmes. The libraries should frame policies that can ensure consistent and comprehensive collection development in the areas mandatory to the institution.

5.9.5. Hindrances to Resource Sharing

The history of library development in Kerala can reveal that various resource sharing programmes and library networks have been planned and proposed during the last two decades. Some like KAULNET have been implemented. But they were not maintained after their commissioning and efficient initial phase. They have become non functional or have been wound up after a few years due to various reasons.

Presently in Kerala no library resource-sharing network is functioning effectively. The same is the case with many of the networks established in other States also.

The present study obtained the views of 77 librarians/officers in charge of libraries from institutions covered by the study in regard to the hindrances for resource sharing programmes. The responses of librarians are presented in the Table 5.9.

Table 5.9: Rating by Librarians of the Factors Hindering Resource Sharing Programmes.

<i>Instns</i>	<i>No</i>	<i>Plan</i>	<i>%</i>	<i>Lead</i>	<i>%</i>	<i>Coop</i>	<i>%</i>	<i>Reso</i>	<i>%</i>	<i>Fin</i>	<i>%</i>	<i>Com</i>	<i>%</i>
KAU	9	6	67	8	89	4	44	3	33	5	56	4	44
ICAR	5	3	60	3	60	2	40	4	80	2	40	4	80
MI	16	9	56	13	81	14	88	11	69	14	88	11	69
OM	47	27	57	35	75	40	85	38	81	41	87	39	83
Totals	77	45	60	59	76	60	64	56	66	62	68	58	69

The responses received on rating of various factors that may hinder Resource sharing Programmes were grouped into four. They are librarians from 9 major institutions under KAU, 5 institutions under ICAR, 16 other major research (MI) institutions dealing with agriculture and biosciences, and 47 minor institutions (OM) in agricultural sector. Of the 77 librarians who responded 45 coming to 60 % of the Librarians have stated that absence of planning is an important factor hindering resource-sharing programmes. Then 59 librarians coming to 76% also stated absence of institutional leadership as an important factor hindering resource-sharing programmes. Of the other factors hindering resource sharing programmes absence of spirit of cooperation (64%), inadequate resources (66%) inadequate finance and (68%) lack of communication (69%), were rated as high by the librarians.

The views of librarians belonging to the four groups of institutions and the average rating are graphically presented in Figure 5.8.

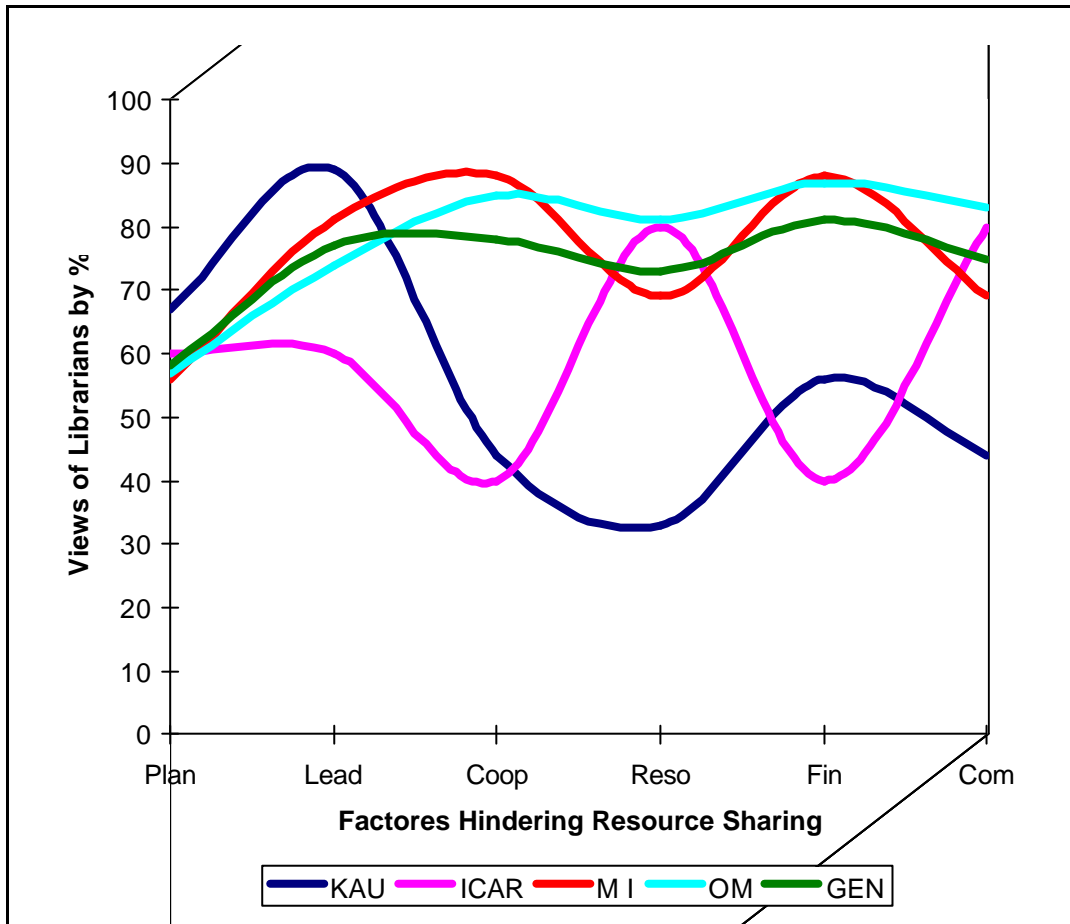


Figure 5.8: Rating of Various Factors That May Hinder Resource Sharing Programmes

5.9.6. Conclusion

When considered with the publisher's statistics and annual additions at ICAR library¹⁴ it is revealed that the book collection strength in agricultural libraries is not strong. Most of the new publications as well as information on current research in agriculture are escaping the attention of those in our agricultural sector, which will surely affect the quality, and speed of development. But if it is considered in the light of the financial resources that will be available to these libraries we cannot expect drastic changes or improvement in our resource allocations for collection development.

The options available to these libraries will be subject specialization in collection development by each institute. All institutions can lessen cost of collection development by limiting their acquisition to allotted specialization. By resource sharing programme access for all institutions to the total information resources available in the State at different specialized institutions will become possible. This will meet the information requirements on other area in which an institution is not specializing by getting access to concerned specialized collections.

From the analysis of the study it is to be concluded that an effective resource-sharing programme requires planned development of the institutions as well as competent and tough managers at the institutions. Well-defined areas for sharing resources, and assignment of specialization at the institutional level are also essential. There should be a detailed agreement on terms and conditions. A resource sharing programme even in selected areas like foreign journals, databases etc can effect considerable savings of recurring expenses for agricultural education, research, extension and development. It can also increase the quantum and quality of information resources available many times at cost lesser than that, which is presently, met.

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Chapter 6

AGRICULTURAL AND FARM INFORMATION SYSTEM FOR KERALA: A PROPOSAL

6.0. Introduction

Agricultural research in Kerala and the Country as a whole has come out with important techniques that could tremendously improve our production. We have scientists who are among leaders in the country and the world in various fields of agriculture. Our scientists have produced much high quality work. The State's agricultural sector has more than 6000 scientists and extension workers. They are spread through the institutions and stations coming under the ICAR, Kerala Agricultural University (KAU) and Departments of Agriculture, Animal Husbandry, and Fisheries of Government of Kerala.

But these institutions including the Krishi Bhavans receive numerous enquiries from enthusiastic farmers of all parts of the State. Most of their questions remain unanswered. It is because these institutions do not have a system, which can provide factual information on latest varieties, place of their availability and new techniques of increasing production. But the fact is that the technology and resultant information has been developed at huge public expense and the agricultural sector of the State is having them. But our agricultural institutions are not equipped to satisfy the information needs of the farmer efficiently in time. There is no data bank or agricultural information system in the State, which covers the Krishi Bhavans, and extension centers near the farm, which provides access to the extension activists and the farmer near their place of work.

We have a widespread agricultural extension network under Union and State governments. Kerala has a Directorate of Agriculture as well as Farm Information Bureau, and district level and village level extension workers including Village

Extension Officers. ICAR has also developed a first line extension system of which Krishi Vigyan Kendras (KVK) forms part¹. There are 9 KVKs in Kerala. The KAU, ICAR institutes and most of the undertakings, organizations and companies dealing with agricultural inputs have their own extension system. The AIR has a farm radio service and Doordarsan beams rural programmes in Malayalam from Thiruvananthapuram Station.

Even then, when a farmer, an extension worker, a scientist or an administrator looks for specific information related to agriculture it is not easily available². The transfer of new technologies generated by laboratories to the farmer's field is very low³. The exercise to collect information on any aspect of agriculture is very tiresome, time-consuming and results ultimately in unreliable and often outdated information.

6.1. Need for an AGFIS

In the absence of strong agricultural information network, production potential of different crops and livestock remain low even though technologies for better results have been developed from the years of painstaking research. Plans, policies and decisions related to agriculture development fail due to lack of correct information in time⁴.

So the present major challenge is to mould the vast resources of State's agricultural sector, including scientists, extension systems and research information into a more coherent whole. One of the most effective tools for doing so is Information and Communication Technologies (ICT). Kerala like Andhra Pradesh and Karnataka is also rapidly becoming a dominant figure in IT development, known particularly for its application at grass roots level. The marriage is therefore a natural one: agricultural research and information management.

To accelerate the pace and increase the productivity and efficiency of agricultural research, education extension and development in the State it is necessary to establish an information system and network. It should cover KAU, its colleges, ICAR Institutes, Research Stations, KVKs, Krishi Bhavans, Veterinary Hospitals, and

village libraries. It should ensure availability of need-based minimum computers at lower level institutions for creating local capabilities as well as for getting access to outside knowledge resources. In view of these factors this study proposes an Agricultural and Farm Information System (AGFIS) and Network, which is also based on the following assumptions.

- ?? Lack of systematic access to information is and will continue to be a serious constraint on both management and scientific decision-making in the State's agricultural sector. The problem is access. A large amount of information already exists in the sector, but in forms, which make its use by managers and scientists difficult.
- ?? Lack of access to information hinders the farmer from adopting current technology and sustainable methods of farming and animal rearing. This results in low productivity in agricultural sector.
- ?? ICT has the potential for bettering information management and by that production in agriculture.
- ?? Improving the information management in the agricultural sector has become important and urgent.

But too much technology and flooding of data will weaken rather than strengthen decision-making. The challenge is to strike a balance between three inter-related considerations.

- ?? The need for information.
- ?? The willingness of managers, scientists and farmers in agricultural sector to use information.
- ?? The capacity of these managers, scientists and farmers to manage both information and Information and Communication Technology (ICT).

6.1.2. The Objectives of AGFIS

Study reports and feasibility reports prepared for the INFLIBNET, ARIS, KAULIS etc can guide to formulate the objectives of the AGFIS. It will be a State

level network. Its goal will be to strengthen Information Management (IM) within the agricultural sector of the State of Kerala⁵. AGFIS will have four specific objectives.

- ?? Putting information close to the managers, scientists, extension activists, and farmers who will use it.
- ?? Improving the capacity of research organizations in agricultural sector to organize, store, and retrieve information relevant to their mandates.
- ?? Developing regular procedures and mechanisms for those organizations to share information.
- ?? As a result of the first three-to improve the capacity of those organizations to plan, monitor, and evaluate their research programs.

To achieve these objectives AGFIS will

- ?? encourage the participants to pool and share their resources so that a usable and exhaustive knowledge resource base required in the field of agriculture is built up and the limited funds are put to optimum use.
- ?? overcome time, space and language barriers in accessing and obtaining the desired document/information through compilation of web based union catalogues and promoting faster modes for delivery of documents.
- ?? facilitate access to national and international databases, information centers and networks in India and abroad dealing with agriculture.
- ?? evolve standards and uniform guidelines in techniques, methods, procedures, hardware, software and services and promote their adoption⁶.

6.1.3. The Concern of AGFIS

The AGFIS will primarily be concerned with information management, not Information and Communication Technology (ICT). The simple tree of means and ends as defined by Annon⁷ which can make this point clear, is presented in Figure 6.1.

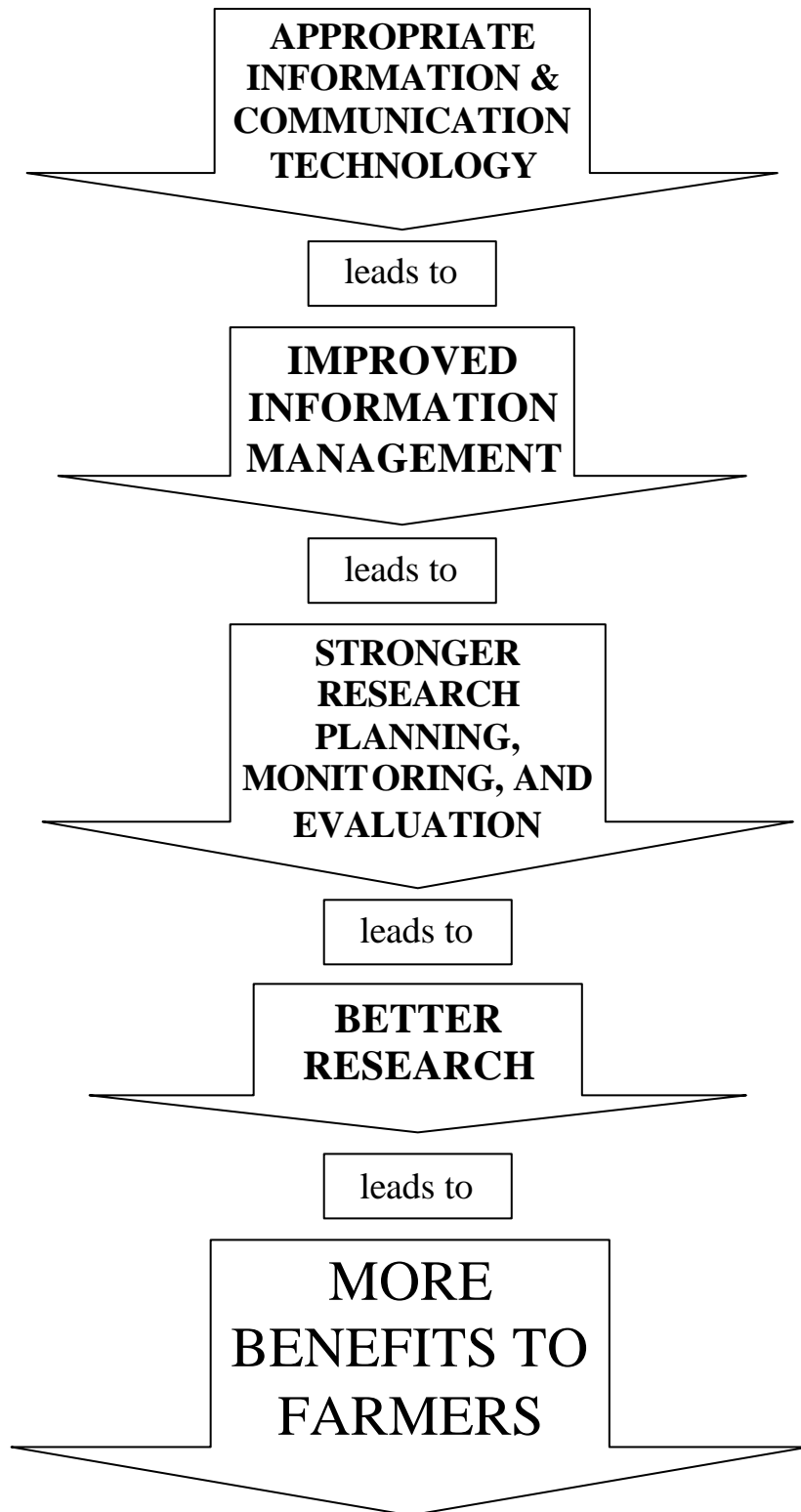


Figure 6.1: Tree of Means and Ends in AGFIS

6.1.4. Strategy Development

This study has assessed the technology requirements of AGFIS. An attempt has also been made to identify appropriate technologies, which may be helpful for establishing AGFIS, and fulfill the objectives specified in Para 6.1.2. The emphasis given by this study is on the development of a strategy and not the formulation of a project proposal or a detailed action plan even though some important aspects for that are discussed.

The clear concept and strategies on the following aspects will be very crucial in development and functioning of the AGFIS⁸.

- ?? Defining the content part of the AGFIS
- ?? Different Levels of AGFIS
- ?? Organizational setup
- ?? Phasing the development of the system
- ?? Imparting required skills to the concerned

The above mentioned aspects are described in detail below.

6.2. Definition of Information Constituent of AGFIS

AGFIS will have an integrated view of information system and content. The system will be a common one for managing all types of information in the agricultural sector of Kerala. Content will also consist of information and documents meant for all activities in the sector, planning, administration, research, education, extension and development. Information professionals, using support of experts from ICT and agricultural subjects, will manage information system and services meant for all categories of users⁹.

The AGFIS will consist of four types of content or information: for managers, for scientists, for farmers/public, and on natural and physical resources¹⁰. This content will be of relevance to the performance of the following main functions.

- ?? System and Institutional Management
- ?? Research Project Management
- ?? Education, Extension and Reference
- ?? Resource Management.

6.2.1. Information for Managers

Information for managers consists of information required for system and institutional management¹¹. This is mainly data on financial, human, and physical resources. The goal is to develop regular procedures for program and project budgeting, monitoring of resource use, and administrative reporting.

The biggest information problem for most senior institute and SAU managers can be summed up in one word: reporting. ICAR or State government continually asks research managers down the line for data on budget, expenditure, personnel, and physical resources. Each time such a request comes in, the Director or head of the institute puts out a request to subordinates to provide the required data. But since almost no institute has computerized spreadsheets or databases, each request must be dealt with manually and from the beginning.

The objective of including such *management information* in the AGFIS will enable an increased capacity for planning/programming and monitoring/evaluation. Much time and energy is spent on dealing with requests from above for information. So considerable management time can be saved if reports and requests could be handled via standard formats prescribed by AGFIS.

6.2.2. Information for Scientists

This part is information meant for research. This is mainly information on the substance of research completed, and is usually in the form of books, articles, abstracts, and reports. The goal is to allow scientists to identify needed documents and then to gain access to them quickly. The rationale is that the availability of such

information will improve research planning, reduce duplication in research efforts, and encourage dissemination of research results.

The biggest management challenge regarding scientific information is identification and access. A scientist planning new research must be able identify and access earlier work done on his specific subject. By identification it is meant that he should know what work on the subject has already been done or is in progress; by whom, where, and when; how have the results of the work been published, in books, articles, abstracts, and/or reports; are the project proposals available?¹² Then he should be able to access these documents. For that he should know where those documents are available and how he can get copies of them.

At the present time, a scientist working in agricultural sector of Kerala has two sources for getting answer to these questions. They are internal facilities like Library of his department or institute or external sources like libraries of KAU or ICAR Institutes.

Most of the institutions lack required library systems. So the sources that can be relied are the KAU/ICAR libraries or those of other major institutions in agricultural sector. But such libraries also may once have been adequate, but the current developments are making them less so. It is firstly due to the fact that agricultural science is growing in size and importance within India. The number of national, regional, and commodity-specific journals is increasing. Gray literature is becoming more important. Secondly, agricultural science is becoming more international, particularly in emerging fields like biotechnology. Librarians in the sector would like to be able to use new technologies to access non-Indian information. But few have the skills to do so. The survey conducted for this study reveals that our agricultural libraries are far behind in this aspect. Third reason is that current financial pressure in both ICAR institutes and KAU, has hit libraries hard. As the survey for this study revealed journal subscriptions have been cut, particularly foreign journals, which are expensive. Equally important, is the lack of sufficient professional staff and lack of in-career training for library staff in current technologies.

There are two national document search services, which are of relevance also to agricultural researchers. The Indian National Scientific Documentation Center (INSDOC) now merged into Indian National Center for Science Communication and Information Resources (INSCAIR) and the National Center for Science Information (NCSI) organizes them¹³. A scientist can use these services to get current contents, current abstracts, and photocopies of full articles. But the problem is, these institutions deal with all the areas of science and technology and so required specialization and coverage of agriculture might not be feasible. Similar service at State level in Kerala that came into existence was Agricultural and Biosciences Information Service of KAU. But it is presently not functional. Then these services also cost money and time.

6.2.3. Information for Resource Management

This will be concerned with information required for resource management. It will be mainly data on natural resources germplasm, agro-climatic conditions and problems affecting agricultural production. ICAR Institutes, KAU and their stations have traditionally generated massive amounts of data in the course of their research. Scientists have written down experimental designs in project proposals, collected and recorded these data from field or lab. They tend to fall into the following three general categories.

6.2.3.1. Generic Data

- ?? on resources like data on germplasm (genetic resources), soil characteristics (production resources), and fish catches (natural resources).
- ?? on agro-climatic conditions like data on temperature and rainfall, used for analyses of production and weather forecasting.
- ?? on pests and diseases like data on attacks-usually by time period, by location, and/or by crop or animal affected.
- ?? on socio-economic conditions like data considered relevant to explanations of why farmers adopt (or do not adopt) recommended cultural practices.
- ?? on research results like experimental designs, results, and analyses.

The goal is to enable scientists in the State to use the above databases both for research planning and for research itself. The biggest challenges to an AGFIS regarding resource management data concern identification and access. Most scientists do not know what data on resources exist, where they are, what they include, and who is responsible for managing and granting access to them.

6.2.3.2. Dynamic Database

This is more relevant for planning appropriate strategies to take advantage of the dynamic market situations as also to minimize the adverse impact of competition from other countries. This will consist of data on market intelligence, demand forecasts, competitive environments, market access, market arrivals, market prices, changing profile of market preferences, changing pattern of quality standards etc. This will provide dynamic information. The production strategies, market promotions and product development have to be planned and implemented according to these changes. Location and crop-specific management information such as crop protection practices and strategies, post harvest technology etc. will also be included in this database system to support the production system.

6.2.3.3. Advisory Service

The third component will be a well-designed advisory service for decision support to the stakeholders like development departments, commodity boards, growers and exporters. This will consist of analytical data support system based on careful and systematic analysis of data to serve specific requirements through transformation of information into knowledge. The advisory service will have three components:

a) Meteorological Information Service: This will provide ready-to-use data on weather parameters for the use of farmers and extension personnel.

b) Management Advisory Service: Crop specific package of practices with special reference to IPM, INM etc. will be offered as an on-line service. Similar management advisory services will be offered to all types of animal husbandry, poultry and fishery products. This will take care of issues like quality standards, grading, curing and related issues to enable the farmers to produce exportable products in accordance with SPS, and other quality standards.

c) Market Intelligence Service: This will consist of ready to use data on emerging market opportunities, price trends, international trade opportunities and other trade related information of dynamic nature.

6.2.4. Information for Extension

This will be a virtual university of agriculture for the use farmers, scientist, students, extension activists, managers and the public. It will consist of digitized archives of materials including text, video and audio files, animations, interactive databases on different aspect of agriculture, information required for day today use by farmers and the public like market information as well as CBT programmes that can be used in extension activities.

6.3. Network Development: Levels and Phasing

Development of AGFIS networks will occur at five levels. Emphasis at each level will depend on the types of information highly relevant to users there. Attention given to each will depend on the specialization, and also whether the content is mainly management information, scientific information, or resource data. The levels are: 1) between the institute and its constituent stations, 2) within the institute campus, 3) between the institute, AGFIS central hub and six nodal centres as well as State Information Infrastructures and public library network and 4) between the institute and the State/national and international scientific community.

6.3.1. Between Institute and Stations

For institutes in agricultural sector, the highest communications priority is to improve links with their stations. Reasons are mainly administrative. The computer-based communications network, linking institute with its stations will be primarily used for messages and file transfers. The head of an institute will be able to request information directly, instantly and on almost interactive basis. The adoption of standard computer software and formats for different aspects will enable transfer of information in formats that can be easily manipulated at both ends. The use of network at this level will expand from managers to scientists. Researchers at stations will use it initially to request scientific information from the library at the institute. In long run, as more scientists get more access to the network -people doing research on similar subjects will communicate with each other directly, to exchange both actual data and analyses. Extension activists will be able to collect documents and information for their work. Farmers accessing the system will get information repacked for them.

6.3.2. Within Institute

Most managers at the concerned institutions have no experience with ICT. So the question of whether they would like to have an intra-campus LAN is largely academic. The assumption of most is that intra-organizational communications can and will continue to be handled by traditional ways, telephone and hand. But Once a LAN is established, the user community can be expected to grow quickly. The experience of KAUC is an example for this.

6.3.3. Between Institute and Hub/Nodal Centres

The logic and future possibilities of this level connecting Institute and six nodal centers and State Information Infrastructure/Public Library Network is connecting lab to the farm. Schematic Representation of information flow from lab to the farm in AGFISNET is presented in Figure 6.2. Networking at this level will enable resource sharing in a specific sub sector of agriculture in Kerala to achieve

maximum information support efficiency in that aspect. The main advantage of this level of AGFIS is that it will make the information system more reliable and will be able to carry larger amounts of data. Since most nodal centers are near cities, connections already exist with Thiruvananthapuram the capital of the State, HQ of KAU at Thrissur and ICAR. Connection to nodal centers from other major institutes is also easy. AGFIS will be connected at this level to State Information Infrastructure or networks to extend information to the Krishi Bhavans, village libraries and to the farm.

6.3.4. Between Institute and the State/International Community

Importance of this level will rise significantly as soon as the AGFISNET is established. Most managers and scientists do not communicate regularly with peers outside the institution/ State/ country. So they have trouble in estimating how much they would use such facilities. But once Internet connectivity exists, it is heavily used. There are two kinds of information: that which we know, and that which we know how to find. Internet will very useful in finding research information.

6.3.5. Priorities for Phasing AGFIS Project

The AGFIS should come into being over a period of three years. The State Government will need to set specific targets and plan activities for each time period. Such planning will be closely related to the issues of content and levels specified above. For example, the biggest initial efforts on management information will be at levels that covers an institution and its constituent stations, and between the institute and State/national level organizations. But the biggest push on scientific information and resource data will be at level within the institute campus and at level covering nodal centers, which specialize in institute's mandatory areas.

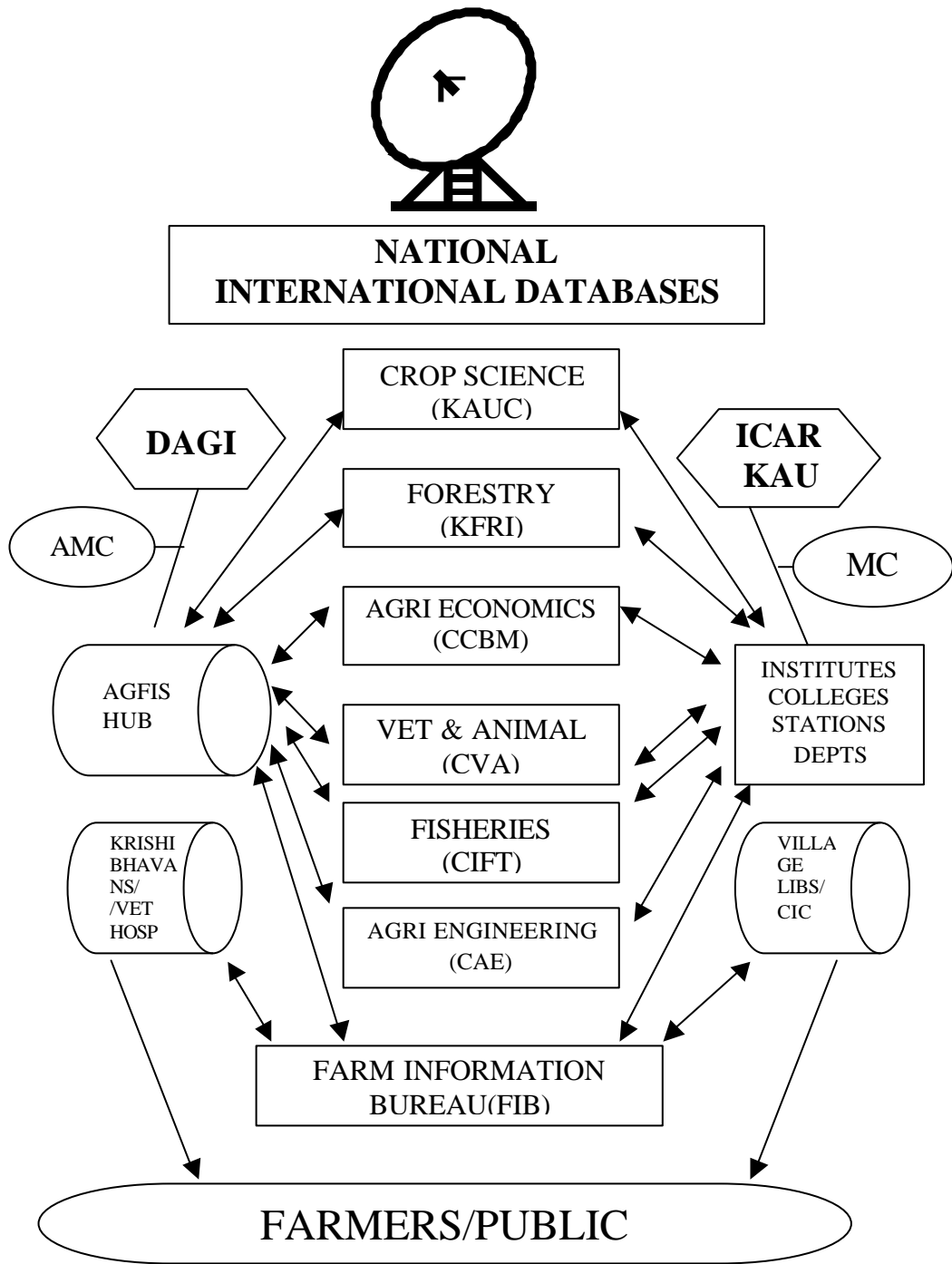


Figure: 6.2: Information Flow in AGFIS-K

6.3.6. Status of ICT Facilities at Institutes

An assessment of the existing status of the ICT facilities in the concerned institutes is one of the essential prerequisites for the successful implementation of AGFIS. The Survey conducted for the present study revealed that all the major institutions in agricultural sector have already acquired computers. Table 4.23 presents the availability of computer systems at the selected agricultural institutions and the library operations, which have been computerized so far. 25 of the 30 major institutions have at least one computer. Few institutions have computerized some of the library operations.

These libraries are very clear about their automation plans. After working for three to four years with various stand-alone software and systems. They are now looking for integrated solutions. Efforts are on to ensure that their catalogues and other databases are accessible offline as well as online through LANs and WANs. For instance the integrated library housekeeping software i.e. SOUL developed by INFLIBNET is already in use at the library of KAUC. KAU colleges are also planning to use this package.

Most of the libraries have started using computers to prepare machine-readable catalogues of their holdings as also to develop other databases. Some of the functions like circulation are also performed using computers at some libraries. But beyond the major institutions in agricultural sector consisting of the ICAR institutes and KAU colleges only very few have computers. The KVKs, the Research Stations in remote areas, Krishi Bhavans, veterinary hospitals, rural libraries etc have no computers or computer familiarization. But this enables standardization easy. The institutes who have already developed infrastructures can try to achieve the standards without much additional commitments.

AGFISNET is proposed to be a financially self-supporting network. So only a few common facilities will be created by the department/institution managing AGFIS. All the participants have to make their own arrangements for hardware, software and other required peripherals.

6.3.7. Phasing and Time Frame

Considering the structure of the agricultural sector of Kerala, the factors such as information resources, subject specializations, infrastructure facilities, manpower as well as the level of computerization in concerned institutions it appears appropriate to launch the network programme in three phases.

The first phase has to cover the library and information systems of six nodal centers to which six different subject areas are assigned, other ICAR Institutes, FIB and a few major institutions. The scheme is to be extended in the second phase to cover the libraries of remaining KAU colleges, Departments of Agriculture, Animal Husbandry, Fisheries and Dairy Science. The relevant departments of the five universities in the State and other institutions listed in Appendix -6 except KVKs and Research Stations will also be brought under the network in this phase. Schematic Representation of AGFISNET networking in the first and second phase as discussed above is shown in Figure 6.3. In the third and final phase all the research stations under KAU and ICAR institutes, Krishi Vigyan Kendras and, District Agricultural Offices, district and block level veterinary hospitals, Krishi Bhavans, village libraries, NGOs and all concerned institutions under government and private agencies engaged in agricultural education, research, extension and development will be provided access to the network.

With the successful completion of the networking programme of third phase linkages can be established with other already existing library and information networks of the State like NIC, Information Kerala Mission, Educational Grid planned by IITM-K etc. This can enable extending the services of AGFISNET up to the farm. Linkages also can be established through national and international gateways to ARISNET, CABI Networks, USDA Net and also other worldwide agriculture related networks.

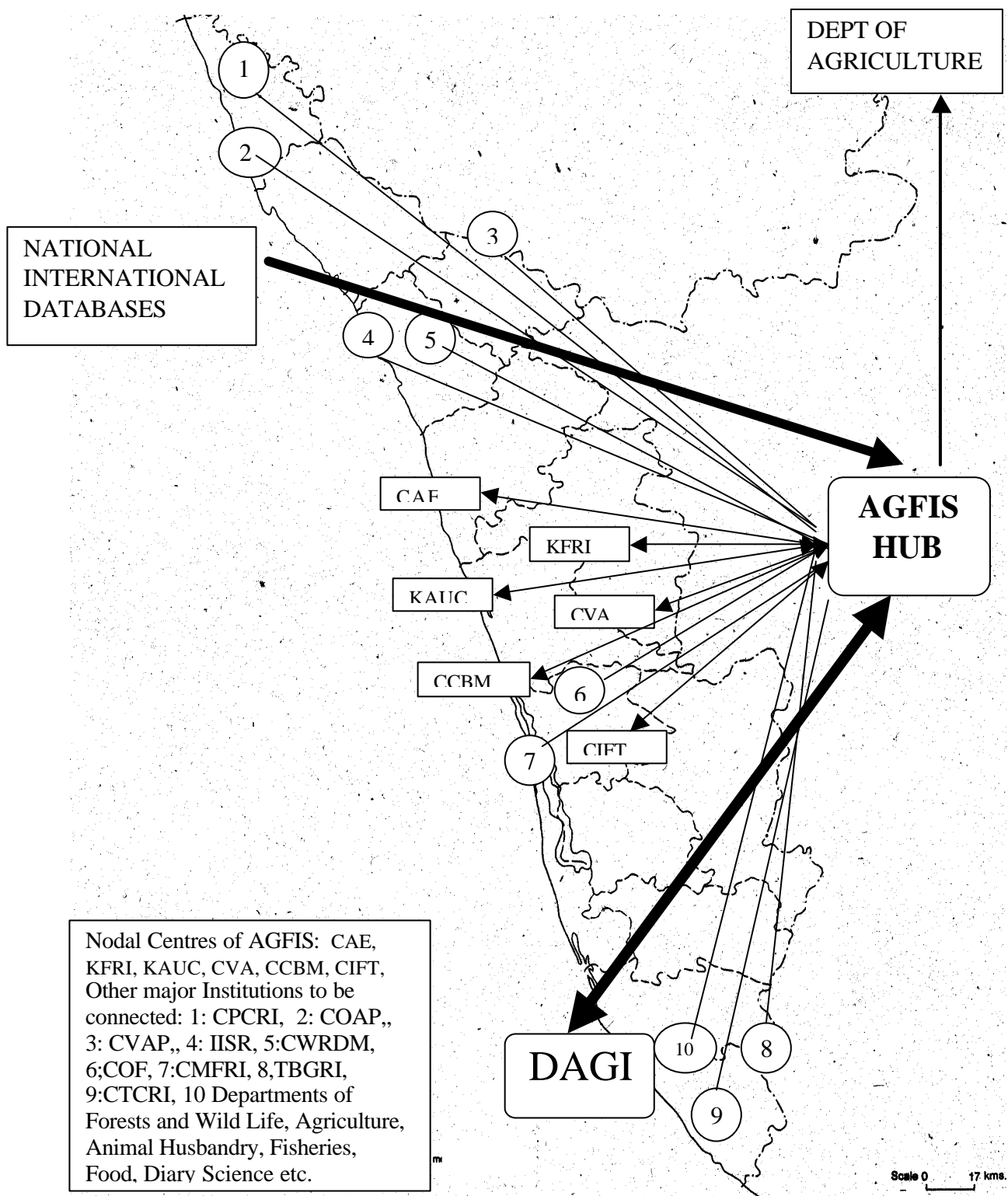


Figure 6.3: AGFISNET Coverage in First Two Phases

6.4. Common Standards, Formats and Procedures

AGFIS will be a decentralized system, which will try to bring information close to its users. The AGFIS will consist of separate, systems for management information, scientific information, and extension information and resource data discussed above. But integration of the system requires uniformity in various aspects¹⁴.

Common standards for aspects like hardware, software, data formats, and procedures are necessary because information exchange is one of the main reasons for having an AGFISNET. Each participating organization and individual has to adhere to these standards if the full benefit of the AGFIS is to be realized. It is an essential pre-requisite for effective functioning of a network. Participating libraries will have to follow certain procedures and practices without which the resources held by them cannot be effectively and meaningfully shared. In the context of AGFISNET, standardization in areas like classification, subject indexing and cataloguing of various kinds and types of library materials is essential. Common codes and abbreviations are to be used for documentation activities.

Hence the establishment of the institute level system for participation in AGFIS will require the following actions at each institute:

- ?? introduction of standard computer software
- ?? agreement on standard formats for information exchange
- ?? field-testing at selected sites
- ?? training
- ?? mandatory use of the software and formats

6.4.1. Standard Computer Software

The AGFIS must require standard software for MIS work, library automation, digital archive development and other aspects. The objective of such standard setting is integration, which will facilitate the following.

?? Institutes and stations will be able to share data without hurdles if they are using the same or compatible software.

?? even in a single workstation of an institute individual users will be able to share data between spreadsheets, databases, and/or word processors.

6.4.1.1. MIS Software

Uniformity is necessary in MIS work if data are to be provided by stations to the institute, by institutes to each other, and also by them to the State Government or ICAR for MIS work only four common software programs are required¹⁵.

?? spreadsheet for financial data.

?? DBMS for data on research projects, as well as on human and physical resources with a capacity to present data in graphics form.

?? word-processor for submission of standard narrative reports with ability to import data from the two programs above.

MS Office, Open Office etc can fulfill all the above three functions. CDS/ISIS and IDAMS supplied free of cost by UNESCO are very powerful packages which can fulfill the first two functions. They can be used along with MSWord or any other word processing package available.

6.4.1.2. Software for Scientific Information/Library

Most scientists have little experience with the use of automated library and information systems. They have only minimal understanding of keywords, on-line searches, and file transfers¹⁶. Survey for the present study also revealed the same. Therefore AGFIS will have to emphasize on standards for simple and easy-to-use library procedures and technologies for identifying and accessing information. The computer environment with regard to scientific information is more complicated than that of MIS. This is because the system has to handle huge quantum of data and

information in innumerable media, formats and types. Also various processes related to acquisition, organization and dissemination of information is to be managed.

The most important will be a program specifically designed for library house keeping with stress to bibliographic activities like cataloging, and information retrieval. For library house keeping there are several Indian software solutions. CAGI has supported the development of a system named AGSOFT. INFLIBNET has developed a program named SOUL. There are about 30 programmes available at present from commercial vendors.

If cataloguing and information retrieval are only to be managed, an international option worth considering is CDS/ISIS from UNESCO. This program is used throughout the world, is available free-of-charge, and a large number of librarians in agricultural sector in Kerala also have already been trained in it. The data from this system can be transferred to any other programme as and when required. It has only modules for catalogue development. But additional modules for other house keeping operations are to be developed in-house or purchased. DESIDOC, INSDOC, VSSC, CAGI etc have developed such modules.

Library will also require an English word processor for the development of current awareness bulletins, lists of current contents, bibliographies, etc. For this the one used for word processing on MIS system is sufficient.

AGFIS has to cater to the information requirement of the farmers and village people through service outlets existing near them. So database management systems, word processor etc in Malayalam is very important. CAGI is associating in the development of a Malayalam Database Management System named M/ISIS. It will be a very important package for AGFIS to be used at Krishi Bhavans, village libraries and other extension centers¹⁷.

No electronic document identification by users outside a particular organization will be possible until its library catalog has been computerized. This catalog must include both formal publications and gray literature.

6.4.1.3. Software for Resource Data

Conversion of resource data into standard formats for enabling its use in the system by other scientists will also require specialized software. One of the presently available solutions is NITYA Archive developed by CAGI which can be used to organize and store huge archives of files, documents in different digital formats and digitally archived books, reports, manuals, journals, maps video files and other documents¹⁸. It is based on CDS/ISIS of UNESCO and CCF.

6.4.1.4. Software for Education /Extension.

Development of virtual libraries and archives for education and extension will require packages for organizing records in different formats which include text, audio, video, animation etc in an interactive way. Nitya Archive developed by CAGI is a cheap solution for organizing such files in an easily retrievable way. IITM-K has developed some solutions for digitizing and making available through web information and documents for education and research¹⁹. There are also many recently developed solutions, which are costly.

6.4.1.5. Indigenous Software Solutions

ICAR even after ten years of its launching of an information system named ARIS with international support could not develop any standard or software for digital archiving, information retrieval etc for agricultural institutes. Not even a single library of any of the 33 SAUs in India has digitized their important documents like PhD dissertations in a retrievable way except an attempt at KAUC in 1997 which was not continued and completed. But CAGI has developed a package for digital archiving of agricultural dissertations, reports, files etc. A prototype of Digital archives of PhD dissertations has already been tested successfully by it. It is based on international standards for communication as well as file formats. It has one of the most powerful search engines available in the world for information retrieval²⁰. It will be ideal if all the agricultural libraries use the same package with web modules.

6.4.1.6. Classification, Cataloguing, Subject Headings

DDC being a widely used and internationally accepted scheme can be used for classification. Presently it has an electronic version also. AACR 2 is advisable for cataloguing purposes and CAB Thesaurus for producing standard subject descriptors. In AGFIS one of the institutions could maintain a directory of new words related to our agro climatic region, which could later form part of AGFIS thesaurus.

6.4.2. Standard Formats for Information Exchange

The next step is the development of standard formats in the standard software. This task will be an easy one for MIS work, since most of the required formats are already specified in commonly used, hardcopy. For example, the format of the monthly/annual expenditure reports that institutes submit to Government or ICAR has already been determined. All that has to be done is to recreate this form in a spreadsheet program for the computer.

Formats have to be specified for development of databases on various aspects related to managing scientific information. Going by INFLIBNET²¹ recommendations in this area however it will be very advantageous if AGFISNET advocates the use of CCF as standard bibliographic format. In this records can be generated much faster and they can be interchanged with any ISO-2709 based format in the world. CCF advised by UNESCO is the best for various aspects of scientific information management in AGFIS. This will smoothen the process of information exchange and pooling at institutional, State, national and even international levels. A policy decision in this direction will be very important for AGFIS.

6.4.3. Hardware

Ideally AGFISNET participants have to go in for computer systems, which have the following characteristics.

- ?? components of current technology
- ?? scope for up gradation
- ?? compatibility to required software and other computer systems.

Exact configuration will however depend upon the purchasing power of the participant library. But a minimum configuration for workstations/PCs is recommended for the AGFISNET participant on the basis of concerned feasibility reports, current technology, and availability. The recommended configuration is Pentium IV 2.6.GHA, 564 RAM, 80GB HDD, CDD 54x, CDRW 48x, 17 Inch Color Monitor, Speakers, Scanner, Web Camera, mike, Internal Modem and 1KVA UPS with 1 hr back up.

6.4.4. Field Tests and Mandatory Use

Testing of hardware, software, and formats at selected nodal centers of AGFIS is essential. Mandatory use has two issues. The first job of AGFIS will be to facilitate the availability of the standard software programs to institutes. Then deadlines for adoption of both software and formats should be set. Without such deadlines, development of information component of the AGFIS will not succeed.

6.5. People and Technology

The major constraint in the development of the AGFIS will be people rather than technology. Information Management (IM) is a new concept to many agricultural research scientists and managers. The survey for the present study revealed that IT literacy of scientists working at grass roots level is poor. Much of the new information and communication technology is frightening to scientists and managers²². One of the major goals of AGFIS planning, therefore, will be to create an environment in which information is regarded as important. IM skills should be seen as part of the tool-kit of each scientist and manager. The scientists, extension activists, information science professionals/ librarians, managers and last but not least the farmers will have to be trained under AFGIS. Training will be on various aspects of ICT relevant to the

activities of each of these groups. It should be provided in institutions at various levels in agricultural sector.

6.5.1. Training for MIS

The target groups for training in MIS development are the following.

- ?? training of senior managers from the institutions participating in AGFIS with the objective to increase awareness of the potentials of systematic management information.
- ?? training of computer specialists and librarians for both their awareness of current technology and skills, for computer people at the agricultural institutes have usually not been able to keep up with developments in the ICT.
- ?? training of support staff which will be skills training, for people who will actually do most of the work.

6.5.2. Training for Scientific Information Management

The target groups for training in "scientific information" management are the following.

- ?? Library professionals at managerial level,
- ?? Skills training, for the library support staff, who will be the ones doing most document identification and delivery,
- ?? Scientists will be brought into such training later on, once the procedures in AGFIS have been finally established.

6.5.3. Training for Resource Data

The target group will include managers, scientists, and information science professionals. Training for the process of incorporating resource management data into an AGFIS will concentrate more on awareness training than on the acquisition of

particular skills. The focus of such training will be on, familiarization with the content of existing national databases. Such sources dealing with genetic resources, agro-climatic data, and socio-economic data will be given importance. Exposure to means by which scientists at institutes and KAU can access these data will have to be provided. Software for creating and maintaining databases at the institute and stations on genetics, production, and natural resources, as well as on research results will be introduced.

6.5.4. Training for Education/Extension Information

The target groups will be scientists, extension activists and information professionals as well as farmers and the public. Training will concentrate on awareness programmes on use of digital archives online, repackaging scientific information, use of multimedia, development of interactive multimedia programmes meant for extension activities, and presentation techniques.

6.5.5. Training on Accessing Information

The target groups will be farmers and at least a system will be continuously available at Krishi Bhavans, KVKs, village libraries etc for their use. Training/familiarization programmes will be periodically offered at these institutes with support from organizations like Information Kerala Mission.

6.6. Services from AGFIS

As AGFIS will be an information resource sharing system and network the content organization, management and providing access to it will be the important activity of the system. In specialization, number of activities, their depth and breadth, aspects related to scientific information or library will dominate the AGFISNET environment if the system is to be relevant to the agricultural sector. Information services will mostly originate from this part of the system and those originating from elsewhere will be supported by this part.

For the purposes of an AGFIS strategy, the identification and access functions related Information for scientists could be described in terms of the following essential tasks.

- ?? acquisition and storage-of books, journals, abstracts, reports, papers, and various types of gray literature.
- ?? indexing and cataloging of the above acquisitions and creation of computerized databases available to users from both inside and outside the organization.
- ?? dissemination of current awareness bulletins, tables of contents, etc.
- ?? delivery of documents-to users within the institute and its constituent centers as well to users outside who needs information on the aspects in which the institute specializes.
- ?? synthesis and review of documents on single subjects like bibliographies, reviews articles, etc.
- ?? transferring data available with scientists, institutions to formats that both they and others can use as well as supporting the transfer of database files between institutes to allow scientists working on similar subjects to use it and interact with the one who created actual data.
- ?? creation of a central repository of information on what resource management databases exist, where they are, what they contain, what formats they use, and who manages them?; to enable scientists who use this database of databases to identify which particular databases one wants to use, make contact with the scientists who manage them, and finally access the material in them.
- ?? facilitating access to information kept at distant sources, worldwide libraries and information systems.

6.6.1. Nature and Types of Services from AGFIS

A fully developed AGFIS will improve the ways in which managers and scientists can perform the following functions.

- ?? Message Exchange and File Transfer
- ?? Document Identification and Access
- ?? Remote Computing

Of the above the first two functions are performed at present-usually not electronically, and often with considerable difficulty-while the third will be new. They are discussed below in the order in which they will become operational as the AGFIS develops.

6.6.2. Message Exchange and File Transfer

The primary vehicle for message exchange in the AGFIS will initially be email. It will have distinct advantages on reliability, coverage, cost and speed over existing methods like post, telephone, fax etc. The sender of a message will be able to address more than one person simultaneously. Same advantages apply to file transfer²³. A manager who requests information from a subordinate usually wants an immediate answer. At present the request goes out by telephone, fax, telex, or post. The subordinate collects the relevant information, gets it typed, and then (usually) posts it. This turn-around time will be dramatically reduced with an AGFISNET, due to the use of common software and ability to attach files. The head of an institute can expect-for example-that managers at all his stations will be using the same spreadsheet, database, and word processing programs. With the AGFISNET, the station head will be able to send a brief email reply to the institute head -and then to attach electronically to that reply a file containing all the necessary information. As the institute and the stations are using common software, the head will be able to read this incoming data file immediately.

6.6.3. Document Identification and Access

There are several traditional ways of document identification. The most common is to look at the card catalog in a library. Another is to go through one or more of the abstracting journals. A third is to look for citations in journals to which one's own library already subscribes. And a fourth is to depend on personal contacts

within one's organization or at professional meetings mostly for gray literature. Identification is the easy part. When one finds a reference to an article that he thinks might be of use the more difficult problem is to get access to a copy. The AGFIS will address both these challenges.

6.6.3.1. Current Awareness Service (CAS)

The first priority for an AGFIS will be to expand existing document identification capabilities. One model here is the Contents, Abstracts and Photocopies Service (CAPS) run by INSDOC. The INSDOC brochure for this program says: Under this service, on a yearly subscription, you can get the contents of 40 journals selected by you from about 5000 core Indian and foreign periodicals pertaining to different disciplines. On browsing the contents, you can order the abstracts and/or photocopies of full articles of your choice.²⁴

Such a service on agriculture may well be too big a job for one institute alone. AGFIS may therefore decide to break agriculture down into 7 sub-fields specified in Para 5.1 and will seek to develop some of its own CAS capabilities at the six nodal centers discussed in Para 5.9.3.

Under the AGFIS, the six nodal centers will be supported to run CAPS equivalents covering their particular area of specialization in more detail. In return for increased financial support from the Government, libraries at these nodal centers will have to be authorized by parent organizations to build up their holdings and to provide additional services including CAPS to other institutes. The long-term objective is that each of these nodal centers will provide an integrated information service in its mandate area.

Institute level is the most immediate one for individual scientists. Under the AGFIS, the library at each institute will perform two functions. First, it will act as an intermediary between scientists and services at the nodal centers. And second, it will undertake services within the institution including expanded CAS programs.

6.6.3.2. Bibliographic Searches

CAS services such as CAPS are useful for scientists who know in advance which journals are most likely to contain articles of their interest. But for scientists who would like to go through a much larger number of journals, other means are necessary. There are two prerequisites for using keywords in such searches. First is that all article titles and accompanying abstracts, will have to be computerized. Secondly librarians must be trained in identifying keywords and in conducting online searches. The AGFIS will develop capacity for searches on the two levels noted above.

The first step will be for libraries at the six nodal centers to plan their future journal holdings. Which journals should they subscribe to? The second step will be to begin an intensive program of computerizing titles and abstracts-not only of journals, but also of reports and of gray literature. And finally the libraries at nodal centers will begin to offer specialized bibliographic search services to scientists at institutes in agricultural sector of Kerala.

Two technologies will be important in the provision of such services. First will be appropriate documentation-management software, and second, subscriptions to appropriate international databases in CDROM. Similar process will be undertaken at institute libraries, but with an important difference. The initial emphasis at this level will be less on journals and more on reports and gray literature, which, in the case of KAU is likely to be primarily of State interest.

6.6.3.3. Photocopying And Full-Text Retrieval

After a scientist has located a citation-perhaps through a CAS, or perhaps through a bibliographic search-the next challenge is to get access to a copy. CAPS from the six nodal centers have to provide this service. In the longer-term, the AGFIS will attempt to develop a capacity for full-text retrieval. With full text retrieval, a scientist will be able to sit at a computer, search a database at a distant library in AGFISNET, identify an article, and download a copy of the article to his/her screen.

There are two major prerequisites. First will be a telecommunications network that can handle large files at high speeds. And second -both more important and more difficult -the computerization of full text of documents so that they can be searched electronically. Center for Agricultural Informatics (CAGI) has developed a programme for this purpose, which was till, recently considered a difficult and costly affair. It is the first Indian solution to digital full text library management.

6.6.4. Remote Computing

Like full-text retrieval, remote computing is also a facility to be developed under AGFISNET. A good example is the massive amount of data on natural and physical resources that institutes and stations have traditionally generated²⁵. As they begin to computerize such data, an objective for the AGFIS will be to allow scientists at other places to get access to them and to perform analytical operations on them on-line. At present, a scientist in Thiruvananthapuram can log on to a computer in California but cannot do so within State network. Here also there are two prerequisites, telecommunications capability, and computerization of the data themselves. Once such conditions have been met, a scientist in Thiruvananthapuram will be able to discover data at Thrissur, look at whichever of those data are computerized, and use them for his own analysis.

6.7. Organization and Management

It is very important for AGFIS to have a governance system for the network activities and guarantee sufficient funding for the network and its maintenance. In view of the governance mechanisms suggested for INFLIBNET, ARIS, NICNET, Information Kerala Mission etc as well as in view of the objectives and functions of proposed AGFIS, overall policy and management of the AGFIS are to be coordinated by the Department of Agriculture, Government of Kerala. A new Directorate for Agricultural Informatics (DAGI) under the Department with the following three characteristics is to be constituted.

- ?? a mandate for agriculture and biosciences information that runs well beyond extension activities, libraries, publications and computers,
- ?? staff with experience in research, Information science, ICT, and project management,
- ?? direct access to the Agricultural Production Commissioner. Secretaries of Departments of Agriculture, Animal Husbandry, Fisheries, concerned directors, heads of concerned institutes etc.

6.7.1. Directorate of Agricultural Informatics (DAGI)

The management structure for the DAGI will have four parts. First will be the office of the Director. The Director will most likely be a senior Information Professional with Information Science qualifications, demonstrated interest, proved record of achievements and innovation and commitment to IM issues in agriculture. Appointment of this scientist may be at the Director/University Librarian level. Qualifications should be that prescribed by ICAR for the post of University Librarian in State Agricultural Universities plus qualification and experience in ICT application in agriculture. The incumbent should have a minimum three years experience in post not below the scale of Rs.16400-22400 or above. Should have also at least three years experience with administrative and financial powers befitting that of a Director in State service. There will be a small unit of administrative staff to assist the Director. The two other major components of DAGI will be a Management Council and IM Unit.

6.7.1.1. Functions of the DAGI

The Directorate will have during the AFISNET implementation phases two main responsibilities: overall project management and public relations. Responsibilities for the project management will be the first and most important one. The Department, the DAGI Management Council, and the Directorate itself will define the precise tasks that fall under this group. It may consist of the following activities:

- ?? design of the AGFIS Network in regard to technical specifications for landline and VSAT installations, hardware and software, standards etc.
- ?? acquisition of required hardware and software.
- ?? installation of required hardware and software at institutes, and stations.
- ?? Providing basic training for staff at the institutes, and stations.
- ?? organization of support and maintenance services.
- ?? supervision of the Demonstration Sites program.

For each of the above activities, the DAGI assisted by consultants as required-will draw up precise terms of reference; supervise the awarding of contracts, and monitor progress.

Public Relations form the second major responsibility. The building of support for the AGFIS will be very crucial. Most managers and scientists at concerned government departments, institutes, and stations do not currently know much about the potential of information systems and networks²⁶. They can be expected to have many doubts. DAGI has to organize a series of seminars and workshops to answer such questions, and to develop consensus about the AGFIS. These events can be held at some central facility created at the capital or at KAUC where excellent facilities created for such purposes remain under utilized. Such programs should try to answer questions from scientists and institutions like the following.

- ?? What will we be able to use the AGFIS for?
- ?? How much will the AGFISNET cost of our institute, station?
- ?? What will be our obligations in accepting an AGFISNET installation?
- ?? What support we can expect from the DAGI managing AGFIS?

In addition to such seminars and workshops for participants in the AGFISNET, the IM Unit will also need to provide continuing information about the network to audiences outside the institutions. The AGFIS will be only a part of an emerging State Information Infrastructure.

6.7.2. DAGI Management Council

Second part is the Management council for DAGI. The primary functions of the council will be:

- ?? to advise the Government on matters related to DAGI and AGFIS policy and management.
- ?? to approve the policies and programmes of AGFIS
- ?? to organize periodical reviews of progress of the AGFISNET project during its implementation

The DAGI Management Council will consist of Agricultural Production Commissioner (Chairman), Director of Agricultural Informatics (Convener), and Secretaries of Department of Agriculture, Animal Husbandry, Dairy, Fisheries, Food, Irrigation etc and heads of six nodal centers as members.

6.7.3. Information Management Unit

There will be an Information Management (IM) Unit in the DAGI. It will be a unit with eight to ten full-time professionals from different subject areas concerned.

During the AGFISNET implementation IM unit will look after the responsibilities of the DAGI specified above. In addition to that IM unit will undertake the responsibility of public relations.

DAGI will have a substantial budget that will enable it to hire consultants for AGFIS as required. These consultants will be involved in the performance of the functions like, preparation of Terms of Reference for contractors, monitoring of contractor performance etc.

6.7.4. Network Service Providers

Third part will be agencies contracted specifically for AGFIS project management. These agencies will be given mandates for network design, hardware procurement, installation, and commissioning in specific institutes/regions. These contracts will be critical to the success of the entire AGFISNET endeavor. The DAGI will not at the earlier phase have the ICT expertise in-house to get such a large project started. The computer and telecommunications field is changing so rapidly that it is often impossible for organizations to develop and maintain sufficient ICT expertise in-house. Hence DAGI also has to turn to specialized outsiders for management of their information technology development. In Kerala there are several organizations that are getting into this outsourcing business, which would be possible collaborators for the AGFIS.

6.7.6. Demonstration Sites

An important feature of the early days of the DAGI will be intensive work at one or two demonstration sites for AGFIS. The KAUC can be used as a site. Department can also create a site in the State capital where sufficient space for a campus is available to it. The research and development as well as education and training will be the main objectives of this campus.

Research and Development work will be to find out what works with the AGFIS and what does not. Each of the Demonstration Site (DS) will receive a heavy dose of technology. Probable activities at each DS will include the following:

- ?? development of LAN capabilities within the campus, through which all scientists and managers will be able to access the AGFIS network and Internet.
- ?? Development of WAN capabilities between the Directorate/institute campus, other distant institutes and constituent stations thereby allowing almost immediate communication on both management and scientific matters.
- ?? Library automation.

- ?? Digital Archiving of experimental and other records.
- ?? Computerization of accounts.
- ?? Development of other management databases like those for personnel and physical facilities.

Education and Training the second objective of the DS program will be to create staff development hub within DAGI. DS at the directorate will be expected to become a focal point for the training of managers and scientists from all institutes, and stations participating in AGFIS. Radio and Television will be very important for dissemination of agricultural information. Agricultural Department of State will need independent telecasting and broadcasting facilities to disseminate agricultural information. DAGI working in close association with regional Doordarsan Kendra and AIR can improve the extension activities to a great extent. Presently Agricultural Department has an adjacent campus to Doordarsan. DAGI can establish a campus there. AGFIS central hub functioning in such a location can in association with experts from Doordarsan start research and development in using ICT and mass media for agricultural extension work.

6.7.7. Benefits & Responsibilities

Any institute selected as DS site will require at least the following facilities to be provided by the Directorate of Agricultural Informatics:

- ?? Provision of hardware and software, paid for by the Directorate.
- ?? Posting of required technical support personnel at the institute paid for by the Directorate.
- ?? Intensive training of institute in the use of technology used for AGFISNET.
- ?? Development of a position both within the State and outside as a leader in IM.

At the same time, the institute will have to make the following commitments.

- ?? make the management changes necessary to get the AGFISNET functional.

- ?? inject financial resources to supplement funds from the Directorate, for AGFISNET project budget if necessary.
- ?? undertake a systematic program of internal staff training in ICT aspects.
- ?? agree to become a nodal center for training and support to other institutes in the AGFISNET.

6.7.8. Management of the DS Program

The Directorate in addition to running a demonstration site will award responsibility for management of the DS program to one or more organizations with proven experience in IM.

The following four considerations are to be taken into account in identifying institutes that will be invited to become DSs:

- ?? a high level of current awareness about the importance of IM, among both managers and scientists.
- ?? a significant amount of IT already in place.
- ?? a size that will make the introduction of the AGFISNET manageable.

In addition to the main DS in the campus of DAGI the institutes like KAUC, CPCRI and FIB would seem to meet some or all of the above criteria, and might therefore be possible DSs at the initial stage.

6.8. Network Options, Architecture and Communication Topology

Our Country's market for ICT products is booming. Most major government offices now have computers. The survey conducted for the present study revealed that (Table 4.23 and 24) all the major institutions in agricultural sector has computers and most of them have dial up connectivity. There is good telecommunication infrastructure in the State. NIC, VSNL, BSNL, Asianet etc are providing network services in the State.

In such an environment, the logical choice is to use facilities offered by existing networks for the AGFIS rather than to try to build its own independent system. Not only will such a choice save money, but also the government will be able to benefit from the management expertise and technological experience that such organizations/service providers possess.

6.8.1. Possible Network Partners

There are several potential partners. A search of the potentials for collaboration between these networks and the AGFIS done during this study revealed that no single service provider would be able to meet all needs of AGFISNET, though NIC is in a better position. There are many organizations that the DAGI can involve in the development of a large project like AGFISNET. The following list is not exhaustive, but is rather intended to identify organizations that are likely to have some part in the process.

- ?? National Informatics Center Network (NICNET)
- ?? Bharath Sanchar Nigam Ltd (BSNL)
- ?? Indian Institute of Information Tech Management-Kerala (IIITM-K)
- ?? Information Kerala Mission (IKM)
- ?? Centre for Digital Imaging Technology (C-DIT)
- ?? Videsh Sanchar Nigam Ltd (VSNL)

6.8.1.1 The National Informatics Centre Network (NICNET)

NICNET, which is a part of the Department of Science and Technology, has centers in all the State capitals, and at the district level. Offices on the NIC network communicate mainly by satellite. NICNET provides access to several well-known on-line databases on subjects including agriculture, revenue administration etc. Any approved user can gain access to these resources through the NICNET installation at the nearest district headquarters. NICNET is a pioneer in satellite-based communications. It has geographic reach, into every district. It is still almost the only

network player within government. If a public sector organization or office wants networking facilities, the first place to which it will look is likely to be NICNET.

6.8.1.2. Bharath Sanchar Nigam Ltd (BSNL)

After the new Telecom Policy of 1999 tele density has increased²⁷ from 1.44% to 6%, rural tele density from 0.4% to 1.5 %. Basic Telephone lines have now doubled to more than 45 million. Optical fiber network has increased from 64,000 route kilometers to more than 400, 000 kilometers and no place is more than 25 kilometers away from Optical fiber access. 80% of the 600,000 villages have been covered with village public telephones. Tariffs have reduced for all segments of the network. In spite of the significant growth in tele density there is still a divide between rural and urban areas. While the urban tele density exceeds 15% the rural penetration is about 1.5%. So the support of BSNL for the agricultural information system seems to be attractive.

6.8.1.3. Indian Institute of Information Technology-Kerala (IIITM-K)

The IIITM-K has already developed satellite-based data broadcasting system for agriculture for use in the KISSAN project of the GOK²⁸. This project aims to establish a satellite based radio broadcasting for State agriculture department in collaboration with M/s. World Space Ltd., a satellite based data casting service provider. This would be an economic and viable solution to disseminate agricultural information to the rural farmers.

6.8.1.4. Information Kerala Mission (IK)

Information Kerala Mission has been setup by Government of Kerala with the objective of computerizing local bodies. Its programme include linking up 1214 local bodies with the District Planning Offices and the State Planning Board, developing different applications for deployment at the local body level, training people in using computers etc²⁹. In terms of both coverage and scope IKM has emerged as the biggest ICT deployment programme taken up in the State so far.

6.8.1.5. Network Options

Each of the organizations and networks described above has strength and weaknesses. None is perfect, though the DAGI must make a choice between them. The decision may be for NICNET. It offers access to a considerable number of national databases like those on patents and medicine. It also manages a countrywide District Information System (DISNIC), in which district and sub-district socio-economic information is aggregated. The AGFIS will want to include an efficient means of accessing such resources.

In addition, NIC itself may be a candidate for taking the management contracts related to AGFISNET. NIC is also likely to play a role in various projects of Department of Agriculture, Government of India (GOI). Its expertise in the management of district-level telecommunications will be important for strengthening the IM capabilities of farmers and extension services, as well as in the improvement of research/extension linkages.

A decision by the AGFIS for NICNET does not mean that other potential players should not or will not be involved. IKM, IITM-K and C-DIT also are certain to play major roles in the implementation of the AGFISNET. The KAUC has highly advanced ICT facilities and experience. It can be expected to participate in whatever network development activities that are finally implemented.

6.8.2. Technology Choices

Technology for the AGFIS network will have to balance the following considerations:

- ?? a track record that is technology that has been proven to work.
- ?? growth potential that is technology that will still be appropriate for at least another ten years.
- ?? cost, meaning technology that the AGFIS can afford.

?? simplicity, which will mean technology that the AGFIS and its participants can support, service, and maintain.

There are three broad technology categories: land lines, both leased and dial-up, satellites, and radio. The AGFIS will be based on a combination of them.

6.8.2.1. Land Lines

In terms of capacity and speed, there are strong arguments in favor of terrestrial lines. If all institutes and their stations could be connected with reliable land lines running through reliable telephone exchanges, the case for them would be very strong.

But these two conditions are not likely to be fully met in the near future. Even with the rapid growth of the telephone network, the last mile issue will be a major one that AGFIS will have to address. Institute headquarters in urban areas will not usually be a problem, since they can dial-up to the nearest telephone exchange/node.

The problem with landlines comes for outlying stations and associated campuses. Many of the research stations as well as Krishi Bhavans may be in remote areas that are not well connected by telephone. Also, even if the small town in which they are located has a new exchange, their offices are usually, at best, on the edge of town, and therefore a last mile problem. For most such units, there is no immediate relief in sight.

6.8.2.2. Satellites

India is recognized internationally as an emerging leader in satellite technology. It has several of its own satellites already in operation, and more are planned. VSAT networks also offer many cost and performance advantages not found in terrestrial networks, like lower cost, flexibility, reliability, speed, and simplicity³⁰. The Government of Kerala can choose to base an AGFISNET at least partially on satellites.

The major cost item in a satellite-based AGFIS will be the VSATs. Most institutes and their major stations will, initially, have to have one. Other stations and associated campuses will also later need one. Several companies are now designing and making VSATs in India. The present cost is about Rs. 5 lakhs. Per unit cost is expected to come down again. There is also no shortage of transponder space on the various INSATs. They have both "C" and "KU" band capabilities.

An AGFISNET's choice for satellite technology will only be as part of a cooperative package with an existing network like NICNET. In the event of such a decision, the AGFIS will have to make an arrangement that will guarantee it and its partner's transponder space, reasonable pricing, and service for at least the medium-term.

6.8.2.3. Radio

India has not experimented much with digital communications by radio. The reasons are that the major players in the national telecommunications market have been pushing other technologies: mainly VSATs (NIC) and telephones (Department of Telecommunications of Government of India). There is also a perceived problem with the allocation of frequencies by the GOI. The primary advantage of radio is cost. A full installation at an institute may cost less than 1 lakh. The institute can use a radio to communicate with the nearest NICNET or other node, just as one would with a telephone.

A major trial of radio technology was done in Haryana, where the objective was to put a radio communications capability in each tehsil in the State³¹. At Indian Institute of Science, in Bangalore, scientists have developed ASTRA (Application of Science and Technology to Rural Areas), a radio-based field network that links IISc field programs³². And C-DOT has developed³³ a single-channel VHF radio that costs approximately Rs. 50,000. In Kerala IITM-K successfully demonstrated³⁴ in July-Aug, 2002 the feasibility of effectively using Digital Satellite Radio for Selective Dissemination of Information (SDI) of value in agriculture. It is meant for the widely dispersed farmers, plantations etc. It consisted of fast communication of best

practices, market prices and weather information, distress management, inputs and financing for farming, agriculture related processing, trade and distribution activities.

6.8.2.4 Technology Choice

The AGFISNET network will be based mainly on a combination of landline and satellite technologies. Digital Radio also will be used in the final phases of its development. As VSAT prices fall and satellite transponder space increases, for the AGFISNET satellite technology will be the cost effective solution. Initially landlines will be used whenever possible. As noted above, institute headquarters in urban areas will usually be able to get leased lines to the nearest NICNET/BSNL/VSNL node. If this is a practical alternative for these sites, it can be preferred.

At the same time, the remaining institutes, and stations will have to use VSATs. Of the major institutes, KAU and many of its colleges/stations as well as ICAR institutes will be getting VSATs from ICAR under various programmes. Of the approximately 120 sites to be linked by the end of three years the estimate of this study is that 20 will be able to use leased landlines and 18 will have to use VSATS. About 82 will require dial up connections.

6.8.3. Configuration for Premises LANs at Institutes

DAGI should establish a campus wide network as well as premises network in its campus at headquarters where the central hub of AGFIS will be established. Major Institutes including the nodal centers which will also act as DS will be premier institutions, imparting awareness and proficiency in one or more of the specified field of agriculture, from their Main Campus. So they should also have a Campus Wide Network as well as a premises network in the building of the information handling division of the institute, which will normally be the library.

Such premise network has to host the central hub of the Campus Wide Network, and digital information storage and processing systems to offer online

services. To implement this fabric, DAGI/Institute has to procure through or under the consultation of DAGI the below mentioned communication stacks.

- ?? graphical work stations
- ?? concurrent dial-up connections
- ?? application server for LMS
- ?? juke boxe/s
- ?? CD servers
- ?? Internet server
- ?? other communication stacks and solutions
- ?? interface/gateway to premises network
- ?? wide area connection to other institutes. (future)
- ?? Internet (GIAS or INET) link

DAGI/Institute Library may be a part of the main building of the institute or may be housed in independent buildings in the campus. The buildings may have different floors structure as KAUC and the access devices have to be scattered uniformly across the length, breadth and depth of this building. Connection to the Campus Wide Network and later connections to the sister campuses also will be required. Besides, several users may dial through to the services offered. Global access also is to be planned through either VSNL/GIAS Internet facilities or through DoT.

The DAGI/institute may be hosting its Library Management System (LMS) software possibly in a Pentium based system, which is to be retained pending porting of the LMS application to other pure UNIX/Linux platforms if essential. Additionally, there will be a need to host a full-blown Internet Server that will offer standard (ftp, telnet, http, newsnet et al) Internet based services to the local academic users of the Institute. Digital libraries and databases in CDROM as well as other electronic publications are to be spread through Jukeboxes, CD Servers- drive based and cashed according to the level of usage. These are to be made accessible over the network.

6.8.3.1. Architecture Prescription

Requirement of DAGI or an institute can be sustained initially within a single LAN collision domain. However, it has to grow rapidly through topology assimilation, aggregation and absorption into an Enterprise Network in the later stages of AGFISNET. With this in mind, DAGI has to chart and craft a technology, product and capacity plan that will emerge through modest beginnings and evolve in a non-disruptive migration continuum into an elastic and scaleable network that can easily imbibe any future local and cross-campus requirements of the Institute as well as AGFIS.

The Premises LAN Hub nodes are to be placed at a central/convenient location in the library building with UTP (CAT -5) wiring encompassing the entire building with pervasive connectivity in a system like that of KAUC. As requirements mount, the secondary hubs can be distributed across each floor of the building and traffic aggregated to the central hub in an optimal cabling pattern.

A terminal access server will be required, which can deploy the network in a loosely coupled manner thereby extending its reach in terms of availability, technology assimilation and capacity growth. A full-function Network Access Server that includes a Terminal Server is to be deployed to address the required dial-up and local dump terminals if any. Wide Area Networking into the campus network and the off-site campuses is to be enabled through routing based solutions initially. Later it can migrate unobtrusively and seamlessly to more effective switching based solutions as the bandwidth and access requirements justify it. With this in mind a capacity continuum is to be placed in perspective right from the start.

Considering that the LMS is normally dependent on an Intel based platform, a Pentium Server is to be configured to host this system that is to be anchored on the central hub. Alongside this machine, a more powerful engine like Alpha Processor running a 64-bit UNIX/Linux Operating System can be placed. It will provide the required Internet services, including a Bastion Host that secures the de-militarized zone (DMZ) of the intended firewall used to connect to the Internet. This machine

will also absorb the LMS function as and when it is ported to the Alpha based UNIX or Linux.

Digital Archives of text, audio, video and other files will be spread through a juke box with 1000 CD capacity (640 GB), a CD Server; drive based of 100 drives (64 GB) and hard disk based of 100 GB, all the three connected to the network.

Initial capacity requirements will only warrant a single segment LAN solution. As traffic and node populations grow this should move into the realm of multiple collision domains. Later it should move into multiple broadcast domains mandating the transcendence to switching and virtual LAN technologies and topologies.

Solution like Digital's enVISN architecture is good for effecting this growth. It starts at the low end with a stackable MultiStack solution that mounts components on top of each other, interconnecting them with an integrated 'cable less' thin-wire connection. It moves across a hybrid work-group chassis (hub 90) onto an enterprise multi-technology chassis (hub 900) that provides industry leading high performance access and configuration flexibility. It provides a 5.6 Gb/s slot independent back plane that can assimilate and integrate diverse protocols, technologies and capacities, all in a single hub chassis.

Based on the paradigm engineered over a solution like enVISN, the best option is to enter the ramp at the bottom of the high-end (hub 900). This option also ensures granular and layered SNMP based management throughout the total solution to insure and ensure high availability and serviceability.

6.8.3.2. Network Design

Hub 900 MultiSwitch enterprise hub chassis is a multi-technology, latest generation hub designed to provide support for large, complex networks ranging from Virtual LAN topologies to high-speed WAN backbones. It offers unparalleled high-performance multi-protocol access, configuration flexibility, superior security and granular SNMP network management over a 5.6 Gb/s back plane. It represents the

industry's top end in the arena of back plane integration. With the advent of IP Switching, the post-modern single-hop routed switching technique adopted in the GIGASwitch/IP module that sits in it; hub 900 is an ideal choice for technology assimilation and growth continuum.

Hub 900 Multiswitch enterprise hub chassis like DECHub900 is an 8 port chassis with 3 RISC processors, fans and redundant power supplies. It is entirely slot independent, providing technology support for Classical and Fast (10 and 100 Mb/s) Ethernet, FDDI, ATM and future technologies like GIGAbit Ethernet.

A single segment, LAN of about 62 nodes at initial phase can be synthesized using a stack that comprises a single 32-port (8 additional ports) repeater 900 TM to eschew watering down the power and performance of the HUB 900 and a pair of LAN-to-WAN routers for wide-area interconnection and integration. A stand-alone remote/ local access server can be configured to address the dial-up and dumb terminal connectivity. This represents the best initial outlay as well as investment protection for DAGI when eventual migration to the Enterprise Chassis occurs.

Server 900 TM is an access server that supports 32 MJ8 based serial connections, be it local or remote dial-up. A stand-alone version of this hubable (hub 900) module will be mounted on a DEChub ONE docking station and connected into a repeater port to provide the backbone for serial connectivity. This server has one of the highest port densities (32 ports) at the highest line speed of 115.2 Kb/s. Four V.34 modems can be used to offer remote dial-up facilities while the remaining 28 ports can be used for connecting the dumb devices if any. If dumb devices are not there or as and when they disappear, these incumbent ports can be used for expanding dial-up access.

Wide-area connectivity will be established through a pair of RouteAbout EW Access modules, each supporting a pair of WAN (serial PPP, X.25, V.25 bis and Frame Relay) ports at T1/E1 speeds. These routers are Internet ready, remotely configurable, SNMP manageable and offer a suite of enhanced IP monitoring and control functions. This includes packet filtering, packet prioritization (protocol

meshing) and bandwidth reservation. WAN ports on these routers will be connected to telematics media through RAD ASM-20 modems.

A standard industry rack can be used to house the entire network and the cabling structures. The networking components can be mounted on this rack. The institute has to procure the necessary UPS and other power conditioning equipments to ensure continuous operation of the above systems. CAT-5 UTP cabling infrastructure components based on standard assumptions will be required which will be subject to the concrete floor plans of the site.

Schematic Representation of Premises LAN of the AGFIS central hub inside DAGI as per specification discussed above is presented in Figure 6.4. The major advantage of the above premise LAN configuration is its elasticity and resilience to absorption of technology and capacity. The power, flexibility and performance of back plane integration are possible with this configuration. This configuration has been successfully tested and implemented at KAUC³⁵.

6.8.3.4. Host Environment

The advisable configuration for the Internet Gateway Server is one based on a machine like an Alpha Server 1000 A5/300 which can retain the performance and power spectrum and continuum of the hub 900 solution. For hosting the LMS system, a server based on Pentium processor will be sufficient. The system can be ported to an Alpha based machine under UNIX/Linux Operating System in future. For less used Digital Records a jukebox with 1000 CD capacity will be sufficient. For electronic document of middle level usage a 100 drive CD Server can be used. To mount highly used databases like CABI database, AGRIS, ASFA etc a Hard disk based 100 GB CD server into which the CDs can be cached will be apt.

As end user workstations Pentium 4 with 2.5 GHz regarded currently as the industry standard can be used. Specification and detailed list of items required for the configuration proposed is given in Appendix 7.1.

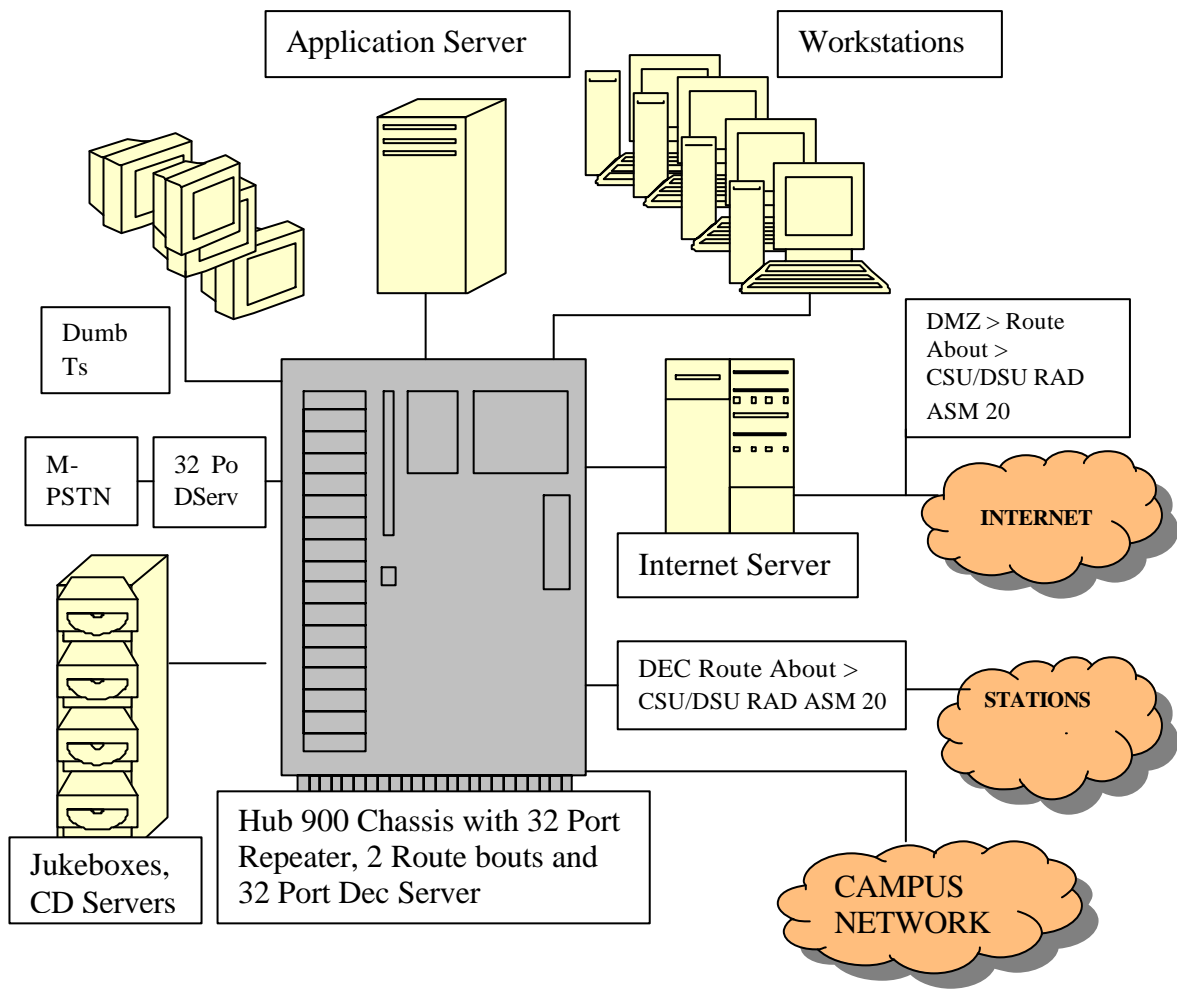


Figure 6.4: DAGI – AGFIS Central Hub and Demonstration Site: Premise LAN Configuration Model

6.9. Conclusions

CAGI while establishing the campus has to develop a well-planned site. The central hub of AGFISNET cum library and information service building should come in physically central position of the campus. This will be a major DS of AGFIS. UPS lines, network cabling etc should also be done along with power lines. IT laboratories, network control rooms, lecture/seminar halls, digital storage system locations etc should have sufficient provisions to plug in required systems and workstations and use multimedia projection systems. KAUC has already developed a similar facility but is remaining under utilized. This facility can be used as the second demonstration site of AGFIS. While developing infrastructures for AGFISNET, the managers should see extension activities, publication, library and information services, Management Information and computer networks with an integrated view. This will help to harness the maximum utility of the Information Infrastructures developed. Such an integrated view will contribute to the quality and efficiency of all related activities, which will ultimately lead to sustainable agricultural development and improved production and food security.

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Chapter 7

FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

7.0. Introduction

Institutions and individuals in the agricultural sector of Kerala are in constant need of information. They require information on diverse aspects like plant, animal, fisheries and other natural resources, agro climatic data, projects, budget, improved varieties, techniques and methods, packages of practices and also on the trends and developments in agricultural sciences and technology. They also need current information about agricultural prices, market trends, loans, supports, subsidies and other aspects. So agricultural sector may require various types of information services. The processing and repackaging of information for customized services to different categories of users also is very expensive. The creation of information systems is further more costly. The sector has already developed various information systems and service facilities at huge cost. To justify the expenditure on information systems in terms of their use it is essential to extract their maximum utility. This needs an integrated approach to information infrastructures their subsystems, libraries and content, which form the heart and lifeblood of the system. This chapter contains the summary of the discussion, major findings and analysis in chapters 4 and 5 and recommendations evolved based on that.

7.1. Extending Use of Information Resources

Presently most libraries in agricultural sector serve users from their parent institutions only. The data collected for the study reveals that no resource sharing programme exists in the sector. There is no cooperation and coordination between institutions in managing information resources. This causes duplication of costly resources. The sector fails to extract optimum utility of the information resources built up at considerable cost.

The information infrastructures should enable extending the services offered by libraries of the agricultural institutions. The libraries in addition to catering the requirements of parent organizations should be responsive to the needs of the agricultural scientists, students, officers, extension workers, administrators, farmers and other users from outside also. An extension of information service along with cooperation between libraries for that purpose will fulfill the long felt needs of the agricultural sector of the State. It will also ensure optimum returns by maximizing the utilization of the knowledge collections held by the institutes in agricultural sector.

7.1.1. Challenges to Information Systems

There is information explosion in every sphere of human activity including agriculture. The agricultural libraries with their limited resources face great difficulties in developing the collections and managing reliable services in the midst of the flooding of documents in various media, their cost escalation and cut in budget allotments. This also necessitates them to modernize their systems, share their resources and organize services on a cooperative basis to satisfy collectively the information needs of the users.

Current developments in ICT enable the networking; cooperation and resource sharing among geographically dispersed and remotely located agricultural institutions. Now information available everywhere can be integrated, disseminated and shared easily. Agricultural sector should harness the possibilities offered by ICT and use the available information infrastructures to link farm to the lab.

7.2. Library in the Institutional Setup

The mandate of institutions coming under the ICAR, Government of India and State Government, functioning in the agricultural sector of Kerala are in total to plan, undertake, and promote education, research, extension and development in agriculture, forestry, veterinary and animal sciences, diary sciences, fisheries, food, nutritional sciences, agricultural engineering and allied areas. The mandate of the libraries under them expressed by the mission statement of their parent institutions

and library guides available are to provide information support for the above-mentioned activities. This is of equal importance to the activity of any other division of those institutes.

For the development of an efficient library and information system with need based, resources, facilities and services a legal basis for the system is essential. Successful participation in resource sharing and networking programs also necessitates such an authority. But this is absent in most of the institutions.

The instruments of governance of the agricultural institutes and university do not define the organization and status of their respective library systems as clearly as they have done for their other divisions or units. They also do not provide for the appointment, responsibilities, functions, powers, status, qualifications and service conditions of the library staff in the same fashion in which they have done such things for their other academic/scientific staff.

The librarian should be directly responsible to the head of the institution to facilitate quick and professionally sound decisions. This is essential for the successful implementation of library policies and programmes. But in ICAR Institutes library is put at third level and the head of another scientific division comes between librarian and the Director. In departments of GOK and institutions under them also library and its officer in charge come in third or fourth level. In KAU libraries the position is better. An earlier study in this aspect has recommended the reorganization of institutions in agricultural sector by bringing library to the second level unit.

7.2.1. Library Advisory Committee (LAC)

The LAC has to serve as a link between the library and its users. LAC exists in almost all the institutions surveyed. But their constitution differs. In KAU Libraries; library management councils in which staff from lowest level to the manager participated in decision-making have been constituted. The revision of constitution of LAC's is essential to make it an effective mechanism. Participatory Management Councils have also become the need of the time.

7.2.2. Internal Organization of Libraries

The internal organizational set up of libraries surveyed also differs. In view of the objectives of the agricultural libraries; range of activities and services to be performed and staff available, the internal organizational structure should follow the model of KAU library combining different functions in accordance with size of the library's requirements and needs at the stages of development if essential.

7.2.3. Qualification and Status of Staff

Most of the institutions are having only one staff for looking after the library. They are mostly unqualified and usually library management is an additional duty allotted to them. Such staff cannot effectively handle information services. Presently no standards or norms for provision of library staff exist in most of the organizations except KAU and ICAR institutes. But in KAU also majority of the libraries are lacking professional staff. The managerial post, University Librarian is also vacant for a long time. In ICAR Institutes the library professionals do not enjoy parity of status and pay scales with scientific/academic staff. There are wide variations in the designations, salary scales and the qualification of the professional staff in agricultural libraries.

The library staff has to support and guide the scientists in their information search for research, extension and development work. For fulfilling this responsibility they require minimum qualifications prescribed by the UGC/ICAR. The professional staff of the library needs to be accorded the status and pay scales at par with other academic and scientific staff of the corresponding levels. The designations, which at present vary also, needs to be standardized and made uniform. Two detailed studies have already come out with necessary recommendations on this aspect. In institutions under State staff formula, qualifications and service conditions recommended by the KAU Expert Committee on Staff Pattern can be adopted. ICAR can consider the recommendations put forward by the detailed studies on staffing agricultural information systems already undertaken, with necessary modifications if any required.

7.2.4. Managerial Positions

The post of University Librarian incepted by KAU Act 1971 who is to give leadership for the system providing services at more than 48 stations spread over the State was vacant from 1971 to 1995 and is again vacant since 2000. The annual reports of the university clearly presents the wide difference in quality of development and functioning of the information system at KAU for the periods with and without the manager in position. This can serve as an eye opener to the fact that only with a competent manager in position an institute will be able to develop its library in a planned and need based way as strong sustainable system.

7.3. Financial Allocation

The library budget of the institutions covered by the study except 4 of them varies between 2 to 5% of the parent institution's budget. Even at KAU the library budget is less than 3% of the university budget. The agricultural sector spends only less than 2.69% of total budget for library and information facilities. Agricultural University Library Commission has recommended a minimum 6% of the institution's budget for the library. A study on resource allocation for university libraries has also supported the 6.5 to 10% of the institutional budget recommended by Kothari Commission. Agricultural institutes should have a separate and regular budget for library and information services. At present there is no norm for that. The budget allocation to the libraries of agricultural institutes is not only inadequate but is also fluctuating from year to year. This should be avoided. It is very critical for resource sharing and networking programmes because there will be commitments of various kinds with other participating libraries.

7.3.1. Expenditure on Print and Non-print Documents

It is seen that the expenditure on collection development accounts for 71% of the total library budget. From that 87% is used for printed materials, which includes books and journals. Only 13% is used for electronic documents. Among books and journals, the trend is towards spending more on duplicate copies of the latter. Very

important source materials are available in other physical forms more cost effectively. The practice of considering only print media needs to be stopped. A rational policy should be framed by each institute for proportion of expenditure to be met for the resources in various media.

7.4. Information Resources

The information resources available in agricultural sector of Kerala can be grouped under different subject specializations. They also belong to different media and type.

7.4.1. Specialization of Institutes

The evaluation of information resources available covered different areas of specialization mentioned below to consider possible resource sharing and networking.

- a) Crop Sciences and Horticulture
- b) Veterinary and Animal Sciences
- c) Fisheries and Marine Sciences
- d) Forestry, Soil Sciences and Water
- e) Agricultural Economics, Statistics and Marketing
- f) Agricultural Engineering and Technology

The survey revealed that information resources are available for use in the above areas of agriculture sector in Kerala at different institutes covered by the study. It is held by various organizations in Kerala with mandate on the above subject areas. They are engaged in education, research, extension and development activities. These institutions have also at their disposal, various physical and technology related facilities to provide information services. Their resources mainly document and journal collections in print and digital form as well as other facilities were comparatively evaluated for this study. Based on that possibilities for resources sharing and networking are identified.

Eight institutions ranking one to eight in size of the collections on each of the six sectors of agriculture are taken for evaluating their possibilities for subject specialization and leadership for resource sharing. Based on that data KAUC was found apt for specialization in crop science and horticulture, College of Veterinary and Animal Sciences, Mannuthy in veterinary and animal Sciences, KFRI in forestry and related subjects, CIFT in fisheries related area, CCBM for agricultural economics, marketing etc, CAE for agricultural engineering and technology.

7.4.2. Types of Information Resource

Information resources on agriculture, biosciences and related areas held in the agricultural sector are found to be of various types. They consist of books, journals, reports, thesis and working papers, video films, interactive multimedia programmes, CDROM databases and web pages. Of these books, reports, thesis and bound journals constitute 97.5% of the resources. The libraries in major institutions together spend approximately Rs. 135 lakhs for the purchase of books and Rs.208 lakhs for journals every year. The subscription of current journals consumes 53 % of the total budget for collection development.

7.4.2. Book Collections

When quantity of collection is considered libraries under KAU and ICAR are found to top the list. The collections in most of the institutions under KAU and ICAR are found to be adequate to serve the user community of those organizations. But the collections in other institutions especially under government departments are found to be highly inadequate.

Even though books are not very costly items there is considerable duplication on them between institutions and between different stations of the same institution. Presently there is no union catalogue in agricultural sector of the State.

Preparing a union catalogue of books available in the sector can help to avoid unnecessary duplication in regard to book purchases. This can publicize the

availability of agriculture related books in different collections. The resources will then become useful beyond the walls of an institution to the whole agricultural sector.

7.4.3. Journal Subscriptions

Journals subscribed by major agricultural institutions in Kerala causes a recurring expenditure of Rs 208 lakhs, which come to 52.58% of the allotment for collection development. Even with that expenditure the sector fails to provide accessibility to most of the important journals at many institutions.

The study found that the number of periodicals subscribed is declining every year. But the expense towards subscription for the decreased number of journals is increasing. During the five year period examined by the study the journals subscribed in agricultural sector in Kerala has gone down by 11.7 %. But at total expenditure on journals has gone up by 94%. The new journals on newly emerging subjects related to agriculture also remain out of reach.

7.4.4. Cost of Duplication of Foreign Journals

Being primary sources of information and being the group of documents causing huge expenditure journals subscription aspect was examined in detail by the study. It is found to be an important area for specialization and resource sharing in agricultural sector.

The major institutions in agricultural sector taken for detailed evaluation, together subscribed 1545 journals. But this constituted only 891 different titles. Of this 659 foreign journal subscriptions constituted only 360 titles. Out of this 299 numbers were duplicate titles. Of the foreign journals 158 titles have 360 subscriptions. Duplication goes up to 8 copies for many titles.

Detailed analysis of two sample groups of journals duplicated reveal important facts. Details of the first group show that 1 journal costing more than Rs 2 lakhs is duplicated at 5 institutions, 5 journals each costing more than Rs 2 lakhs per year are

subscribed at 3 institutions, another 2 journals each costing more than Rs two lakhs per year are duplicated in 2 institutions. 4 journals each costing between Rs one lakh to two lakh each per year is duplicated in 2 to 5 institutions. Of the 158 foreign journals duplicated 12 titles costing Rs.1 lakh to Rs 2 lakh are subscribed in 2 or more copies. The total cost of single subscription for them was only Rs.23, 17, 400. But the total expense including their duplication was found to be Rs.68, 44,650. The expenditure due to duplication comes to Rs.45, 27,250. Cost of one copy each of another 14 foreign journals comes to Rs.9, 05,735. But the total subscription cost met by the sector for these journals including their duplicate copies is Rs.27, 56,499. The expenditure for duplication is Rs.18, 50,764.

The actual total cost of single subscriptions for 158 foreign journals duplicated in the sector is Rs.51, 59,103. But total amount spend by the agricultural sector of the State for this 158 journals is Rs.154, 51,613. Hence it was found that Rs.102, 92,510 per year go for duplicate copies of the 158 foreign journals in the State.

Duplication of journals consumes a considerable amount of library budget. Their price is also increasing every year and they cost our foreign exchange. Library budget also shrinks causing discontinuation of many journals every year.

In such circumstances it is very important to avoid duplication of costly foreign journals and to make subscribed titles accessible to all. This will enable the institutions to divert the amount for duplication to the tune of Rs.103 lakhs for meeting the escalating journal cost, avoiding discontinuation of existing journals and addition of new journals in emerging fields of agriculture. So instead of foreign journal titles worth Rs. 52 lakhs available presently, the institutions will be able to have titles worth Rs.103 lakhs at their disposal if they establish a resource-sharing programme. All the institutions will also get full benefit.

7.4.5. Databases in CD ROM

Considerable portion of allotment for collection development in institutions like KAUC (35%) and CPCRI (22%) is utilized for electronic publications from

foreign countries. Even though these are essential to most of the institutions in the sector, cost makes them unaffordable. Only 11 institutions are subscribing to any of these titles. But these titles are normally not accessible to those from outside the institution.

The present study revealed that against a total of 52 subscriptions of databases costing Rs.99 lakhs the libraries received only 30 titles costing Rs.40 lakhs. Duplicate copies of 11 titles related to agriculture are subscribed in 2 to 4 copies in Kerala. There is a net expenditure of Rs.67 lakhs for this duplication.

Back files of most of these titles from 1971 are available from publishers but not subscribed. About 50 titles of relevance to agricultural sector are published. Their total cost comes to approximately Rs.55 lakhs only, which includes back files also. By avoiding duplication and through a resource-sharing programme the libraries can subscribe to all the 50 titles with full back files at a cost less than that which is met presently to subscribe 30 titles. Their use can also be extended to all institutions in Kerala.

7.4.6. Reference Sources in Digital and Other Forms

Various reference sources in digital form are available at KAUC, CPCRI, IISR, and CAGI. They include, reference books, specialized libraries in digital form, current back files of abstracting journals, and complete collections of back volumes as well as current issues of a few primary journals. The cost of these materials ranges from Rs.1000 to R.15 lakhs per title as subscription or annual license fee.

The major collection of audiovisual materials on agriculture useful for teaching, extension and awareness programmes among farmers and tribal groups and the general public is available at KAUC library. These documents can form important tools for extension activity at KVKs and Krishi Bhavans, which interact with the farmers. But they are rare and not available through normal trade channels.

The libraries surveyed also hold significant collections of theses, reports, maps, posters etc mostly generated in-house. These documents are prepared at huge expense. They being unpublished are not available for other institutions. The theses collection at KAU includes 3870 PhD and MSc dissertations in different branches of agriculture. Traditional universities also have PhD thesis very relevant to agricultural sector. There is also a good collection of research reports and maps generated in-house spread through different libraries

All the above items can be made accessible to their expected users in agricultural sector only through a resource-sharing programme. A resource-sharing programme has to publicize the availability of these materials among all institutions. Sharing these resources with other institutions can effect savings of space and cost of binding, purchase, indexing etc of their printed equivalents at many institutes.

7.4.7. Collection Development Policy

Each library should evaluate the strength of the existing collection against the current and future teaching, research, extension and development programmes. The libraries should frame policies that can ensure consistent and comprehensive collection development in the areas mandatory to the institution. Quality of collection and services depends on such policies and planned development. To fulfill commitments related to resource sharing programmes all the participating libraries should have appropriate collection development policy.

7. 5. The Library Building and Access

Presently the technological devices like computers, communication stacks and other such gadgets are becoming normal tools in libraries. Hence in building design, along with electrical wirings and fittings, UPS and network cabling and other such requirements should be appropriately considered. Along with space planning for readers, staff and reading materials, new servers, work stations, digitization equipments, electronic document storage systems, CD servers, juke boxes, digital presentation systems etc are becoming critical and are to be considered. The involving

of the librarian in the planning and design of the library building as well as librarian's ICT literacy has become very important in the present day context. The projections regarding the space requirements for various items including stacking of books, periodicals, other materials, reading areas, staff areas, as well as ICT related aspects like IT Labs, network control rooms, record storage rooms of the digital library, conference/seminar facilities etc should be made with a vision for next 20 years according to the norms and standards specified for the purpose by concerned agencies. KAUC is found to be an excellent model for physical facilities on this line. CTCRI, CPCRI, CIFT, etc also have excellent physical facilities.

7.5.1. Access and Opening Hours

Of the Libraries, which responded to the survey, 40 libraries were following open access. In 21 libraries closed access system is followed. The libraries surveyed function from 10 AM to 5 PM only. The institutes being in remote locations and staff mostly residing inside the campus itself it is advisable that opening hours should be adjusted as per the demand of users and should be at least from 12 to 15 hours a day. KAUC is a library in main campus of the university which has invested about 9 crore for its development. More than 1000 students, scientists, teachers and other staff are residing in the same campus where the library is situated. It is accessible to those from nearby campuses also. Hence it should be kept open day and night to extract optimum returns for the investments made.

7.6. Areas for Resource Sharing

The study has analyzed in detail the possibilities for resource sharing in regard to book, journal and electronic publications and databases. The findings suggest that resource sharing will bring in cost effectiveness and efficiency not only in collection development but also in many other processes and services of library and information systems. Important areas identified are technical processing, storage of less used materials, HRD in ICT, reprographic services, documentation services including abstracting and union catalogues, conservation activities etc.

7.6.1. Technical Processing

In most of the libraries in agricultural sector in Kerala the collection is not classified, catalogued and arranged accordingly. Only major institutions have technically processed their collections at least partially. There is large extent of duplication of titles in different collections. Libraries presently do the technical processing independently.

Technical processing works like classification, cataloguing, data entry in computers, preparation of union catalogues, OPACs, production of bibliographies and abstracts, HRD etc can be done cost effectively under a resource sharing programme. It can by pooling together the catalogues of participating libraries make available an online public access union catalogue. The libraries can download the records related to their newly acquired titles and can save the effort for cataloguing, classification and data entry work. This will avoid huge waste of human and financial resources caused by the duplication of technical processing work.

7.6.2. OPACS and Bibliographies

A resource-sharing programme can also circulate a union Monthly New Addition List for Books pertaining to the libraries participating in the programme. It should be based on the records received from participating libraries. Nodal Centers can prepare and periodically publish in digital or printed form bibliographies on the area of their specialization.

7.6.3. Documentation Services

Most of the agricultural libraries surveyed provide various documentation services. These are not automated and are presently done individually by the libraries. Documentation services are costly when done by individual institutions. If the services are provided jointly it becomes less expensive. Resource sharing also improves their scope, comprehensiveness, coverage, speed, quality and reliability.

7.6.4. Current Awareness Service

Agricultural libraries have to expand existing document identification capabilities by establishing Contents, Abstracts and Photocopies Service (CAPS) as run by INSDOC. The institutions suggested by this study for acting, as nodal centers in the six sub-fields of agriculture are capable to provide CAPS service on their subject area. These nodal centers should be supported by government or other agency like DAGI, KAU, ICAR etc to run CAPS in their particular area of specialization as well as maintain common facilities. In return for such increased financial support, libraries at these institutes are to be authorized by their parent organizations to build up collection in well-planned way to provide services including CAPS to other institutes also.

In a resource-sharing programme for journals each library can prepare and transmit content pages of the journals received in those institutions every month to a leading institution which is to publish a monthly bulletin or volume of the content pages and circulate them to all libraries participating in the programme.

7.6.5. Abstracts and Indexes

A resource-sharing programme for agriculture and bioscience information can create instruments for conduct of bibliographic searches in articles contained in the journals subscribed by participants. Libraries at the nodal centers should plan their journal subscriptions jointly without overlapping of titles between them. They should prepare a computerized database of articles pertaining to Kerala in their mandatory subject available in the journals and other documents subscribed at the nodal center as well as other institutes cooperating with it. For this all article titles and accompanying abstracts, should be computerized. This database should form the key to document provision through CAP services also. Based on this database Monthly Abstracts on Agriculture limiting to the agro climatic regions of Kerala can be published under a resource-sharing programme.

Major agricultural databases like CABI, ASFA, AGRIS, AGRICOLA and MEDLINE are subscribed in Kerala. Records related to agro climatic regions relevant to Kerala could be downloaded at the institutions subscribing them. These records can be organized for reference under a resource-sharing programme.

7.6.6. Full-Text Retrieval

As most of the important reports, theses etc on agriculture are not published; developing full text digital libraries of such materials are very important for agricultural research. Many big collections from groups of agricultural libraries of foreign countries are available in digital version. Already attempts on development of full text thesis library have been successfully conducted in one of the libraries surveyed. A resource-sharing programme should develop full text digital archives of the documents generated in-house by all participating institutes as well as documents relevant to the agro climatic regions of Kerala produced elsewhere.

7.6.7. Other Services

Inter library loan between participating institutions, establishing common storage facility for less used materials, common preservation labs and, common printing facilities etc are found to be other areas which can be considered under a resource sharing programme.

7.6.8. Human Resource Development

Success of resource sharing and networking will depend on continuous training of the librarians in the knowledge, skills and techniques in information work. Training facilities are costly and each and every institution cannot establish their own training facilities. AGRIS should take leadership in providing such training. In the institutions covered by this study KAUC was found to have excellent training facilities for librarians. Use of this facility for HRD will extract the optimum utility of public money invested there.

7.7. Resource Sharing Network

Based on the facts and needs discussed above this study proposes the establishment of an Agricultural and Farm Information System (AGFIS) and Network for Kerala covering agricultural institutions in the State under KAU, ICAR, GOK and other agencies. It will be a State level network intended to strengthen Information Management (IM) within the agricultural sector of the State of Kerala.

AGFIS proposed by this study will have an integrated view of information system and content. The system will be a common one to support, managing and making available for use information and documents meant for different activities in the sector like planning, administration, research, education, extension and development. Considering the needs of the agricultural sector of the State the AGFIS network is proposed to be implemented with five levels.

7.7.1. Status of ICT Facilities at Institutes

Minimum ICT facilities in the concerned institutes are one of the essential prerequisites for the successful implementation of resource sharing network. The survey conducted for this study revealed that most of the major institutions in agricultural sector have already acquired computers. But for AGFIS some costly common facilities will become essential and are to be created by the DAGI the agency managing AGFIS. The participants normally will have to make their own arrangements for required hardware, software and other peripherals to become a nodal center or to participate in the programme. Government has to provide minimum computers and connectivity at lower level institutions like research stations, KVKs, Krishi Bhavans, veterinary hospitals, village libraries etc. This can enable such institutions to develop local capabilities and give farmers and the public the power to use the information system.

7.7.2. Phasing and Time Frame

Considering structure of the agricultural sector of Kerala and also factors such as information resources, infrastructure facilities, manpower and level of computerization at present in various agricultural institutions this study proposes launching of the AGFISNET in three phases running over three financial years.

The first phase has to cover the library and information systems of six nodal centers, other ICAR Institutes, major institutes under KAU, FIB etc. The second phase will cover remaining KAU colleges, concerned departments of GOK and other institutions. In the third and final phase all the research stations, Krishi Vigyan Kendras, Agricultural Offices, veterinary, hospitals, Krishi Bhavans, village libraries, NGOs and all concerned institutions under government and private agencies in agricultural sector of the State will be brought into the network programme.

By the end of third year AGFISNET implementation is to be completed and services should be extended to the farmers and extension workers in villages through their nearest accessible service outlets. Scientists from any remote location of the State will then get linked to State, national and international information systems in agriculture.

7.7.3. Common Standards, Formats and Procedures

Successful participation in AGFIS system will require uniformity in various aspects. Hence common standards for hardware, software, MIS work, library processes etc will be essential. Standard formats are to be used for different processes. For MIS most of the required formats are already specified in commonly used, hardcopy. All that has to be done in this regard will be to recreate these forms in a spreadsheet program for the computer.

Cooperation for technical processing works, documentation services etc will require the use of common standards and codes for cataloguing classification,

computerized databases etc by libraries participating in the programme. A prior agreement on standards for bibliographical and DBMS format is essential.

Presently among 30 major libraries; for Classification 7 institutions uses DC, 6 institutions UDC and 8 institutions CC. For cataloguing 7 uses AACR, 10 CCC and 1 their own scheme. Others have no specific standards or schemes. For database development 14 uses CDS/ISIS 6 uses other software.

INFLIBNET, which supports most of the academic and research libraries in India, has recommended the use of DDC for classification, AACR for cataloguing and CCF format for database development. In CCF records can be generated much faster and they can be interchanged with any ISO-2709 based format in the world. Presently DDC has an electronic version also. INFLIBNET has also developed library automation software SOUL, which can be also be considered by AGFISNET for use in participating libraries.

7.7.4. Hardware

Presently there is no prescribed standard for computer hardware in institutions surveyed. It is recommended that AGFISNET participants should go in for computer systems, which have components of current technology, scope for up gradation and compatibility to packages used for highly specialized functions in the system. A minimum configuration is to be recommended by AGFIS for workstations/PCs at the institutions like Krishi Bhavans, village Libraries etc for enabling their access to the network.

Based on current technology and affordability a Pentium IV 2.5.GHz, 256 MB RAM, 40GB HDD, CDD 54x, CDRW 48x, 17 Inch Color Monitor, Speakers, Scanner, Keyboard and Scroll Mouse, Web Camera and Internal Modem and an Ink jet Printer and scanner is proposed by this study for service outlets at Krishi Bhavans, village libraries etc and for use as workstations. This costs less than Rs. 20000 and can fulfill the requirements at these service points.

7.7.5. People and Technology

The study considers that awareness about AGFIS is to be created among the people for the success of the system. Training is also to be provided to scientists, teachers, extension workers, farmers and the public to make the system useful for agricultural development.

7.7.6. Organizations and Management

The overall policy and management of the AGFIS is to be coordinated by the Department of Agriculture, GOK. But a special department of required status with delegation of concerned powers needs to be constituted.

For the implementation and future management of the AGFIS this study considers it essential to form a Directorate for Agricultural Informatics (DAGI). It should have mandate for agriculture and biosciences information that runs beyond management information, extension activities, libraries, publications and computers. Constituting Management Council for DAGI by GOK with Agricultural Production Commissioner as Chairman is also found to be a requirement. An Information Management (IM) Unit in the DAGI with ICT experts and subject experts from each sub sector of agriculture also is proposed. The discussion in Chapter 6 suggests that organizations of repute in ICT ventures taking up outsourcing ICT based works are to be contracted for network design, hardware procurement, installation, and commissioning in DAGI and institutes participating in AGFIS as nodal centers.

7.7.7. Demonstration Sites

Mass Media will be very important for dissemination of agricultural information. DAGI will in future require independent studio and radio facilities. It will be a blessing if DAGI could work near and in close association with regional Doordarshan Kendra at the State Capital and All India Radio. Presently GOK has that facility. It has an adjacent campus to Doordarshan under it where presently a few extension and training activities are going on.

DAGI can establish a campus in State capital near Doordarshan where sufficient space for that is available to it. AGFIS central hub at the campus should start research and development as well as education and training for participating institutions.

7.7.8. Network Options and Architecture

There is good telecommunication infrastructure in the State. NIC is likely to participate in various projects of Department of Agriculture, (GOI). Its expertise in the management of district-level telecommunications will be of importance for strengthening the IM capabilities of farmers and extension services and also the research/extension linkages.

Network designs based on available functional models can be adhered to in AGFISNET. Such Networks to be initially established in DAGI and nodal centers under AGFIS programme have to grow rapidly through topology assimilation, aggregation and absorption into Enterprise Networks at later stages. All network development has to be done with this in mind.

DAGI under GOK should establish a well-planned Campus, campus wide network as well as required premises networks at headquarters where the central hub of AGFIS will be established. Six nodal centers also should establish similar networks. The institutes should acquire required LAN/communication stacks and solutions as per standards prescribed by DAGI in consultation with it.

7.7.9. Technology Choices

The technology choices available and their positive and negative aspects are discussed Chapter 6. AGFIS should consider only the technology that has proven to work, that will still be appropriate for at least another ten years, which can be afforded as well as simple. Based on current trends it is found advisable to use a combination of landlines both leased and dial-up, satellites, and radio in AGFISNET.

7.8. Quality and Utility of the Systems and Services

The assessment of the utility of libraries in agricultural sector for their qualitative evaluation was done through user's responses to the questionnaire.

In the survey of the 427 users from manager, scientist and student categories who responded to the questionnaire 15% of the users rated the book collection as excellent, 19% as very good, 23% as good and 11% as poor.

Journal collection was rated as excellent by 4 % of users, as very good by 19%, as good by 40 %, as average by 15 % and as poor by another 15 %.

Data on user's ratings of the library staff shows that 26% of users rated staff in agricultural libraries as excellent, 24 % as good, 26 % percent as average and 18 % as poor

User's awareness and use of the information resources was also assessed by the study. Of the users 24% reported that they were fully aware of the resources of the library and 9 % stated that they were making full utilization of the resources. Another 4 % was utilizing the resources at least up to 75%. Only 3.56 % reported that they were not at all aware of the resources of the library.

Rating of the users on the organizational set up, presentation of the library system and quality of services from the experience of users was obtained through the questionnaire. The overall system of the library was rated as excellent by 13% of users, 19% as very good, 29% as good, 18% as average and 7% as poor.

Of the 77 librarians that responded to the survey from inside the system 3.5 % rated the library as excellent, 2 % as very good, 26 % as good, 25 % as average and 23 % as poor.

.8.1 Lack of Farmer Orientation

A few of the major libraries surveyed are having excellent collections specially meant for the farmers. But farmers are not using such libraries. Krishi Bhavans are not having any such document resources, but village libraries are rich in this aspect. Of the expected users of agricultural information systems less than 1 % will be scientists and administrators (who exist to serve the farmers) and 99 % are farmers. But presently the information systems under agricultural sector are not accessible or inviting to the farmers whom they have to serve directly and indirectly.

A survey using a questionnaire in regional language was conducted among randomly selected farmers and public living near the regions of the major agricultural institutions. The intention was to check the sources they use for agricultural information, its accessibility and use. Of the 220 responses only 17 % stated that they were aware of the agricultural institution existing near them and 8 % stated that they approach those institutions for information. From this less than 1 % only stated that they are satisfied and another 5 % opined that the service is not satisfactory or relevant. For 32 % the procedural difficulties and the psychological barriers prevented them from using the services of those institutions.

Among the farmers and public who responded 77 % stated that they were aware of the Krishi Bhavans existing nearby and of this 14 % stated that they approach Krishi Bhavans for information. From this 7% stated their service as satisfactory and 20 % as unsatisfactory.

Among the responses 93 % stated that they were aware of the village library and 32 % of the total responses stated that they approach them for agricultural information. The survey revealed that village library was the most sought after institution by farmers, and that procedures and psychological barriers in using those collections were less there.

But 65 % of the respondents were of the opinion that Krishi Bhavans are the apt place for providing agricultural information services to the farmers. But 59 % preferred village libraries and 12 % research institutes for providing agricultural information services to farmers.

7.8.2 Possible Hindrances to Resource Sharing

The present study obtained the views of the librarians/officers in charge of libraries from institutions covered by the study in regard to the hindrances for resource sharing programmes. Of the librarians who responded 60% have stated that absence of planning is an important factor hindering resource-sharing programmes. Then 76 % stated absence of institutional leadership as an important factor. Of the other factors hindering resource sharing programmes absence of spirit of cooperation (64 %), inadequate resources (66 %), inadequate finance (68 %), lack of communication (69 %) etc, were rated as high by the librarians.

From the analysis of the responses of librarians collected for this study it is to be concluded that an effective resource sharing programmes requires planned development of the institutions, and competent and tough managers at the institutions. Well-defined areas for sharing resources and assignment of specialization at the institutional level are also essential. There should be a detailed agreement on terms and conditions.

7.9 The Outcome of the Study

Agriculture is the lifeblood of our economy. It contributes 25 percent of Gross Domestic Product. In agricultural sector of Kerala there are approximately ten thousand professionals, which include scientists, extension officers and other staff working. Agriculture continues to be the occupation and way of life of more than half of our population even today. Sustainable prosperity of this class; the farmers and the landless agricultural laborers holds the key for improving the overall human resource development scenario in the country. The efficiency and effectiveness of education,

research, extensions and development at the farm depend upon several factors amongst which information is one of the important.

The study revealed that we have rich and relevant knowledge/information resources in our agricultural sector. But it is not getting connected to the scientist and managers and extension activists who require it. The information to reach over the farmers spread over the blocks and villages mostly in remote areas is an up hill task. The diversity of Kerala's agro ecological situation adds to this challenge further. In today's world farmer's needs are much more diversified and the knowledge required to address them is beyond the capacity of the present extension functionaries.

But today, it is possible to find a solution to this situation by using the potential of Information and Communication Technology. This can enable pooling and sharing of the available resources. It can also enable information systems access to resources available world wide to cater to the requirements of the scientists and extension workers as well as the location specific needs of the farmers.

The present study could identify the institutions and groups that require information services and the facilities available to them. The study also assessed the agricultural information resources available in the State, their location, accessibility, usage, hindrances for access/usage, the extent of loss of public money due to unnecessary duplication, provision for coordination and resource sharing available etc. Based on the above the study could formulate various recommendations for extracting the maximum utility of the available information resources by extending their accessibility to the whole agricultural sector to all its levels. A model plan for resource sharing and networking in the agricultural sector also is put forward by the study.

7.9.1. Recommendations

Based on the findings of the study and the discussions in the above paragraphs a few suggestions and recommendations on important aspects of agricultural library and information system of Kerala are given below. Implementation of these

recommendations can improve the quality, efficiency and cost effectiveness of agricultural information services in the State and contribute to increased production.

- a) The instruments of governance of the agricultural institutes should clearly define the organizational set up of their libraries divisions along with that of other divisions. These instruments should also provide for the appointment, responsibilities, duties, powers, status, qualifications and service conditions of the library staff in the same fashion in which such regulations are devised for other academic/scientific staff.
- b) The organizational setup of institutions in agricultural sector should be reorganized by bringing Library also as the second level unit.
- c) Library Advisory Committees (LAC) in all institutes should incorporate representatives from every unit/department that library has to serve. The head of the institution should chair LAC and Librarian should act as the Secretary. Library Management Councils with intra departmental representation should also be constituted in all libraries as in KAU with Librarian as Chairman. This will ensure transparency and participation of all staff concerned in library and information systems development.
- d) Staff formula, qualifications and service conditions recommended by the KAU Expert Committee on Staff Pattern for University College/Research Station and other institute libraries may be adopted for libraries under KAU and State government. ICAR should also consider revising qualifications and service conditions of library and information service professionals for its institutes in the changed context of ICT inroad to libraries.
- e) Qualifications prescribed by UGC/ICAR and additional qualifications on specialization in agricultural information handling prescribed by concerned expert committees should be strictly adhered to for filling up the posts of librarians at managerial level in all institutes.
- f) It is very important that the chief librarian of all institutions small or big should be appointed right from the inception of the institution. He/she should be a professional. The foundations for library development should be laid under his/her

supervision. Such library posts at the managerial level should never be kept vacant considering the importance of information systems for development.

- g) A minimum 6% of the institution's budget should be earmarked for the library. Agricultural institutes should have a separate and regular budget for library and information services.
- h) The nodal centers specializing on different sub sectors should lead in providing services in concerned areas to agricultural sector. Based on present study KAUC is recommended for specialization on crop science and horticulture, CVA for veterinary and animal sciences, KFRI for forestry and related subjects, CIFT for fisheries related area, CCBM for agricultural economics, marketing etc, and CAE for agricultural engineering and technology.
- i) Web based union catalogue of books, reference sources in electronic media, audio and video documents, dissertations, reports, maps etc available in the agricultural sector of the State should be published. This can help to avoid unnecessary duplication in purchase as well as technical processing works. This can publicize the availability and maximize the use of resources.
- j) Development of digital full text library of theses and dissertations of doctoral studies in agriculture and biosciences conducted in Kerala in KAU and other traditional universities as well as other documents generated in-house at the institutions in agricultural sector of Kerala like project reports, journals, annual reports, experimental data, resource data etc should form priority item under AGFIS. Technology developed in the region itself for full text library like Nitya Archive by CAGI should be given preference if parameters related to cost, efficiency and possibilities for future scaling stands equal with others considered.
- k) Standards prescribed by INFLIBNET for classification, and cataloguing, CCF format recommended by it and supported by UNECO for database development and CAB Thesaurus for producing standard subject descriptors etc are recommended for agricultural sector.
- l) The scientists, extension activists, librarians managers and the farmers should be trained under AFGIS in various aspects of ICT relevant to each group in institutions at various levels under AGFIS.

- m) Duplication of foreign journals should be stopped. Journals should be subscribed under a resource-sharing programme, and made accessible to all institutions. The funds presently put on duplicate titles should be utilized to subscribe new titles.
- n) Duplication of subscription to CDROM databases between institutions should be stopped. They should be subscribed under a resource-sharing programme. The savings should be diverted to purchase new titles and full back files.
- o) The projections regarding the space requirements for various aspects in libraries should envisage IT Labs, network control rooms; record storage rooms of the digital library, conference/seminar facilities etc also and should be made with a vision for next 20 years.
- p) To extract returns for the amount spent at the costliest information service infrastructure of KAUC, that facility should function 24 hours a day, 365 days a year with maximum publicity on that aspect.
- q) It is recommended that technical processing in libraries should be done on cooperative basis.
- r) An Agricultural and Farm Information System (AGFIS) and Network covering agricultural institutions in the State under KAU, ICAR, Departments of GOK and other agencies should be established. It should be a State level network intended to strengthen information management within the agricultural sector of the State of Kerala. AGFIS should have an integrated view of information system and content. The system should be a common one to support, managing and making available for use information and documents meant for different activities like planning, administration, research, education, extension and development.
- s) For the management of the AGFIS creation of a Directorate for Agricultural Informatics (DAGI) under Department of Agriculture, GOK with mandate for agriculture and biosciences information that runs beyond management information, research information, extension activities, libraries, publications and computers is recommended. The Director of DAGI should be a senior information scientist with proved record of achievements, innovation and commitment to information management issues in agriculture. Management Council for DAGI also should be constituted by GOK with Agricultural Production Commissioner as

Chairman. An Information Management (IM) Unit with ICT experts and subject experts from each sub sector of agriculture should also be created.

- t) It is recommended that DAGI should establish a campus in State capital near Doordarshan where sufficient space is available to the Department. AGFIS central hub at the campus should start research and development as well as education and training; for participating institutions.
- u) Networking facilities offered by NIC should be utilized for extending the service of AGFIS to the farm for cost effectiveness and also to get the management and technical experience that NIC possess.
- v) DAGI should chart and craft a technology, product and capacity plan that will emerge through modest beginnings and evolve in a non-disruptive migration continuum into an elastic and scaleable network that can easily imbibe any future local and cross-campus requirements of the Institutes as well as AGFIS.
- w) At DAGI Main Campus and at all nodal centers the central hubs of the concerned campus networks, their administration, and digital information storage and processing systems should be located in the buildings of the information handling divisions of the institutes, which will normally be the library.
- x) AGFIS should use the technology that has been proven to work, that will still be appropriate for at least another ten years that can be afforded as well as simple.
- y) Every agricultural institute's library should build up an important unit for providing information service to farmers. Their collections should consist of information materials repacked for them. Preferably they should be in regional language. Interactive multimedia programmes, videos and poster as well as facilities for using and presenting them should be available in this unit. At least one access terminal to AGFISNET should be provided at this unit. Continuous training on use of ICT facilities as well as extension programmes related to sustainable methods of farming, animal rearing, fisheries etc should be conducted in association with this unit. There should be facilities for farmers to present their innovations as well as for recording and preserving traditional knowledge obtained from them at this unit. There should be a well-qualified professional librarian with ICT literacy and aptitude to manage this unit. If the institute and its

library are located in an urban area this unit should be located at a nearest village relevant to the mandate of the institute concerned. The expenditure incurred for an agricultural institute can in no way be justified unless such a service is provided by it.

7.9.2. Fulfillment of the Objectives of the Study

The study was conducted with the objectives to evaluate the resources, facilities and services of the information support systems in agricultural sector of the State of Kerala. Investigation on the factors hindering their efficiency, finding out solutions to overcome them, as well as evolving proposals for resource sharing and networking also formed the objectives. The study has made a general assessment of information resources and facilities of 105 institutions in agriculture sector which consisted of 30 resource rich institutions, 75 minor institutions consisting of samples of all categories of institutions from among approximately 6745 existing in the State. Appraisal from inside the system was done by a survey and interview schedule conducted among librarians and officers in charge of information services. The quality and relevance of the collections and efficiency and accessibility of the systems were evaluated through surveys among managers, scientists and farmers.

The study observed the richness of the existing collections, lack of provision for extending their use outside the institutions, recurring loss of crores of rupees occurring due to present need for duplication of resources, and lack of coordination and cooperation in managing and disseminating information in the sector. Based on these findings the study succeeded in framing various recommendations for improving the situation as well as preparing a plan for establishing a resource sharing network for agricultural sector of Kerala. The recommendations and proposals if implemented can enable the optimum utility of agricultural information resources available in the State; can ensure accessibility to the managers, scientists, and farmers from any part of the State to the complete agricultural knowledge available. An effective communication link will come into existence between the laboratory and the farm, enabling quick transfer of technology, which will lead to improved quality and production in the sector.

7.9.3. The Tenability of the Hypothesis

The hypothesis formulated at the beginning of the study are that; agricultural information and extension systems in Kerala fail to utilize the available resources for providing need based services to various categories of users in the agricultural sector and that there is lack of efficient information infrastructure and coordination form information management, access and dissemination in the sector. The hypothesis was proved to the extent that the sector is holding valuable information resources; but the same and related facilities are not spread according to the requirement. It was also found that available resource is not accessible to most of the expected users, there is no resource sharing programme as well as provision for coordination of the information services to extract the maximum utility of the resources developed at huge cost.

7.9.4. Areas for Further Study

As agriculture is concerned with the production, conservation and improvement of the plants and animals and the natural environment in which they grow it is a vast subject with various sub disciplines. Agricultural science may require research information from various branches of biosciences. This necessitates the agricultural information systems to specialize on different disciplines under it and share that knowledge with scientists working in other disciplines under agriculture as well as facilitate access to information from a wide variety of topics coming under agriculture and biosciences. Then agricultural sector is also an area in which two types of information dissemination systems exist - extension activities provided by scientists themselves and information services by librarians. They exist independently and duplicate resources and fail to achieve efficiency and effectiveness. One system holds information and the other system hold facilities for disseminating it.

Also library and information service scenario where most aspects of ICT were initially tested and perfected is witnessing revolutionary changes in the mediums and methods for accessing, storing, organizing, processing and disseminating information. In live agricultural libraries traditional hard copy materials, online databases and

familiar CDROM products have been joined by the World Wide Web, electronic journals and Intranets. Continuous professional improvement to cope up with these developments has become very essential for agricultural librarians. Resource sharing, cooperative technical processing and access to centrally located collections have become the standard of the time. In Library and Information Science field agricultural information systems is a neglected area of research and hence all the above aspects of agricultural information systems need studies and can be listed as follows.

- ?? National and State level agricultural information systems
- ?? Resource sharing and networking at national level and State level
- ?? Information systems on specific disciplines of agriculture like crop sciences, veterinary and animal sciences, forestry, fisheries, agricultural engineering, agricultural economics etc.
- ?? Agricultural university libraries: general and specific
- ?? ICAR institute libraries: general and specific
- ?? Information services for extension activities in agriculture
- ?? Agricultural information services at local community, Krishi Bhavans, village libraries etc.
- ?? Agricultural libraries and their organization, management, staffing, standards etc.
- ?? Information sources in agriculture relevant to India.
- ?? User studies in agricultural libraries.

Of the above areas studies has already been made on conceptual framework for establishing a National Agricultural Information System by Subbaiah, SAUs by Prasher, user studies on veterinarians by Gokul and forestry libraries at national level by Singh. The present study has covered establishment of an agricultural information system at State level including possible resource sharing and networking mechanisms. Studies on the other aspects at national and State level are also open to researchers in library science. At State level the following aspects are virgin fields for research.

- ?? Specialized information systems at State level on the six sub sectors of agriculture; like general agriculture, veterinary and animal science, forestry, fisheries, agricultural engineering and agricultural economics.
- ?? Information systems at agricultural colleges in the State
- ?? Information systems for the organizations under Departments of Agriculture, Animal Husbandry, Poultry, Fisheries, Dairy Sciences etc.
- ?? Organization, management, staffing etc of agricultural libraries at different levels in the State
- ?? Information services for the farmers and village level systems for managing local information.

7.9.5. Conclusion

The study has brought to light the richness of information resource available in Kerala on various aspects of agriculture. It has also revealed the factors that hinder the State from extracting optimum utility of the resources. The observations have helped in framing necessary recommendations to improve the situation as well as for planning an integrated information system and resource-sharing network for agricultural sector.

A resource-sharing network programme like AGFISNET proposed by this study will lessen the duplication of costly journals, books and databases. Even in selected areas like foreign journals, electronic databases etc it can effect considerable savings of recurring expenses to the tune of approximately one crore per year. This amount can be diverted to increase the quantum and quality of information resources available. AGFISNET will also ensure availability of all the materials held by the institutions in agricultural sector in Kerala to each and every institution and user in the State. This will ensure access to all the scientists of Kerala, teachers, researchers, extension workers, development activists, and administrators, farmers and public, the whole wealth of knowledge/information resources on agriculture available in the State. Availability and accessibility to more resources at less cost by all institutions and to all concerned will become possible.

While developing infrastructures for AGFISNET, the managers should see extension activities, publication, library and information services, management information, research information, and computer and communication networks with an integrated view. This will help to harness the maximum utility of the information infrastructures developed as well as contribute to the quality and efficiency of all the activities in agricultural sector. Such an integrated view will avoid duplication of computer and communication infrastructures between management, library and extension information systems. It will also keep the information component connected to information infrastructures. The failure of most of the information infrastructures is due to the lack of such an integrated approach.

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LIBRARY/INFORMATION SYSTEM QUESTIONNAIRE

Purpose: To study the resources, facilities and services of the library and information systems that support agricultural education, research, extension and development with a view to ascertain the feasibility for resource sharing, standardization, coordination and networking.

1. The information furnished in the questionnaire will be kept confidential.
2. Where possible answers and boxes are provided tick the box against the appropriate answer.
3. Where possible answers are given in tables tick appropriate position/cell in to denote correct answer:

A. RESOURCES OF THE LIBRARY

1. Name of the Institution/Organization/Department: _____

2. Year of Establishment: _____

3. Management: State: Govt ? Central Govt. ? Semi Govt. ? NGO ? Private ?

4. Name of the Library and Information Services Division: _____

Complete Postal Address: _____

Pin: _____ Telephone: _____ Fax: _____

Website: _____ E-mail: _____

5. Year of Starting of Library and Information Services Division: _____

6. Mandate (Aims and Objectives) of the Institute/Organization/Department:

7. Major Activities of the Organization: Education ? Research ? Extension ? Devt ?

8. Courses Taught:

Level: UG/PG/Res.	Name of Degree	Subjects
UG PG Research MDP Other		

9. Other Academic/HRD Programmes if any:

10. Areas of Active Research: _____

11. Extension Programmes presently handled: _____

12. Developments projects going on: _____

13. Staff/User Strength of the Organization: Total: ____ Faculty: ____ Scientist: Research: _____
 Scientist: Extension: ____ Administrative/Support Staff: ____ Students: _____ Others _____
14. Aims and Objectives of the Library in the context of the activities of the parent organization: _____

15. Library Building: Attached ? Separate ? Total building Area: in Sq Feet . _____ Carpet Area: _____ Stacking Area: _____ Reading Area: _____

Availability of provision for future expansion: Yes ? No ? If available: Vertical ? Horizontal ?

16. Average Number of users reading in the library per day: _____
 Section wise break up of use per day: Digitized Documents: _____ Reference: ____ Periodical: ____
 Text: _____ General: _____ Audiovisual: _____

17. Library Timings: From _____ To _____

18. Use of the library during working days/hours

Normal working hours: High ? Moderate ? Low ? Poor ?

Extended hours: High ? Moderate ? Low ? Poor ?

Holidays: High ? Moderate ? Low ? Poor ?

19. Existing Divisions of the Library: Acquisition Section ? Reference Section ?
 Periodicals Section ? Online Services ? Documentation ?

20. Organizational set up of the library: Please Tick: Centralized ? Decentralized ? Decentralized with Coordination ? Others. Mention: _____

21. Designation of the Head of the Library and Information System: _____

22. Annual Budget of the Parent Organization and the Library

	1997-1998	1998-1999	1999-2000	2000-2001	2001-2002
Parent Institute/ Organization's Budget					
Library Budget					

23. Total strength of Library's Collection: _____
 Books _____ Electronic Documents _____
 Bound Periodicals _____ Microforms _____
 Reports _____ Video films _____
 Other media: Specify _____

24. **Annual Acquisition of documents.** Please give data for the maximum available years specifying number of items acquired and total cost.

Year	No of Books	Amount for Books in Rs.	No. of Journals	Amount for Journals in Rs.	No. of Digital Media, CD, Floppy etc	Amount for Digital Docs in Rs.	Other types of Documents	Amount for other types. Rs
1998-99								
1999-2000								
2000-01								
2001-02								
2002-03								

25. **Subject wise strength of the Collection:** In the appropriate cell/position against each subject please indicate the strength of the collection by writing the appropriate letter denoting the Grade: E = Excellent, V = Very Good, G = Good, A = Average, P = Poor

Subjects	Books	Journals	Digital	Other
Agriculture General				
Horticulture				
Spices				
Tuber Crops				
Plantation Crops				
Plant Breeding				
Fertilizers				
Forestry				
Food Science, Nutrition				
Irrigation				
Veterinary and Animal Sciences				
Diary Sciences				
Fisheries				
Biotechnology				
Management				
Agricultural Engineering				
Agricultural Economics				

26. **Strength of Journals subscribed in each subject area.**

Subject Area	No of Foreign Journals Primary	No of Foreign Journals Secondary	Approximate Cost of Foreign Jls	No of Indian Journals Primary	No of Indian Journals Secondary	Approximate Cost of Indian Jls
Agriculture General						
Horticulture						
Spices						
Tuber Crops						
Fertilizers						
Forestry						
Food Science, Nutrition						
Irrigation						
Veterinary and Animal Sc						
Fisheries						
Biotechnology						
Management						
Agricultural Engineering						
Agricultural Economics						

27. **List the Journals costing more than Rs. 20000/-** each for their annual subscription and mark their frequency of use in the concerned column. Please attach additional Sheet if essential: The letters denoting frequency of use are A = most frequently used, B = Frequently used, C = Reasonable use, D = Rarely Used

Name of Journal	Cost	Frequency of Use

Please attach additional sheet if essential.

28. Please attach a complete list of periodicals (primary and secondary) presently subscribed by the library in print and electronic media. Based on the libraries experience please write the letter denoting the frequency of use of the journals against each title. (The letters denoting frequency of use are A = most frequently used, B = Frequently used, C = Reasonable use, D = Rarely Used)

29. **List of Reference Books Costing more than Rs. 20000/-** Based on the libraries experience mark the letter denoting the frequency of use of the books against each title. (The letters denoting frequency of use are A = most frequently used, B = Frequently used, C = Reasonable use, D = Rarely Used)

Name of Reference Books	Cost	Frequency of Use

Please attach additional sheet if essential.

30. **List of Reference Sources/Databases in CDROMs** costing more than Rs. 20000/- as cost or annual subscription. Based on the library's experience please mark the letter denoting the frequency of use of the Database against each title: The letters denoting frequency of use are A = most frequently used, B = Frequently used, C = Reasonable use, D = Rarely Used

Name of CDROM	Cost	Frequency of Use

Please attach additional sheet if essential.

31. Details of the Staff Strength of The Library:

SN	Designation	Qualification	Scale of Pay	No	Duties
1					
2					
3					
4					

32. Librarians Name: _____
 Qualification _____ Scale of Pay _____
 Joined the Institution on _____ Professional Experience _____ yrs
 Status and Level in administrative setup: Second Level? Third Level? Fourth Level?

B. FACILITIES OF THE LIBRARY

33. Major Equipments and Machinery Available in the Library

Items	Total No	Details if any
Computer Hardware:		
Servers		
Workstations		
DVD Drives/CD/DVD Writers		
CD Servers/Jukeboxes		
Scanners/Modems/Networking Equipments		
LCD Projectors		
Overhead Projectors		
Television/VCR/VCP		
Photocopying Machines		
UPS/other power systems		

34. Classification Scheme Used: Colon Classification (CC)? Dewy Decimal Classification (DDC)?
 Universal Decimal Classification (UDC)? Other?

The specific schemes usefulness in the context of collection: _____

35. Catalogue Code Used: Anglo American Catalogue Code? Classified Catalogue Code?

The specific code's usefulness in the context of the collection: _____

36 The Scheme used for deriving subject headings: Library of Congress Subject Heading List? CABI? Other? The Specific scheme's usefulness in the context of the collection: _____

37 Method of access allowed to the users: Tick Appropriate method. Open Access? Semi- Open? Closed? Different methods for different Users?

38 **Details of the Functions for which Computers are used in the Library if applicable.**

	Functions	Hardware Details	Software Details
1	Book Acquisition		
2	Periodical Acquisition		
3	Circulation		
4	Cataloguing		
5	Classification		
6	Library LAN		
7.	CD Networking		
8.	Office Works		
9	Presentations		
10	Digital Library		
11	Web Based Services		
12	Communications		

If Library is not computerized please give the reasons: _____

C. SERVICES FROM THE LIBRARY

39 Circulation System Used: Automated? Manual?

Average Daily Issue/Returns: Less than 50? 50 to 100? 100 to 200? 200 to 500?

Is Issue/Return System Computerized: Yes? No?

Method used for Issue/Return: Register System? Card system? Other Specify_____

Average Book Issue per Year fromlast five years: _____

Is there any Interlibrary Loan Facility: Yes? No?

40 Availability of Photo Copying services: Yes? No?

Average Number of Copies made available per year: _____

41 Details of the Current Awareness Services Provided by the Library: Please provide the name scope, frequency of such services

Current Additions books/reports: _____

Content pages of Periodicals: _____

Newspaper Clipping Services: _____

Others: Please mention: _____

42 Is Bibliographical Services Provided from the Library: Yes? No?

If provided is it provided in anticipation or demand: _____

Names of Bibliographical compilations produced by the library: _____

43 Other services Provided by the Library

Reference Services:	Yes?	No?
Abstracting Services:	Yes?	No?
Translation services:	Yes?	No?
SDI Services:	Yes?	No?

44 Does the Library facilitates to its clientele use of the following documents from other libraries on demand under Inter Library Loan Schemes.

Books	Yes?	No?	Journals/Periodicals	Yes?	No?
Articles/Papers	Yes?	No?	PhD Thesis/Dissertations	Yes?	No?
CDROM Databases	Yes?	No?	Others Specify _____		

Which category of users often demand services under Inter Library Loan Schemes.

Academic staff _____%	Scientists _____%	Extension workers _____%
Researchers _____%	Students _____%	Farmers _____%

The arrangement for service when a document requested by the user is not available in the Library:

Purchases it: ? Requests other Library for a photocopy ? Arranges it under Interlibrary Loan ?

The other Libraries with which the library is having resource sharing/interlibrary loan agreements:

E. ORGANIZATION AND MANAGEMENT

45 Please give your ratings about aspect of the organization of your library:

	Divisions/Area	Excellent	Very Good	Good	Average	Poor
1	Main Library -Organizational set up -Operation -staff -services					
2	Books Reports Division -Organizational set up -Operation -staff -services					
3	Periodicals Division -Organizational set up -Operation -staff -services					
4	Reference Division -Organizational set up -Operation -staff -services					
5	Computer Information Technology Division Organizational set up -Operation -staff -services					
6	Others Please Specify-					

D. RESOURCE SHARING NETWORKING

- 46 Is the Library participating in any Resource Sharing/networking activity like cooperative acquisition, cooperative cataloguing, cooperative depository or storage, cooperative binding, cooperative processing, cooperative training, cooperative documentation etc. Yes? No?

If yes to any please provide details _____

- 47 Please identify the areas of resource sharing, which will be highly beneficial to the library, and rate them by tick marking in the cell/position in the table against the areas mentioned:

	Network Activities	Highly Desirable	Somewhat Desirable	Undesirable
	Acquisition			
	-Cooperative purchase of books			
	-Cooperative purchase of Journals			
	-Cooperative acquisition of expensive reference Sources			
	-Non Print and Rare materials			
	-Assigned Subject Specialization in Acquisition			
	Cataloguing			
	-Use of ISBD for Network Cataloguing			
	-Union Shelf list			
	-Centralized Cataloguing Unit			
	-Others- specify			
	Inter- Library Loan			
	-for rare materials			
	-for non-print materials			
	-photocopying services			
	Reference Service			
	-Costly Reference sources			
	-Abstracting and Indexing			
	-Digital Information sources			
	Storage/Preservation			
	-Storage Centre for Old materials			
	-Storage for back volumes of Journals			
	-Conservation laboratory			
	Digital Library			
	-Digitization of Collection			
	-Web based Information services			
	-Digital Storage			
	-OPAC Catalogues on the Web			
	Education/Research			
	-Personal training			
	-HRD in Information Technology			
	-Joint research projects			
	-Consultation			
	Other Activities if any to be made cooperative			
	-			
	-			

48 Library Cooperation/Resource Sharing is usually affected by the following factors. Please rate each by ticking on the appropriate cell/position in the table against each factor.

	Factors	Very High	High	Moderate	Low	Very Low
a	Absence of Planning					
b	Absence of Institutional Leadership					
c	Absence of Spirit of cooperation					
d	Inadequate resources					
e	In adequate finance					
f	Communication					
g	Other Reasons					

49 Your suggestions to improve the present library and information services in the institution: _____

50 Any other Details that may be of use in assessing the library's contributions: _____

Note: Please attach separate sheets if required. Please attach the following items also which will be helpful to study the library. 1) Institutions Brochure. 2) Library Brochure/Guide. 3) List of Journals. 4) List of CDROMS. 5) Library's Annual Report if available.

LIBRARY/INFORMATION SYSTEM QUESTIONNAIRE

Purpose: To study the resources, facilities and services of the libraries in agricultural sector.

The information furnished here will be kept confidential. Wherever possible answers and boxes are provided tick the box against the appropriate answer. Where answers are given in tables tick appropriate position/cell in table.

- Name of the Library/Institution/Organization/Department: _____
 _____ Year of Establishment: _____
- Management: State: Govt. ? Central Govt. ? Semi Govt. ? NGO ? Private ?
- Complete Postal Address: _____
 _____ Pin: _____
- Telephone: _____ Website: _____ E-mail: _____
- Mandate (Aims and Objectives) of the Institute/Organization/Department/Library:

- Major Activities of the Organization: Education ? Research ? Extension ? Devt ?
- Staff/ Strength of the Organization: Total: _____ Scientist: Teaching/Research/Extension: _____
 Administrative/Support Staff: _____ Library Staff: _____ Students: _____ Other Lib Users _____
- Library Building: Attached ? Separate ? Total building Area: in Sq Feet. _____
- Availability of provision for future expansion: Yes ? No ? If yes: Vertical ? Horizontal ?
- Approximate Annual Budget of the Parent Organization and the Library

	1998-1999	1999-2000	2000-2001	2001-2002	2002-2003
Parent Institute/ Organization's Budget					
Library Budget					

- Total Strength of Library's Collection: _____
 Books _____ Electronic Documents (CDROMs etc): _____
 Bound Periodicals _____ Microforms _____
 Reports/Thesis _____ Video Films _____
- Annual Purchase of documents. (Approximate data on number of items acquired and total cost.)

Year	No of Books	Amount for Books in Rs.	No. of Journals	Amount for Journals in Rs.	No. of Digital Media, CD, Floppy etc	Amount for Digital Docs in Rs.	Other types of Documents	Amount for other types. Rs
2002-03								

- Average Number of users reading/using the library per day: _____
- Library Timings: From _____ To _____
- Details of the Staff of The Library:
 Librarians Name: _____ Designation _____
 Qualification _____ Scale of Pay _____
 Joined the Institution on _____ Professional Experience _____ yrs.
 No of other Prof Staff _____, Non professional Staff _____ Temporary Staff _____
- Status and Level of Librarian in the administrative setup: Second Level ? Third ? Fourth ?

17. Subject wise strength of the Collection:

In first row give app. number of books. In other rows in appropriate cell/position against each subject please indicate the strength of the collection by the appropriate letter denoting the Grade: E = Excellent, V = Very Good, G = Good, A = Average, P = Poor

Subjects	Approximate No of books	Books	Journals	CDROM
Agriculture General				
Horticulture				
Spices				
Tuber Crops				
Plantation Crops				
Plant Breeding				
Fertilizers				
Forestry				
Food Science, Nutrition				
Irrigation				
Veterinary and Animal Sciences				
Diary Sciences				
Fisheries				
Biotechnology				
Management				
Agricultural Engineering				
Agricultural Economics				
Botany, Zoology, Plant Sc or Related Subjects				

18. Major Equipments and Machinery Available in the Library

Items	Total No	Items	Total No
Servers		LCD Projectors	
Workstations		Overhead Projectors	
DVD Drives/CD/DVD Writers		Television/VCR/VCP	
CD Servers/Jukeboxes		Photocopying Machines	
Scanners/Modems/Networking Equipments		UPS/other power systems	

19. Classification Scheme Used: Colon Classification (CC) ? Dewy Decimal Classification (DDC) ? Universal Decimal Classification (UDC) ? Other ?

Catalogue Code Used: Anglo American Catalogue Code (AACR) ? Classified Catalogue Code (CCC) ?

20. Method of access allowed to the users: Tick Appropriate method. Open Access ? Semi- Open ? Closed ? Different methods for different Users ?

21. Is the Library participating in any Resource Sharing/networking activity like cooperative acquisition, cooperative cataloguing, cooperative depository or storage, cooperative binding, cooperative processing, cooperative training, cooperative documentation etc. Yes ? No ?
If yes to any please provide details _____

22. Your suggestions to improve library and information services in the institution

Note: Please attach separate sheets if required. Please attach the following items also which will be helpful to study the library. 1) Institutions Brochure. 2) Library Brochure/Guide. 3) List of Journals. 4) List of CDROMS.

LIBRARY/INFORMATION USER'S QUESTIONNAIRE

Purpose: To study the awareness and utilization by library users; the resources, facilities and services of the library and information systems that support agricultural sector with a view to ascertain the feasibility for resource sharing and networking to improve the systems and services.

1. The information furnished in the questionnaire will be kept confidential.
2. Where possible answers and boxes are provided tick the box against the appropriate answer.
3. Where possible answers are given in tables tick appropriate position/cell in to denote correct answer:

Name of the Library: _____

A. ABOUT YOURSELF

1. Area of Specialization: _____
2. Area of Responsibility: Student? Teacher? Research? Extension?
Development? Other? specify: _____
3. Current areas of study/research: _____

B. About Your Library

4. How long you have been using this library: 1- 2 yrs? 2-5 yrs? 5-10 yrs? 10+ yrs?
5. Are you aware of the resources, facilities and services of the library (Tick appropriate answer): Fully Aware? Limited Awareness? Not Aware? .

If You are not aware Please give your comment on its reasons: _____

If fully aware have you been utilizing all facilities and services: (Tick appropriate answer): Fully? In a limited way? Not using?

If not using the facilities/services or using it in a limited way only please indicate the reasons (Tick appropriate answer): Information about the services/facilities was not provided? Have not felt any need for using them? If it is due to some other reason please specify it: _____

C. COLLECTION

CA. Books

6. Your Rating of the Quality of Collection of Books/Reports in the Library (Tick appropriate Position/cell in the table for answer):

Item	Excellent	Very Good	Good	Average	Poor	% of Requirement met
Book Collection : Overall rating						
Reference Collection						
Areas of your Interest: specify 1						
2						
3						

7. Your rating of strength of the collection in various subject areas(Tick appropriate position/ cell in the table for answer):

Subject Areas	Excellent	Very Good	Good	Average	Poor	% of Requirement met
Agriculture (General)						
Horticulture						
Different Crops/Commodities						
Bio Technology						
Food Science, Nutrition						
Veterinary and Animal Sciences						
Diary Sciences						
Fisheries						
Forestry						
Agricultural Engineering						
Agricultural Economics						
Other: Specify						

CB. Journals

8. Your rating of the Journal Collection in the library: 3.1. (Tick appropriate position/cell in the table for answer):

Journals in Subject areas	Excellent	Very Good	Good	Average	Poor	% of Requirement met
Overall Journal Collection in the Library						
Primary Journals						
Secondary Journals (Indexing/Abstracting/Reviewing Journals)						
Popular Agricultural Magazines						
Agricultural Magazines in Local languages						
Others: Specify						

Approximately how many journals you think are absolutely essential for your work: _____
Of this how much percentage is subscribed by the library: _____

Do you think the journal collection in your area needs further strengthened: Yes?
No? If the journal collection is to be strengthened please give the list of titles to be added. _____

(Attach Separate sheet if essential)

Your awareness and use of back volumes of journals available in the library (Tick appropriate position/cell in the table for answer):

	0%	25%	50%	75%	100%
Awareness					
Use					

If you are not aware of this collection up to 50 % please mention the reasons: _____

Do you feel that Journal back volume collection needs further strengthening Yes? No?
 If yes please mention the titles you suggest for keeping back volumes:_____

Please state the reasons for that suggestion: _____

The media to be used for maintaining Back volumes of Journals: Print? Digital?

CDROM? Reasons for your suggestion: _____

CC. Dissertations and Other Documents

9. Your ratings of Dissertations and Other document collections and their use (Tick appropriate position/cell in the table for answer):

Documents	Excellent	Very Good	Good	Average	Poor	% of Use
Dissertations/Thesis						
Reports						
Video Films						
Interactive Multimedia						
Standards						
Patents						
Other: Specify						

D. Organizational Setup and Services

10. Please give your ratings about various aspect of the organization and services of your library based on your experiences while using the library: (Tick appropriate position/cell in the table for answer):

	Divisions/Area	Excellent	Very Good	Good	Average	Poor
1	Main Library					
2	Books Reports Division					
3	Periodicals Division					
4	Reference Division					
5	Services					
6	Staff					

11. The professional bodies/societies in your subject areas in which you consider that the library should be a member. _____

E. Services

12. Is your library meeting your document requirements: Yes? No?

If yes is it meeting your requirement: Fully? Partially? Reasonably? Not at all?

If not meeting your requirements please mention your demands that are not met by it

13. If you are receiving the following services from your library (please tick mark in the appropriate cell/position below for answer).

	Services	Always	Most time	Some times	Rarely	Never
1	Personal assistance of staff in locating the materials on your subject of interest					
2	Answers to your fact finding enquiries and supply of brief information you need .					
3	Supply of relevant information in anticipation					
4	Can easily get a book/periodical/other document from your library					
5	Timely information about availability of the documents requested					
6	Information about arrival of books/ periodicals and other documents added to the library					

14. Please provide your ratings of the following Current Awareness Services if provided by your library (please tick mark in the box below the appropriate answer).

	Services	Most Useful	Useful	Somewhat useful	Not Useful
1	Monthly Bulletins of Latest Additions of Books/Reports				
2	Weekly Content list of current periodicals received in the library				
3	Bibliographical services in the areas of your interest				
4	Informal: answers, guidance, provision of documents, information				
4	Any other: Please specify				

F. Staff

15. How you rate the library staff members (from lowest level to the Chief Librarian) you come in contact with while using the resources of the library? (please tick mark in the box below the appropriate answer):

	Parameters	Excellent	Good	Average	Poor
1	Attitude				
2	Knowledge				
3.	Discipline				
4	Knowledge of your subject				
5	Communication skill				

G. General Evaluation

16. Your evaluative statement/suggestions about the library and information services:

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INTERVIEW SCHEDULE: MANAGERS/SCIENTISTS OF AGRICULTURAL ORGANIZATIONS

Purpose: To study the information accessibility in agricultural sector and computer/IT/modern information retrieval literacy of scientists/managers/staff of agricultural organizations with a view to ascertain the need for establishing an information system and resource sharing networks to extend services..

The answers/information furnished in response to the questions will be kept confidential..

Name of the Organization: _____(Optional)

A. ABOUT YOURSELF

- 1 Area of Specialization: _____
- 2 Qualifications: _____
- 3 Area of Responsibility: Management? Teaching? Research? Extension?
Development? Other?
- 4 Library/ collection of relevant documents available in your organization YES? NO?
- 5 Is outside library services relevant to your work accessible to you for work YES? NO?
- 6 Have you faced the need for reference in the context of your work in office YES? NO?
- 7 Was such service available in time at any time in present organization YES? NO?
- 8 Is Internet facility accessible in your office? YES? NO?
- 9 Is computers available in your organization YES? NO?
- 10 Is there an internal computer network YES? NO?
- 11 The software available in your institution which you remember
 - 1.
 - 2.
 - 3.
- 12 Do you have the basic knowledge to use the following software/ programmes

Word Processor MSWord or other packages	YES? NO?
Database Management package: MS Access/CDSISIS or other	YES? NO?
Spread Sheet: MS Excel / IDAMS or other	YES? NO?
Presentation Packages MS PowerPoint /Harward Graphics or other	YES? NO?
- 13 Are you familiar with following information retrieval tools and

facilities?

- | | | |
|--|-------------|--------|
| Computerized Catalogues/OPAC | YES ? | NO ? |
| Databases in CDROM | YES ? | NO ? |
| Electronic Reference Sources, encyclopedias in CDROM | YES ? | NO ? |
| Digital Libraries | YES ? | NO ? |
| Agricultural Expert Systems | YES ? | NO ? |
| 14 Do you feel that literacy programmes in the followings areas should be conducted regularly in agricultural institutions: | | |
| Basic Computer Literacy programmes | YES ? | NO ? |
| Internet familiarization programmes | YES ? | NO ? |
| 15 If your organization is having a library: How you will rate the quality of the collection of Journals Books/Reports in the Library: | EXCELLANT ? | POOR ? |
| 16 Is there a Library Advisory Committee | YES ? | NO ? |
| 17 Do you feel that the committee is well represented | YES ? | NO ? |
| 18 Do feel it essential that information services is to be kept accessible in the campus on holidays and after office hours | YES ? | NO ? |
| 19 Notes on Other Aspects Enquired: | | |
| 20 Record of Suggestions Voluntarily Provided | | |

**LIST OF ORGANIZATIONS/ INSTITUTIONS/ GROUPES ENGAGED
IN AGRICULTURE RELATED ACTIVITIES IN KERALA**

Agmark Grading Labs, 10 Labs (GOK)
Agricultural Research Station, Mannuthy (KAU)
Agronomic Research Station, Chalakudy (KAU)
AICRP (M&AP), Vellanikkara (KAU)
AICRP on Biological Control of Crop Pests and Weeds, Vellanikkara (KAU)
AICRP on Weed Control, Vellanikkara (KAU)
All India Coordinated Res. Project on Agricultural Drainage, Karumady (KAU)
All India Coordinated Research Project (Palms), CPCRI (ICAR)
All India Coordinated Research Project (Spices), IISR (ICAR)
All India Coordinated Research Project (Tuber Crops), CTCRI, Tpm (ICAR)
Aromatic and Medicinal Plants Research Station, Odakkali (KAU)
Attappady Social Service Organization (ASSO), Palakkad
Banana Research Station, Kannara (KAU)
Bio Control Labs, 1 Lab, (GOK)
Broiler Farms, 15 Farms (GOK)
Cardamom Research Station, Pampadumpara (KAU)
Cashew Research Station, Anakkyam (KAU)
Cattle Breeding Farm, Thumburmuzhi (KAU)
Central Coir Research Institute, Kalavoor, Alleppy (GOI)
Central Institute of Fisheries Technology, Kochi (ICAR)
Central Library And Information System, Vellanikkara (KAU)
Central Marine Fisheries Research Institute, Kochi - 682 014 (ICAR)
Central Plantation Crops Research Institute, Kasaragod (ICAR)
Central Tuber crops Research Institute, Thiruvananthapuram (ICAR)
Centre for Advanced Studies in Animal Genetics & Breeding, Mannuthy (KAU)
Centre for Advanced Studies in Poultry Science (KAU)
Centre for Agricultural Informatics, Kannur
Centre for Development Studies (CDS), Ulloor, Thiruvananthapuram
Centre for Earth Science Studies, Thiruvananthapuram

Centre for Pig Production and Research, Mannuthy (KAU)
Centre for Water Resources Development and Management, Kozhikode
Cochin University of Science and Technology
Coconut Development Board, Ministry of Agriculture (GOI)
Coconut Research Station, Balaramapuram (KAU)
Coir Board, Coir House, Kochi
College of Agriculture, Padannakad (KAU)
College of Agriculture, Vellayani (KAU)
College of Co-operation, Banking and Management, Vellanikkara (KAU)
College of Dairy Science & Technology, Mannuthy (KAU)
College of Fisheries, Panangad (KAU)
College of Forestry, Vellanikkara (KAU)
College of Horticulture, Vellanikkara (KAU)
College of Veterinary and Animal Sciences, Mannuthy (KAU)
College of Veterinary and Animal Sciences, Pookode (KAU)
Communication Centre, Mannuthy (KAU)
Co-operative Department (GOK)
Cropping System Research Centre, Karamana (KAU)
Cropping System Research Sub Centre, Wadakkumcherry (KAU)
Department of Forests and Wild Life (GOK)
Department of Fisheries (GOK)
Department of Food, Civil Supplies and Consument Affairs (GOK)
Department of Irrigation and Water Resources (GOK)
Diagnostic Labs. 4 labs (GOK)
Diary Cooperatives, 3143 Numbers
Diary Plants, 17 Plants (GOK)
Directorate of Soil survey (GOK)
Directorate of Agriculture (GOK)
Directorate of Animal Husbandry (GOK)
Directorate of Soil Conservation (GOK)
Directorate of Academic and PG Studies (KAU)
Directorate of Cashew nut and Cocoa Development, Kochi (GOI)
Directorate of Cocoa, Areca nut & Spices Development, Calicut. (GOI)
Directorate of Diary Development (GOK)

Directorate of Extension (KAU)
Directorate of Physical Plant, Vellanikkara (KAU)
Directorate of Research (KAU)
Directorate of Students Welfare, Mannuthy (KAU)
Economics and Statistics Department, Vikas Bhavan, Thiruvananthapuram (GOK)
Farm Information Bureau (GOK)
Farmer Training Centers, 2 Centres (GOK)
Farming Systems Research Station, Sadanandapuram (KAU)
Fertilizer Quality Control Labs, 2 Labs (GOK)
Fertilizers and Chemicals Travancore Ltd, Udyogamandal
Fisheries Cooperatives, 201 Numbers
Fisheries Station, Puduveypu (KAU)
Gandhi Smaraka Grama Seva Kendram, Kasaragod
Goat Farms, 4 Farms (GOK)
Indian Institute of Spices Research, Calicut (ICAR)
Instructional Farm, College of Agriculture, Vellayani (KAU)
Instructional Farm, College of Horticulture, Vellanikkara (KAU)
Jersey Farms, 3 Farms (GOK)
Kannur University
KAU Dairy Plant, Mannuthy ...124 AICRP on Poultry, Mannuthy (KAU)
KAU Estate, Vellanikkara (KAU)
Kelappaji College of Agricultural Engineering and Technology, Tavanur (KAU)
Kerala Agricultural University
Kerala Agro Industries Corporation Ltd, Thiruvananthapuram (GOK)
Kerala Agro Machinery Corporation Ltd, Ernakulam (GOK)
Kerala Cooperative Agricultural Rural Development Bank, Tvpm (GOK)
Kerala C-operative Milk Marketing Federation (MILM), Tvpm (GOK)
Kerala Forest Research Institute
Kerala Horticultural Development Programmer
Kerala Kera Karshaka Shakarana Federation.KERAFED, Tvpm
Kerala Land Development Corporation, Thiruvananthapuram (GOK)
Kerala Legislature Secretariat
Kerala Livestock Development Board, Thiruvananthapuram
Kerala Sahitya Akademi, Thrissur.

Kerala Sate Poultry Development Corporation, Thiruvananthapuram
 Kerala State Cooperative Rubber Marketing Federation Limited, Kochi (GOK)
 Kerala State Horticultural Products Development Corporation, Tvpm (GOK)
 Kerala State Land Use Board, Vikas Bhavan, Thiruvananthapuram (GOK)
 Krishi Vigyan Kendra, Central Plantation Crops Res. Institute, Kasaragod (ICAR)
 Krishi Vigyan Kendra, Chakkupallam, Idukki.
 Krishi Vigyan Kendra, Mitranikethan, Vellanad -696543, Thiruvananthapuram.
 Krishi Vigyan Kendra, Pathanamthitta
 Krishi Vigyan Kendra, Peeruvannamuzhi, Calicut -673 012 (KAU)
 Krishi Vigyan Kendra, Regional Research Station, KAU, Narakkal
 Krishi Vigyan Kendra, Regional Research Station, KAU, Ambalavayal
 Krishi Vigyan Kendra, Regional Research Station, KAU, Pattampi
 Krishi Vigyan Kendra, Sadanandapuram, (KAU)
 Kristi Bhavans, 1569 (GOK)
 Kuttanad Vikasana Samithi, Pallikkoothumma, Alappuzha Dist,
 Livestock Mgt Training Centers, 6 Centres (GOK)
 Livestock Research Station, Thiruvazharnkunnu (KAU)
 M.S. Swaminathan Research Foundation, Agro Bio Diversity Centre, Kalpetta
 Mahatma Gandhi University
 Malanadu Development Society, Pastoral Centre, Kottayam District
 Marine Products Export Development Authority, Kochi (GOI)
 Meat Products India Ltd, Ernakulam
 NARP (Southern Region), Vellayani (KAU)
 Neyyatinkara Integral Development Society, (NIDS) Vazhuthoor.
 Oil Palm Research Centre, CPRI, Near Bus Stand, Palode. (ICAR)
 Onattukara Regional Agricultural Research Station, Kayamkulam (KAU)
 Paddy Development Agencies, 11 (GOK)
 Pepper Research Station, Panniyur (KAU)
 Pest Surveillance Units, 1 (GOK)
 Pesticide Testing Labs, 2 Labs (GOK)
 Pig Breeding Farms, 8 Farms (GOK)
 Pineapple Research Station, Vazhakkulam (KAU)
 Plantation Corporation of Kerala, Kottayam (GOK)
 Rajeev Gandhi Centre for Biotechnology, Thiruvananthapuram

Reg Agri Tech Training Centers , 5 Centres (GOK)
 Regional.Cattle Infertility Research Centre, Kozhikode (KAU)
 Regional Agricultural Research Station, Ambalavayal (KAU)
 Regional Agricultural research Station, Pattambi (KAU)
 Regional Agricultural Research Station, Pilicode (KAU)
 Regional Research Laboratory, Thiruvananthapuram 695069 (GOI)
 Rice Research Station, Moncompu (KAU)
 Rice Research Station, Vyttila (KAU)
 Rubber Board, Kottayam, (GOI)
 Rubber Research Institute of India, Kottayam
 Seed Testing Labs, 1 Lab (GOK)
 Seeds Planting Materials production Centres, 61 Centres (GOK)
 SERIFED, Sasthamangalam, Thiruvananthapuram
 Small Farmers Agri Business Consortium, Thiruvananthapuram
 Soil Conservation Research Station, Konni (KAU)
 Soil Testing Labs, 14 labs (GOK)
 Spices Board, Sugandha Bhavan, Cochin
 State Agricultural Prices Board, Thiruvananthapuram (GOI)
 State Farming Corporation of Kerala, Punalur (GOK)
 State Institute of Languages (GOK)
 State Planning Board, Pattom, Thiruvananthapuram (GOI)
 Sugarcane Breeding Station, Kannur (ICAR)
 Sugarcane Research Station, Thiruvalla (KAU)
 The Cashew Export Promotion Council of India, Kochi (GOI)
 Trivandrum Rubber Works, Thiruvananthapuram (GOK)
 Tropical Botanic Garden and Research Institute, Thiruvananthapuram-
 University Goat and Sheep Farm, Mannuthy (KAU)
 University Livestock Farm & Fodder Research Development Scheme, Mty (KAU)
 Universities of Calicut
 University of Kerala
 University Veterinary Hospital, Kokkalai (KAU)
 Vegitable and Fruit Promotion Council Keralam, Kochi
 Veterinary Hospitals, 1569 (GOK)
 Village Libraries, App 5000 Numbers

LIST OF FOREIGN JOURNALS IN AGRICULTURE AND RELATED AREAS SUBSCRIBE BY INSTITUTIONS IN KERALA

Title	Institutions	No	Cost	Net
Acta Horticulturae	KAUC	1	2550	2550
Advances in Water Resources	CWRD, CAE	2	8500	17000
Agricultural Engineering Abstracts	CAE, COAP, CPCRI	3	17000	51000
Agricultural Equipment International	CTCR, CAGI	2	19000	38000
Agricultural Mechanization in Asia, Africa and Latin America	CPCRI, CAE, CAGI	3	12000	36000
Agricultural Water Management	CWRD, COAP, CAE, CPCRI	4	71800	287200
Agro forestry Systems	COF, KFRI	2	51690	103380
Agronomy Journal	KAUC, IISR, CTCR, COHV, CPCRI, COAV	6	12472	74832
Agronomy Journal (online ver. with year end CD)	CPCRI	1	35000	35000
AMA Agricultural Mechanization in Asia, Africa and Latin America	KAUC	1	48750	48750
American Economic Review	CDS	1	24763	24763
American Fruit Grower	COAV	1	8700	8700
American Journal of Agricultural Economics	KAUC, CDS, COHV, CPCRI,	4	14000	56000
American Journal of Clinical Nutrition	COHV, COAV	2	11150	22300
American Journal of Veterinary Research	CVA	1	7265	7265
American Naturalist	CMFRI	1	12500	12500
Analytical Biochemistry	KAUC, COHV, COAV	3	200300	600900
Analytical Biochemistry	KAUC, COHV, COAV	3	200300	600900
Animal Breeding Abstract (2003)	KAUC	1	35700	35700
Animal Feed Science & Technology	CVA	1	68155	68155
Animal Genetics	CVA	1	18215	18215
Annals of Agricultural Research	CPCRI	1	14750	14750
Annals of Applied Biology	CTCR	1	8000	8000
Annals of Tropical Research	CTCR	1	7500	7500
Annual Review of Entomology	CTCR, KAUC	2	9250	18500
Annual Review of Genetics	CTCR	1	12500	12500
Annual Review of Microbiology	CTCR	1	14000	14000
Annual Review of Phytopathology	CTCR	1	18700	18700
Annual Review of Plant Physiology and Plant Molecular Biology	CTCR	1	9500	9500
Annual Review of Biochemistry	CTCR, CIFT, RGCB	3	11200	33600
Annual Review of Cell and Developmental Biology	RGCB	1	27500	27500
Annual Review Of Ecology And Systematics	KFRI	1	3500	3500
Annual Review of Entomology	KAUC, KFRI, COAV, IISR, CPCRI	5	8250	41250
Annual Review of Fish Diseases	CIFT, CMFRI	2	8500	17000
Annual Review of Genetics	KAUC, KFRI, COAV, RGCB	4	8500	34000
Annual Review of Immunology	RGCB	1	12750	12750
Annual Review of Microbiology	KAUC, COAP, COAV, RGCB	4	8250	33000
Annual Review of Phytopathology	KAUC, KFRI, COAV, IISR	4	8500	34000

Title	Institutions	No	Cost	Net
Annual Review Of Plant Biology	KFRI	1	6500	6500
Annual Review of Plant Physiology & Plant Molecular Biology	KAUC, COAV, CPCRI, IISR	4	7750	31000
Applied Environmental Microbiology	RGCB	1	9750	9750
Appropriate Technology	KAUC, CAE, CPCRI, IISR, CAGI	5	9600	48000
Aqua cultural Engineering	CFIS, CIFT, CMFRI	3	21953	65859
Aquaculture	CFIS, CIFT, CMFR	3	154850	464550
Aquaculture Advocate	MPED	1	12500	12500
Aquaculture International	CMFRI, CIFT	2	19250	38500
Aquaculture Magazine	CMFRI, MPED, CIFT, CFIS	4	14500	58000
Aquaculture Nutrition	CIFT, CMFRI, CFIS	3	25551	76653
Aquaculture Research	CFIS, CIFT, CMFR	3	50719	152157
Aquarium Fish Magazine	CFIS, CIFT, CMFR	3	2750	8250
Aquarium Sciences and Conservation	CMFRI	1	6500	6500
Aquatic Botany	CMFRI, CIFT	2	13500	27000
Aquatic Science and Fisheries Abstracts ASFA	CUSA, CIFT, CMFRI	3	227000	681000
Aquatic Toxicology	CMFRI, CUSA	2	11250	22500
Aroideana	CTCR	1	16400	16400
ASCE Journal of Environmental Engineering	CWRD	1	14500	14500
ASCE Journal of Irrigation and Drainage Engineering	CWRD	1	13250	13250
ASCE Journal of Water Resource Planning and Management	CWRD	1	12500	12500
ASFA Aquaculture Abstracts	CMFRI	1	11000	11000
ASFA Marine Biotechnology Abstracts	CMFRI	1	115000	115000
Asia Week	CDS, KAUC	2	4750	9500
Asian Fisheries Science	CMFRI, CIFT, CFIS	2	12500	25000
Asian Journal of Microbiology, Biotechnology & Environmental Sciences	CPCRI, CUSA	2	8500	17000
Austasia Aquaculture	CFIS, CIFT, CMFR	3	24000	72000
Austrailian Veterinary Journal (2003)	KAUC	1	16100	16100
Australian Economic Papers	CDS	1	3500	3500
Australian Forestry	KFRI	1	5250	5250
Australian Journal of Soil Research	KFRI	1	3500	3500
Bangladesh Development Studies	CDS	1	2750	2750
Biochemical Genetics	CMFRI, CIFT	2	17800	35600
Biofouling	CIFT	1	64134	64134
Biologia Plantonim	TBGR, COF	2	31915	63830
Biological Abstracts	CMFRI, KU, KAUC	3	225000	675000
Biological Bulletin	CMFRI	1	7800	7800
Biological Reviews	CMFRI	1	9450	9450
Biometrics	CPCRI, CMFRI	2	16400	32800
Biometrika*	KAUC, CMFRI	2	11200	22400
Biotechnology Citation Index	RGCB, CUSA	2	112750	225500
Biotropica	KFRI, COF	2	16475	32950
Blumea	KFRI	1	15250	15250
British Journal of Nutrition	COAV	1	12500	12500
Brooking Papers on Economic Activity	CDS	1	11000	11000
Bulletin of the International Dairy Federation	SPB	1	3750	3750

Title	Institutions	No	Cost	Net
Bulletin of WHO	SPB	1	2500	2500
California Agriculture	CPCRI	1	2250	2250
Cambridge Journal of Economics	CDS, CCBM	2	8500	17000
Canadian Journal of Soil Science	COAV	1	7250	7250
Canadian Journal of Botany,	KAUC, COF	2	39600	79200
Canadian Journal of Economics	CDS	1	4750	4750
Canadian Journal Of Forest Research	KFRI, COF	2	5500	11000
Canadian Journal Of Soil Research	KFRI, CPCRI	2	4500	9000
Cell	RGCB, CUSA	2	11400	22800
Cellular and Molecular Life Scs	TBGR	1	34678	34678
Chemical Abstracts	KU, CUSA, CIFT	3	225000	675000
Chinese Economy	CDS	1	55719	55719
CMIE Economic Intelligence Service	SPB	1	30000	30000
Communication Research	KU, CAGI	2	6500	13000
Communications in Soil Sciences and Plant Analysis	CTCR	1	6750	6750
Community Market and Developing Countries	SPB, CCBM	2	8500	17000
Computer and Electronics in Agriculture	CTCR, CAGI	2	27500	55000
Conservation Biology	DFW, KFRI	2	22000	44000
Crop Science	KAUC, COHV, CTCR, CPCRI	4	15350	61400
Current Advances in Plant Science	TBGR	1	69556	69556
Current Contents – Agricultural Biology and Environmental Sciences	CTCR, CPCRI, CUSA, KAUC, KFRI	5	215000	1075000
Current Contents - Life Science	CUSA, RGCB,	2	175000	350000
Current Contents Chemical and Earth Sciences	CUSA	1	155000	155000
Cytologia	IISR, CPCRI, CTCR	3	14200	42600
Developmental Dynamics	CVA	1	101087	101087
Dissertation Abstracts	KU	1	115000	115000
Ecologis Asia	SPB	1	11400	11400
Ecologist	KFRI, CDS, CWRD	3	30427	91281
Economia Internationale	CDS	1	11500	11500
Economic Botany	KAUC, KFRI, CPCRI, IISR	4	5678	22712
Egyptian Journal of Dairy Science	KAUC	1	4500	4500
Endocrine Research	KUL	1	50000	50000
Entomon	CTCR, CPCRI	2	21000	42000
Environmental And Ecological Statistics	KFRI, CAGI	2	5250	10500
Environmental Conservation (2003)	KAUC, CWRD, COF, IISR, IISR, CPCRI, CTCR, KAUC, COAV	4	17280	69120
Euphytica	5	110800	554000	
European Economic Review	CDS	1	7500	7500
Experimental Agriculture	CTCR, CPCRI, CAGI	3	12500	37500
Far Eastern Economic Review	CDS	1	3500	3500
Farmer and Parliament	CPCRI, CTCR	2	2750	5500
Field Crop Abstract	KAUC, CTCR	2	64800	129600
Fish and Fisheries Worldwide	CIFT	1	61000	61000
Fish Farmer	MPED	1	8500	8500
Fish Farming International	CFIS, CIFT, CMFR, MPED	4	3813	15252
Fisheries Research	CIFT	1	91161	91161
Fisheries Science	CFIS, CIFT, CMFR	3	24750	74250
Fishing News International	CFIS, CIFT, CMFR	3	4587	13761

Title	Institutions	No	Cost	Net
Food Engineering International	CAE	1	11400	11400
Food Microbiology	CIFT, KAUC	2	32219	64438
Food Science and Technology Abstracts FSTA	CIFT	1	180000	180000
Food Technology	CVA, COHV, CIFT	3	4235	12705
Food Technology Magazine	KAUC	1	6600	6600
Forest Ecology and Management	KFRI	1	156717	156717
Forest Science	KFRI, COF	2	6500	13000
Fortune International	CDS	1	4500	4500
Fresh Water & Marine Aquarium	CFIS, CIFT, CMFR	3	4200	12600
Freshwater and Marine Aquarium Magazine	CFIS, CFIS, CIFT, CMFR	4	9875	39500
Genetic Resources and Crop evolution	IISR, CPCRI	2	34540	69080
Genome	KFRI	1	15600	15600
Harvard Business Review	CCBM, CUSA	2	3500	7000
Hitotsubashi Journal of Economics	CDS	1	6500	6500
Hort Science	CPCRI, KAUC, COAV, IISR	4	5200	20800
Horticultural Abstracts	COAV, COHV, CPCRI	3	22500	67500
Iawa Journal	KFRI	1	14750	14750
ILO: Bulletin of Labour Statistics	CDS	1	3500	3500
ILO: International Labour Review	CDS	1	2750	2750
ILO: Official Bulletin Series-A&B	CDS	1	2500	2500
Immunological Investigations	CVA	1	41532	41532
In Practice	KAUC	1	5340	5340
Indian Standards on Food and Agricultural Division	CIFT	1	58000	58000
Info fish	CFIS, CIFT	2	2350	4700
Info fish International	CFIS, CIFT, CMFR	3	1025	3075
Info fish Trade News	MPED	1	1450	1450
Information Development	KAUC, CAGI	2	8100	16200
Insect Science and Its Applications	IISR, CPCRI	2	14900	29800
Integrated Pest Management Reviews	IISR, CPCRI	2	25355	50710
International Journal of Health Services	SPB	1	12500	12500
International Bio Deterioration and Biodegradation	CIFT	1	63268	63268
International Digest of Health Legislation	SPB	1	8500	8500
International Economic Review	CDS	1	20350	20350
International Family Planning Perspectives	SPB	1	2750	2750
International Inst of Population Science Bulletin	SPB	1	4500	4500
International Journal of Food Science and Technology	CIFT, CUSA	2	53506	107012
International Journal of Health Services	CDS	1	6750	6750
International Journal of Pest Management	IISR,CTCR, CPCRI	3	27074	81222
International Journal of Remote Sensing	CWRD	1	200000	200000
International Journal of Systematic and Evolutionary Microbiology	CIFT	1	34443	34443
International Journal of Tropical Plant Diseases	CPCRI	1	19800	19800
International Journal of Usufructs Management	KFRI	1	14500	14500
International Research Group On Wood Preservation	KFRI	1	25400	25400
International Review of Forestry	KFRI	1	11200	11200

Title	Institutions	No	Cost	Net
International Ship Building Progress	CUSA	1	14800	14800
International Tree Crops Journal	COF	1	11200	11200
International Zoo Yearbook	COF	1	8750	8750
Intl Journal of Water Resources Dvpt.	COAP, CAE	2	5500	11000
Irrigation And Drainage Abstracts	CAE	1	21500	21500
Irrigation and Drainage System	CWRD, CAE	2	8500	17000
Irrigation Journal	CWRD, CAE	2	4500	9000
Irrigation Science	IISR, CAE, CPCRI	3	18000	54000
JARQ	CPCRI	1	8750	8750
Journal of American Statistical Assn.	COAV	1	5400	5400
Journal of Agricultural and Food Chemistry	CTCR, KAUC	2	6500	13000
Journal of Agricultural Engineering Research	CTCR	1	11250	11250
Journal of Agriculture of the University of Puerto Rico				
Rico	CTCR	1	3250	3250
Journal of Economic Entomology	CTCR	1	14500	14500
Journal of Food Science	CTCR	1	12400	12400
Journal of Natural Products	IISR	1	31941	31941
Journal of Nemetology	IISR	1	7098	7098
Journal of Stored Products Research	CTCR	1	9750	9750
Journal of the Science of Food and Agriculture	CTCR	1	8500	8500
Journal of Agricultural and Food Chemistry	CIFT	1	56600	56600
Journal of Agricultural Engineering Research	KAUC, CPCRI	2	41150	82300
Journal of Agricultural Marketing	CCBM	1	27000	27000
Journal of Americ. Society for Hort. Science	COHV, COAP	2	3850	7700
Journal of Americ. Society for Information Sc	KU	1	12500	12500
Journal of Animal Science	KAUC	1	21250	21250
Journal of AOAC International	CIFT	1	24839	24839
Journal of Applied Econometrics	CDS	1	53445	53445
Journal of Applied Entomology	IISR, CPCRI	2	59950	119900
Journal of Applied Microbiology	CIFT	1	101646	101646
Journal of Aqua cultural in Tropics	CFIS, CIFT, CMFR	3	1860	5580
Journal of Biological Chemistry	RGCB	1	21200	21200
Journal of Cell Biology	RGCB	1	17500	17500
Journal of Essential Oil Research	IISR, CPCRI	2	19773	39546
Journal of Ethno Pharmacology	TBGR, RGCB	2	55499	110998
Journal of Extension Education	CPCRI, CWRD	2	4250	8500
Journal of Fish Disease	CFIS, CIFT, CMFR	3	64720	194160
Journal of Food Science	KAUC, CPCRI, CFIS, COAV, CMFR, CIFT, CUSA	7	5605	39235
Journal of Food Science and Technology	SB, CFIS, CIFT, CUSA, KU, CPCRI	6	42750	256500
Journal of Forest Economics	KFRI	1	12300	12300
Journal of Horticultural Sciences & Biotechnology	KAUC, CPCRI, COAP, COAT	4	10800	43200
Journal of Hydraulic Research	CWRD	1	11500	11500
Journal of Hydrology	CWRD, CAE	2	232000	464000
Journal of Insect Physiology	KAUC, COAT	2	99850	199700
Journal of International Money and Finance	KAUC	1	46800	46800
Journal of Invertebrate Pathology	KU	1	14200	14200
Journal of Librarianship & Information Science	KAUC	1	11200	11200

Title	Institutions	No	Cost	Net
Journal of Lipid Research	CIFT	1	28300	28300
Journal of Mycology and Plant Pathology	KAUC,CPCRI	2	6400	12800
Journal of Nutrition	CIFT	1	25195	25195
Journal of Quantitative Economics	CDS, SPB	2	1250	2500
Journal of Small Animal Practice	CVA	1	10120	10120
Journal of Soil and Water Conservation (2003)	KAUC, COAP	2	4750	9500
Journal of the American Statistical Association	CPCRI	1	4500	4500
Journal of the American Veterinary Medical Association (2003)	KAUC	1	7000	7000
Journal of the American Water Resources	CAE	1	6750	6750
Journal of the Royal Statistical Society. Series C	CPCRI	1	4250	4250
Journal of the Science of Food and Agriculture	CIFT	1	111980	111980
Journal of the World Aquaculture Society	CFIS,CIFT,CMFRI	3	5605	16815
Journal of Wildlife Management	KFRI, COF	2	7250	14500
Journal of Wildlife Monograph	KFRI	1	9450	9450
Journal of Wood Science (2003)	KAUC	1	12900	12900
Journal of World Aquatic Society	CFIS, CMFRI	1	8550	8550
Journal. Fish Biology	CIFT,CMFR	2	18300	36600
Journal. Food Protection	CIFT,CMFR	2	6400	12800
Kew Bulletin	KFRI	1	2750	2750
Knowledge Engineering Review	CUSA	1	21000	21000
KOI USA	CIFT	1	32000	32000
Landscape Ecology	DFW	1	21000	21000
Life Science	KU	1	12300	12300
Marine and Fresh Water Research	CFIS, CIFT, CMFR	3	18681	56043
Marine Pollution Bulletin	CIFT, CUSA	2	54921	109842
Molecular and Cell Biology	RGCB	1	18250	18250
Molecular Breeding	IISR,CPCRI	2	27753	55506
Molecular Endocrinology	RGCB	1	14500	14500
Molecular Plant Pathology	KFRI	1	13450	13450
Mycologia	IISR, CPCRI	2	8720	17440
Mycorrhiza	IISR, CPCRI	2	33706	67412
Naga	CFIS, CIFT, CMFR, KAUC IISR, KAUC, CWRD, CTCR,	4	4575	18300
National Geographic	CAE, CPCRI, KU, CUSA KFRI, RGCB, CTCR, COAV, CIFT, CPCRI, KAUC CUSA,	8	2375	19000
Nature	TBGR	9	43650	392850
Nature Biotechnology	TBGR, CUSA	2	23744	47488
Nematology	IISR, CPCRI	2	28270	56540
Nemetological Abstracts	CTCR IISR, CTCR, CPCRI, KAUC,	1	11400	11400
New Scientist	KU	5	12556	62780
New Zealand Journal of Forest Science	COF	1	3500	3500
Nucleic Acid Research	RGCB	1	8750	8750
Nucleus	CPCRI, CTCRI	2	11200	22400
Nutrition Reviews	KU,	1	18500	18500
Oncogene and Oncogene Reviews	RGCB	1	13450	13450
Outlook on Agriculture	KAUC	1	11640	11640
Oxford Bulletin of Economics and Statistics	CDS	1	2750	2750
Palms	KFRI, CPCRI	2	43214	86428

Title	Institutions	No	Cost	Net
Pestology	CTCR, CPCRI	2	11340	22680
Pharmacological Review	CVA	1	7265	7265
Pharmoco Genetics	RGCB	1	14200	14200
Philippine Journal of Coconut Studies	CPCRI	1	7800	7800
Photogrametric Engineering and Remote Sensing	CWRD, CAGI	2	12400	24800
Physiological Entomology	KU	1	11500	11500
Phytomorphology	CTCR, CPCRI	2	14500	29000
Phytopathology	IISR, CTCR, CPCRI, KAUC, COAV	5	24843	124215
Plant and Soil	CPCRI, COF, COAP	3	12350	37050
Plant Breeding Abstracts	KAUC, CPCRI, CTCR, COAV	4	74800	299200
Plant Cell	RGCB, CTCR	2	15750	31500
Plant Cell Reports	IISR, TBGR, COAV, CPCRI, KAUC	5	61088	305440
Plant Cell Tissue and Organ Culture	TBGR, CPCRI, IISR, CTCR, KAUC	5	68342	341710
Plant Disease	IISR, CTCR, CPCRI, KAUC, COAV	5	24843	124215
Plant Food for Human Nutrition	IISR, CPCRI	2	21800	43600
Plant Foods for Human Nutrition	KU	1	7650	7650
Plant Genetic Resource Newsletter	COHV, CPCRI	2	3750	7500
Plant Molecular Biology	RGCB, COF	2	24350	48700
Plant Pathology	IISR, CPCRI, COA, KAUC	4	26620	106480
Plant Physiology	CTCR, RGCB	2	12500	25000
Planta Medica	KAUC, COAV	2	34920	69840
Popular Science	KAUC, CAE	2	2500	5000
Post Harvest News and Information	CTCR	1	4500	4500
Practical Fish Keeping	CFIS, CMFR, CIFT	3	1392	4176
Proceedings of the National Academy of Sciences USA	RGCB	1	5400	5400
Protein and Peptide Letters	RBCB	1	3500	3500
Quarterly Journal of Economics	KAUC, CDS	2	9500	19000
Research in Veterinary Science	KAUC	1	16950	16950
Reserve Bank of India Bulletin	CDS, SPB	2	2400	4800
Review of Agricultural Entomology	KAUC, CTCR, CPCRI, COAV	4	41400	165600
Review of International Cooperation	CCBM	1	5600	5600
Review of Plant Pathology	KAUC, CTCR, COAV, CPCRI, KU	5	36900	184500
Rural Development Abstracts	COAV	1	12750	12750
Scandinavian Journal of Economics	CDS	1	3750	3750
Science	TBGR, RGCB, KAUC, CUSA	4	23525	94100
Science Education	KU	1	2250	2250
Science Reporter	CPCRI, CTCR	2	2350	4700
Scientia Horticulture	KAUC, CPCRI, COAV, COAP, KAUC, CPCRI, CDS, RGCB, CTCR	4	74050	296200
Scientific American	CTCR	6	31000	186000
Seafood International	MPED, CMFRI	1	7500	7500
Seed Science and Technology	COF, KFRI	2	18750	37500
Selbyana	KFRI	1	12350	12350
Sivae Genetica	KFRI, COF	2	11725	23450
Soil Biology and Biochemistry	CPCRI, COF	2	17500	35000
Soil Science	CPCRI, COAV	2	14275	28550
Soil Science Society of America Journal	IISR, COAV, CWD, KAUC,	5	13850	69250

Title	Institutions	No	Cost	Net
	CPCRI			
Soils & Fertilizers (2003) Print + Online	KAUC	1	63300	63300
Starch/Starke	CTCR	1	8600	8600
Systematic Entomology	KU	1	12000	12000
Taxon	KFRI	1	14500	14500
The International Tree Crops Journal(2003)	KAUC	1	5340	5340
The Veterinary Journal	CVA	1	25700	25700
Theoretical and Applied Genetics	KAUC, COAV	2	239400	478800
Theriogenology	CVA	1	33211	33211
Transactions of ASAE	KAUC, CTCR, COAP, CAE, PCR	5	19860	99300
Trends in Biochemical Sciences	CUSA, IISR	2	28400	56800
Tropical Agriculture	KAUC, IISR, CTCR, CPCRI, KFRI, COAV, CAGI	7	12337	86359
Tropical Science	CTCR	1	11400	11400
Veterinary Bulletin	KAUC	1	45600	45600
Veterinary Medicin	KAUC	1	4750	4750
Veterinary Microbiology	CVA	1	59331	59331
Veterinary Parasitology	CVA	1	71041	71041
Veterinary Pathology	CVA	1	5439	5439
Veterinary Record	KAUC	1	10800	10800
Veterinary Research Communication	KAUC	1	31740	31740
Water Research	CWRD	1	31500	31500
Water Resource Bulletin	CWRD, CAE	2	4575	9150
Water Science and Technology	CWRD	1	31500	31500
Weed Abstracts	COHV	1	12700	12700
Weekly Weather Report	CTCR	1	12500	12500
WHO Bulletin	CDS	1	3250	3250
WHO Journal	SPB	1	4375	4375
Wildlife Society Bulletin	KFRI	1	3500	3500
Wood & Fiber Science (2003)	KAUC	1	12500	12500
World Agri. Rural Sociology, Abstracts	COHV	1	14500	14500
World Development	CDS	1	90017	90017
World Economy	CDS	1	24763	24763
World Water	CWRD	1	12450	12450
Zoological Records	KU	1	225000	225000

**LIST OF ABSTRACTING JOURNALS IN ELECTRONIC / PRINT
MEDIUM CONTAINED BY DATABASES SUBSCRIBED BY KAU**

1. CAB Abstracting Journals Covered by CAB CD

1. AgBiotech News and Information
2. Agricultural Engineering Abstracts
3. Apicultural Abstracts
4. Agroforestry Abstracts
5. Animal Breeding Abstracts
6. Biocontrol News and Information
7. Biodeterioration Abstracts
8. Crop Physiology Abstracts
9. Dairy Science Abstracts
10. Field Crop Abstracts
11. Forest Products Abstracts
12. Forestry Abstracts
13. Grassland and Forage Abstracts
14. Helminthological Abstracts
15. Horticultural Abstracts
16. Index Veterinarians
17. Irrigation and Drainage Abstracts
18. Leisure, Recreation and Tourism Abstracts
19. Maize Abstracts
20. Nematological Abstracts
21. Nutrition Abstracts Series A: Human and Experimental
22. Nutrition Abstracts Series B: Livestock Feeds and Feeding
23. Ornamental Horticulture
24. Pignews and Information
25. Plant Breeding Abstracts
26. Plant Genetic Resource Abstracts
27. Plant Growth Regulator Abstracts
28. Post Harvest News and Information
29. Potato Abstracts
30. Poultry Abstracts
31. Review of Agricultural Entomology
32. Protozoological Abstracts
33. Review of Medical and Veterinary Entomology
34. Review of Plant Pathology
35. Rice Abstracts
36. Rural Development Abstracts
37. Seed abstracts
38. Soils and Fertilizers
39. Sorghum and Millets Abstracts
40. Soybean Abstracts
41. Sugar Industry Abstracts
42. Veterinary bulletin
43. Weed Abstracts
44. Wheat Barley and Triticale Abstracts
45. World Agricultural Economics and Rural Sociology Abstracts

LIST OF REFERENCE SOURCES ON AGRICULTURE AND RELATED AREAS IN DIGITAL MEDIA HELD BY INSTITUTINS IN KERALA

Title	Location
AgEcon	CPCR
AGRICOLA	KAUC
Agricultural Dissertation Electronic Library Prototype	CAGI
AGRIS: 1975- 2002	KAUC
ANI-CD, Arthropod Name Index: 1996	KAUC
Annotated Bamboo Bibliography	CAGI
APAFRI	KFRI
Aquatic Biology, Aquaculture & Fisheries Resources1971-2000	KAUC, CIFT, CFIS,
Arecanut Cultivation	CPCR
ASFA-Aquatic Sciences & Fisheries Abstracts: 1978-2000	KAUC, CIFT, CFIS,
Asia Alive	KAUC
Birds of Europe	KAUC
Birds: How We Identify Them	KAUC
British Cattle Veterinary Association Conference Proceedings	KAUC
Calculus for Windows	KAUC
CAB Abstracts: World’s Leading Agricultural Database 1972-2003	KAUC, COAT, KFRI,
CAB SAC on CDROM	KAUC
Cash-in-Shell; Scientific Cultivation Of Coconut	KAUC
CBT Program Visual Basic 5 C. .D Rom Tutorial For Windows	KAUC
Central Plantation Crops Institute - An Overview	CPCR
Cocoa Crop Management	CPCR
Coconut Cultivation	CPCR
Coconut Descriptor 2 Parts	CPCR
Collected Works of Mahatma Gandhi	KAUC
Communicate	KAUC
Compact International Agricultural Research Library (CIARL)	KAUC
Corel Super Packs Animal	KAUC
Corel Super Packs Food	KAUC
Corel Super Packs Gardens	KAUC
Corel Super Packs Seasons	KAUC
Corel Word Perfect Suit	KAUC
Corel Office Suite	CAGI
Crop Protection Compendium	KAUC
Cultivation and Farming of Marine Plants: World Biodiversity	KAUC
Current Contents – Agri Biology and Environmental Sciences	KAUC, CTCR, CPCRI
Current Contents – Life Sciences	RGCB
Database on Coconut Biotechnology	CPCR
Database on Indian Coconut Literature	CPCR
Database on Root Wilt Disease	CPCR
Desk View: Drivers and Utilities	KAUC
Dewey For Windows Version: 1.00	KAUC
Digital Presentation Techniques	CAGI
DU Reference	CAGI
Dinosaur Hunters	KAUC
Dr. Schuler’s Medical Informatics	KAUC
Earth Quest	KAUC

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Easy Tutor for Office 97	KAUC
Easy Tutor for Windows 98	KAUC
Easy Tutor for Windows NT	KAUC
Elephant: Lord Of The Jungle	KAUC
Encyclopedia of Science and Technology	CAGI
Encyclopedia of Science Fiction	KAUC
Engineering Entrance	KAUC
Eureka's Cosmopedia: Animal Encyclopedia	KAUC
Eureka's Cosmopedia: Body & Exploring Our Solar System and Total Body	KAUC
Eureka's Cosmopedia: Extra Terrestrials	KAUC
Eureka's Cosmopedia: Webster's Concise Encyclopedia	KAUC
Eureka's Cosmopedia: World Fact Book	KAUC
Eye Witness Encyclopedia of Nature	KAUC, KFRI
Eyewitness Encyclopedia of Science	CAGI, KFRI
Eyewitness Encyclopedia of Space And Universe	KAUC
Eyewitness Virtual Reality Bird	KAUC, KFRI
Family Medical Guide	KAUC
Fishes of the North Eastern Atlantic and Mediterranean	KAUC
Five Kingdoms	KAUC
Food & Human Nutrition in AGRIS: 1975-Dec1996	KAUC
Food and Human Nutrition1971-2000	KAUC
GCSE Biology	KAUC
GCSE English	KAUC
Golden Harvest And Bamboo	KAUC
Golden Harvest and to Save Our Environment Conservation	KAUC
Green Health; The Teak Defoliator	KAUC
Greenstone Software	CAGI
Grolier Encyclopedia of Science Fiction	KAUC
Guide for International Students	KAUC
Health Encyclopedia (Health Library in CDROM)	KAUC
HortCD,	CPCR
How Computers Work.	KAUC
IDRISI 32	KAUC
India: A Multimedia Journey	KAUC
Indian Standards	KAUC
Indian Wild Life	KAUC
Innoware IAS General Knowledge	KAUC
Integrated Pest Management In Coconut	CPCR
Irrigation and Drainage: Journal Collection	KAUC
Karishma	KAUC
KAU – Agricultural Theses Collections	KAUC
KAU – Agricultural Theses Collections: Searching Software	KAUC
Kerala Society Papers	CAGI
Kerala Telephone Directory –1999	KAUC
King of Oils: Nature's Finest Drink, Wealth From Waste	KAUC
LEAP: Personal Publisher For Indian Languages And English	KAUC
Learn IT: Windows 95 for Interactive Training	KAUC
Lexmark V.2 30, V.4 20	KAUC
Macromedia Director 7 Shock Wave Internet Studio V.7.02	KAUC
Malabar Manual - Willaiam Logan	CAGI
Malabar Gazetteer - Innes	CAGI
Manage Stress	KAUC

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Manage Time	KAUC
Managing Digital Libraries in Agriculture	CAGI
Man-Eating Tigers	KAUC
Marine Lobster Of The World	KAUC
Marine Mammals Of The World	KAUC
Mastering the Internet	KAUC
MBA Entrance	KAUC
McGraw-Hill Multimedia Encyclopedia of Science And Technology	KAUC
MCSE: NT Server 4 in the Enterprise Study Guide	KAUC
MCSE: Networking Assembling Study Guide	KAUC
MCSE: NT Workstation Study Guide	KAUC
MCSE: TCP/ IP for NT 4 Study Guide	KAUC
MEDLINE 1972- 2000	KAUC
Microsoft Encarta 98	KAUC
Microsoft Office 2000 Professional	KAUC
Microsoft Office 97	KAUC
Microsoft Windows 95: CD Sampler	KAUC
Microsoft Windows 98	KAUC
Microsoft Windows 98 Training Starts Here How & Why	KAUC
Microsoft Windows 98: Learning Materials	KAUC
Microsoft Windows NT Server	KAUC
Modeling Dynamic Biological Systems	KAUC
MS Ancient Lands	KAUC
MS Bookshelf 95 Windows	KAUC
MS Office 95	KAUC
MS Office Professional/ Book Shelf 97	KAUC
MS Windows 98 Training Kit	KAUC
MSDN Library Visual Studio 6.0	KAUC
Multimedia: An Introduction	KAUC
National Geographic 1888 to 1999	KAUC
National Union Catalogue Of Scientific Serials In India 1997	KAUC
Nature, Time and Man	CAGI
New Scientist: Summer 1998-2002	KAUC
Nitya Archive	CAGI
Norton Antivirus 5.0 For Windows NT	KAUC
Novell's Complete Encyclopedia of NT	KAUC
OASIS/ Alice Software Multi-User Version 5.25 Window NT Platform	KAUC
Oceans Below	KAUC
Organize for Success	KAUC
Oxford English Dictionary, Ed.2 on CD for PC Windows	KAUC
Pest CD,	CPCR
Professor Multimedia	KAUC
Professor Teaches Netscape Communicator	KAUC
Professors for MS Office For Windows	KAUC
Right to Information. Proceedings of the Seminar	CAGI
Road To Freedom	KAUC
Saving The Tiger	KAUC
Science Navigator	KAUC
Silver Platter Software Resource CD	KAUC
SITNET: Auto Shutdown for Windows NT	KAUC
Smart CD on NT	KAUC
Soil CD	CPCR
Sound Forge: Express Audio For Multimedia And The Internet	KAUC

Title	Location
South Canara Manual -	CAGI
Tara Dalal's Desi Khana	KAUC
Travancore State Manual - Velu Pillai	CAGI
Travancore State Manual - Nagam Iyya	CAGI
Teach Yourself Internet	CAGI
The Guinness Encyclopedia	KAUC
The Ultimate Human Body	KAUC
The Way Things Work 2.0	KAUC
The World Book Multimedia Encyclopedia	KAUC
Travancore Archelological Series - Gopinatha Rao	CAGI
Travancore State Manual - Nagam Iyya	CAGI
Travancore: Land of Charity - Samuel Matteer	CAGI
Treaties, Engagements and Sanads	CAGI
Tree CD	DFW, KFRI
Tropag & Rural CD.	CPCR
Tutor Value Collection –In 5 Floppies	KAUC
UNESCO Programmes for computerised Documentation Systems	CAGI, KFRI
UNESCO/ISEEK Energy Database	KAUC
Versatile Coconut: Coconut From Tradition To Technology	KAUC
Visual J+ +6.0	KAUC
Visual Studio 6.0 Professional	KAUC
Viswanathan, Prof. T. on Information Infrastructures	CAGI
Voice Direct Professional	KAUC
Water Resource Planning And Management: Journal Collection	KAUC
Webster's New World Dictionary & Thesaurus	KAUC
Who is who in CDROM	KAUC
Woods of the World	KAUC
World Data 1994	KAUC
World Development Indicators 1998-2000	KAUC
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LIST OF DOCTORAL THESES ON AGRICULTURE AND BIOSCIENCES IN COLLECTIONS OF SELECTED INSTITUTIONS

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Adoption of farm implements by the rice farmers of Kerala. Ahamed, P. 1993	COAT, KAUC
Agronomic evaluation of bio farming techniques for forage production in coconut gardens. Sansamma George. 1996	COAT, KAUC
Agronomic evaluation of chemical and bio-agents on phosphorus dynamics in red loam soils of southern Kerala. Viswambharan, K. 1995	COAT, KAUC
Agronomic evaluation of rice cultivars for rain fed conditions of Kerala. Sheela K. R.. 1993	COAT, KAUC
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Animal Nutrition studies on the influence of carbohydrates on the utilization of protein. Thomas CT. 1975	UOC
Applicability of diagnosis and recommendation integrated system (dris) in coconut palm (cocos nucifera L.). Mathewkutty T. I. 1994	COAT, KAUC
Assessment of immunity to duck plague virus (duck virus enteritis) on vaccination. Diwakar Dattatrayrao Kulkarni. 1993	CVA, KAUC
Assessment of quality of selected varieties of green gram and grain cowpea. Jessy Philip. 1996	COAT, KAUC
Assessment of the role of aflatoxin in the aetiology of carcinoma of the mucosa of the ethmoid. Surinder K. Chaudhary. 1995	CVA, KAUC
Bacterial wilt resistance and yield in brinjal (Solanum melongena L.). Singh, P.K. 1996	COHT, KAUC
Benefit cost analysis of investments in irrigation in Kerala. Neena, KP. 1988	UOC
Bio eltology and morphology of the figwasp, kradibia, and cestroi (grandhi) aganidae hymenoptena) from ficus exasperate vahl. Balakrishnan Nair P. 1983	UOC
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Biochemical and pharmacological properties of medicinal plants. Beena Panikkar. 1991	UOC
Biochemical aspects of differentiation development; orchid (vanilla) tissue culture and germination of tea seed. Ayyappan P. 1990	UOC
Biochemistry and physiology of semen in fresh water crabs. Mathad SG. 1984	UOC
Biochemistry and physiology of semen in penacid prawns. Muthuraman, AL. 1988	UOC
Bioefficacy of systematic fungicides against phytopphtora infections in black pepper(pipernigrum L). Ramachandran N. 1990	UOC

Biological activity of different plant extracts with particular reference to their insecticidal, hormonal and antifeeding actions. Saradamma, K. 1989	COAT, KAUC
Biological studies on the germination of winged bean phosphocaps, tetragololum (L DCC) seeds. Kamala Devi T. 1987	UOC
Biometrical studies on selected sugarcane cultivators in relation to their performance in plant ratoon crops. Sankaranarayanan P. 1982	UOC
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Blood groups and biochemical polymorphism in the malabari breed of goat and its exotic crosses. Nandakumaran, B. 1989	CVA, KAUC
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Calcium and phosphorus requirements of caged layers. Brahma .T.C. 1986	CVA, KAUC
Cellular and humoral immune responses to <i>carynebacterium pseudotuberculosis</i> infection in goats. Jayaprakasan, V. 1986	CVA, KAUC
Characterization and evaluation of indigenous ducks of Kerala. Mahanta. J.D. 1997	CVA, KAUC
Characterization and evaluation of the dwarf cattle of Kerala. Girija, C R. 1994	CVA, KAUC
Characterization of plasmids of <i>escherichia coli</i> isolated from mastitis. Avinash Ganpatrao Karpe. 1993	CVA, KAUC
Chemical investigation of some medicinal plants in Kerala. Omana P Perumpully. 1983	UOC
Chromosome profile of zebu x taurus cattle in Kerala. Raghunandan, K V. 1988	CVA, KAUC
Comparative analysis of characteristics of women labourers engaged in rice farming in the social systems of Kollam and Kanyakumari districts. Rajula Shanthi, T. 1996	COAT, KAUC
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Comparative pathology of aflatoxicosis in the duck and fish with special reference to the immune system. George, K C. 1998	CVA, KAUC
Comparative study of the immunopathological response in ochratoxin a, cadmium and mercury toxicities in ducks (<i>Anas Platyrhynchos Domesticus</i>). Vyas Madhavrao Shingatgeri. 1996	CVA, KAUC
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Cytotaxonomical studies on banana cultivars. Valsalakumari, P K. 1984	COHT, KAUC
Design of statistical (field) experiments and forecast in agriculture with special reference to rice. Palani Swami KM. 1991	UOC
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Development of acid tolerant strains of Bradyrhizobium sp. suitable for certain pulse crops of Kerala. Meena Kumari K. S.. 1998	COAT, KAUC
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Interaction between va mycorrhiza and bradyrhizobium in cowpea. Beena, S. 1999	COHT, KAUC
Interaction of psychological economic, sociological and technological determinants of the entrepreneurial behavior of agricultural students. Seema .B. 1997	COAT, KAUC
Inter-relationship of applied nutrients on growth, productivity and latex flow characteristics of Hevea brasiliensis Muell. Arg.. Punnoose, K I. 1993	COAT, KAUC
Intraclonal variations and nutritional studies in banana cv. 'palayankodan'. Rajeevan, P.K. 1985	COHT, KAUC
Investigations on root and stem borers of cashew (Anacardium Occidentale Linnaeus). Mariamma Daniel . 1991	UOC
Investigations on the nutrition of black pepper (Piper nigrum L.). Nybe, E V. 1986	COHT, KAUC
Isolation of the bioactive principles of thevetia neriifolia juss. (apocynaceae) and determination of their biological activities. Hebsy Bai. 1996	COAT, KAUC
Job efficiency of Panchayat level agricultural officers of department f agriculture in Kerala. Mothilal Nehru, S. 1993	COAT, KAUC
Land evaluation and suitability rating of the major soils of Onattukara region. Premachandran, P N. 1998	COAT, KAUC
Leaf litter dynamics in acacia and eucalyptus plantations. Moossa P. P.. 1997	COAT, KAUC
Low milk fat syndrome in crossbred diary cows. Sivaraman, S. 1997	CVA, KAUC
Management of foot rot of black pepper (piper nigrum L.) with va mycorrhiza and antagonists. Christin P.Robert. 1998	COAT, KAUC
Management of rhizome rot and root-knot of ginger (zingiber officinale r) using V.A.Mycorrhizal fungi and antagonists. Joseph. P.J.. 1997	COAT, KAUC
Micro propagation of Phalaenopsis. Jyothi Bhaskar. 1996	COHT, KAUC
Mineral nutrition of nutmeg (myristica fragrans hout.) in relation to deficiency symptoms and flowering. Joseph Philip. 1986	COHT, KAUC

Morphological studies on palame. Renuka C. 1982	UOC
Morphological, physical and chemical characterization of the soils of North Kuttanad. Manorama Thampatti, K C. 1997	COHT, KAUC
Multi variate approach to define the quality of rice. Nandini. P V. 1995	COAT, KAUC
Nitrogen losses from the rice soils of Kerala with special reference to ammonia volatilization. Anila Kumar, K. 1989	COHT, KAUC
Nutrient – moisture – ligh interactions in a coconut based homestead cropping system. Ravindran, C S. 1997	COAT, KAUC
Nutrient – moisture interaction under phasic stress irrigation of sweet potato in summer rice fallows. Muraleedharan Nair, G. 1994	COAT, KAUC
Nutrient dynamics in the rice based cropping systems. Sundaresan Nair, C. 1989	COAT, KAUC
Nutrient-growth regulator interaction in snake gourd (<i>trichosanthes anguina</i> l) under drip irrigations system. Elizabeth K. Syriac. 1998	COAT, KAUC
Nutritional status and dietary habits of irulas of Attappady. Indira .V. 1993	COAT, KAUC
Nutritional status of ICDS (Integrated Child Development Services) beneficiaries with respect to participation. Mary Ukkuru Pulikkottil. 1993	COAT, KAUC
Nutritional status of women engaged in fish vending in Trivandrum district. Karuna M. S.. 1993	COAT, KAUC
Ochratoxicosis in quails (<i>coturnix coturnix japonica</i>) with special reference to immunopathological response. Amir Abbas Farshid. 1992	CVA, KAUC
Ochratoxicosis in the goat. Maryamma, K I. 1983	CVA, KAUC
Optimization of agronomic resources for maximizing grain and mill yield of rice. Kannan Mukundan. 1976	KAUC
Optimization of shade, nutrients and growth regulators for cut-flower production in anthurium. Salvi, B R. 1997	COHT, KAUC
Optimum energy and protein requirements of broiler rabbits. Ganga Devi. P. 1995	CVA, KAUC
Organizational and morphaogenesis of the vascular system in plyphodiaceae - an enquiry into the nature of shoot system in vascular plants. Molly MJ. 1987	UOC
Ovarian response to gonadotrophin releasing hormone in non-cyclic goats. Aravinda Ghosh.K. N. 1998	CVA, KAUC
Partial substitution of muriate of potash by common salt for cassava (<i>Manihot esculenta</i> Crantz) in oxisols of Kerala. Sudharmai Devi, C R. 1995	COAT, KAUC
Pathogenicity of thai sac brood virus to the ecotypes of <i>apis cerana indica</i> fab. in Kerala. Devanesan, S. 1998	COAT, KAUC
Pathology of the reproductive organs in experimental hypothyroidism in goats. Nemali Mohan. 1982	CVA, KAUC
Performance of selected orchids under varying light regims, culture methods and nutrition. Sabina George Thekkayam. 1996	COAT, KAUC
Phosphorus management in a rice based cropping system. Annamma George. 1989	COAT, KAUC

Physiology of growth and productivity of turmeric: (<i>Curcuma domestica</i> val) in monoculture and as intercrop in coconut garden. Satheesan KV. 1985	UOC
Postnatal development of testis and epididymis, semen characteristics and fertility of brown-Swiss crossbred bulls. Surendra Varma Raja, C K. 1981	CVA, KAUC
Potassium supplying capacity of Neyattinkara – Vellayani soil association and its relationship with potash nutrition of major crops on them. Valsaji, K. 1989	COAT, KAUC
Preliminary study of agaric flora of south India. Thresia PC. 1987	UOC
Production potential of cassava-based cropping systems. Ashokan P. K. 1986	COHT, KAUC
Productive performance of crossbred diary cattle in hot humid environment. Noble. D. 1990	CVA, KAUC
Productivity in relation to branching pattern and pruning in cashew (<i>Anacardium occidentale</i> L.). Nalini, P V. 1997	COHT, KAUC
Pteridophyte flora of Malabar - a taxonomic and morphological study. Geevarghese KK. 1984	UOC
qualitative changes of yoghurt prepared from milk preserved by different methods. Prasad. V. 1990	CVA, KAUC
Reinvestigation of Medicinal Plants in Hortus Malabaricus. Suresh CR. 1987	UOC
Reproductive performance of cows under homoeothermal disturbances. Athman, K V. 1995	CVA, KAUC
Requirements of protein and energy for broilers during summer season. Amritha Viswanath. 1992	CVA, KAUC
Response of cucumber (<i>cucumis melo</i> l.) to drip irrigation under varying levels of nitrogen and potash. Lakshmi, S. 1997	COAT, KAUC
Resurgence of brown planthopper <i>Nilaparvata lugens</i> (Stal) on rice treated with various insecticides. Thomas Biju Mathew. 1989	COAT, KAUC
Rice based cropping system analysis in Kerala. Chidananda Pillai, M R. 1993	COAT, KAUC, UOC
Role of cooperative marketing societies in stabilizing Planters with special reference to areca nut industry in Kerala. Sainul Abydeen EP. 1982	
Role of cooperative milk supply societies in the development of diary industry with particular reference to Kerala. Muraleedharan KP. 1990	UOC
Role of cooperative societies in the socio economic development of Fishermen in Kerala. Sreeranganathan, K. 1989	UOC
Seasonal variation in black pepper (<i>Piper nigrum</i> L.). Shylaja, M R. 1996	COHT, KAUC
Seed production in <i>stylosanthes gracilis</i> under varying levels of population denisty, nutrition, moisture regims and cuttings. Balachandran Nair, G K. 1989	COAT, KAUC
Selection efficiency and genetic and biochemical bases of resistance to bacterial wilt in tomato. Rajan, S. 1985	COHT, KAUC
Selection studies in chicken for egg number on part records. Maheswar Rath. 1986	CVA, KAUC
Sequential analysis of constraints in increasing production of rice and coconut in Kerala. Prakash, R. 1989	COAT, KAUC
Soil fungi of Malabar. Zacharia S. 1982	UOC

Soil test crop response studies in cassava in laterite soils of Kerala. Kumari Swadija .O. 1997	COAT, KAUC
Some aspects of the biology of the fresh water crab, paratelphusa hydromous (Herbs). Suma Gupta . 1990	UOC
standardization of in vitro pollination and fertilization for generating genetic variability in Zingiber officinale (Rosc.). Valsala, PA. 1994	COHT, KAUC
Standardization of in vitro techniques for mass multiplications of aranthera and dendrobium. Sherly Kuriakose. 1997	COAT, KAUC
Standardization of in vitro techniques for rooting, hardening and micro grafting in cocoa (Theobroma cacao L.). Bindu, M R. 1997	COHT, KAUC
Standardization of in vitro techniques for the rapid clonal propagation of mango (Mangifera indica L.). Sulekha G. R.. 1996	COAT, KAUC
standardization of plant part as an index of potassium status in banana, musa (aab group) nendran. Sumam George. 1994	COAT, KAUC
Standardization of tissue / meristem culture techniques in important horticultural crops. Rajmohan, K. 1985	COHT, KAUC
Statistical analysis of daily rainfall data for identifying the onset of effective monsoon and critical dry spells with special reference to Kerala. Ashok Raj PC. 1984	UOC
status and availability of sulpher in the major paddy soils of Kerala and the response of rice to sulphatic fertilizersers. Purushothaman Nair, N. 1995	COHT, KAUC
Status and impact of heavy metals in selected soils and crops of Kerala. Usha Mathew. 1999	COAT, KAUC
Strain variation in colletotrichum gloeosporiodes (PENZ.) PENZ. & SACC. Alice, K J. 1996	COAT, KAUC
Structural and functional linkages in the transfer of technology of improved rice varieties released by the Kerala agricultural university – a systems analysis. Abdul Rahiman Kunju, O. 1989	COAT, KAUC
Structure analysis and system dynamics of agro forestry home gardens of southern Kerala. Jacob John. 1997	COAT, KAUC
Studies on black pepper (Piper nigrum L) and some of its wild relatives. Ravindran Nayar PN . 1991	UOC
Studies on certain gastro-intestinal nematodes with special reference to those found in goats. Sathianesan. V. 1980	CVA, KAUC
Studies on certain species of squirrels affecting cocoa and other plantation crops in South India. Kesava Bhat S. 1983	UOC
Studies on crop growth and the physiology and biochemistry of revised flowering in pineapples. Madhusudhanan Pillai KN. 1985	UOC
Studies on digestive organs of insects. Pakrutty, TK. 1988	UOC
Studies on genetic basis of selection in sugarcane. Santhakumari Amma PN. 1984	UOC
Studies on Indian Cinnamomums. Shylaja M. 1985	UOC

Studies on macro meso and micro morphology and clay mineralogy of the acid sulphate soils of Kerala. Subramonia Iyer, M. 1989	COAT, KAUC
Studies on mango leaf webber orthago exvinacea hamps and its parasitoids. Sherly a George. 1988	UOC
Studies on mites associated with economically important plants. Ramani N. 1988	UOC
Studies on philotaxy, apical organization and bulbil formation in coconut. Jose Joseph. 1985	UOC
Studies on properties of irradiated wood. Thomas PT. 1987	UOC
Studies on Rhizosphere mycoflora of pepper (pipeernigrum. Sankaran KV. 1983	UOC
Studies on Smut Diseases in Sugarcane. Alexander K.C. 1976	UOC
Studies on soil organic matter. Balagopalan M University of Calicut. 1991	UOC
Studies on the biology, pathogenicity and treatment of important nematodes of domestic duck. Chandrasekharan, K. 1977	CVA, KAUC
Studies on the chemical control and insect-plant relationships of the rice leafroller, cnaphalocrocis meninalis guenee (pyraustidae lepidoptera). Mohandas, N. 1975	COAT, KAUC
Studies on the common ticks affecting live-stock in Kerala. Rajamohanam.K. 1980	CVA, KAUC
Studies on the degradability of proteins and protected proteins in the rumen of cattle. Sampath, K T. 1985	CVA, KAUC
Studies on the ecology, systematics and biomies of the fishes of the inundated paddy fields and canals of Trichur District. Thobias MP. 1977	UOC
Studies on the effect of hormones and hormone analysis and antihormones on spodoters mauritia boised (Lepidoptera noetuidae). Sanita A George. 1989	UOC
Studies on the environmental management of heavy metals and pesticides with respect to their toxicity towards aquatic organisms. Rajendra Prasad Soni. 1991	UOC
Studies on the extent of damage caused by pests of stored copra and control of the important pests. Nalina Kumari, T. 1989	COAT, KAUC
studies on the meat qualities and meat potentialities of buffalo calves. Thachanat Gopalan Rajagopalan. 1981	CVA, KAUC
Studies on the metabolic activity of the reproductive system of chicken. Ramakrishna Pillai, M G. 1978	CVA, KAUC
Studies on the nutritional requirements of the Indian elephant. Ananthasubramaniam. C R. 1979	CVA, KAUC
Studies on the solubilisation of iron in submerged soils and methods to minimise its solubility and toxic concentration to paddy. Ramasubramonian, P R. 1989	COAT, KAUC
Studies on Wild rice species interrelationship. Shyla R. 1986	UOC
Studies on wood inhabiting macro fungi of Kerala. Ganesh PN. 1990	UOC
Study on productivity of agricultural investment finance with special reference to Kerala. Ramachandran Nair MK. 1988	UOC

super ovulation, synchronization of oestrus and embryo transfer in crossbred cows. Suresan Nair, S P. 1992	CVA, KAUC
Survival of rhizoctonia solani kuhn with special reference to antagonistic soil microflora. Padmakumary, G . 1989	COAT, KAUC
Survival of Xanthomonas campestris pv. Oryzae and its control in Kuttanad. Mary, C A. 1996	COAT, KAUC
Systematics, ecology, bionomies and the distribution of the hill stream fishes of Trichur district. Antony AD. 1978	UOC
Taxonomic and Ethnobotanical study on Acipiadicas. Swarupanandan K. 1985	UOC
Taxonomic studies on agriclaes of Kerala. Manimohan. 1988	UOC
Taxonomic studies on medicinal herbs used in Ayurveda with special reference to Kerala. Indira PA. 1988	UOC
Taxonomic studies on orchids of Kerala. Satheesh Kumar C . 1991	UOC
Taxonomic studies on pyraloid fauna(insecta, cepidotera) of Kerala. George Mathew. 1985	UOC
Taxonomic study of Araceae of south India. Sivadasan M. 1983	UOC
Technological evaluation of Kera ice cream. Geevarghese. P.I. 1996	CVA, KAUC
The cellular response in inflammatory reaction in the duck. Valsala, K V. 1985	CVA, KAUC
The effect of certain biopesticides and irradiation on the developmental stages of myiasis producing flies. Subramanian .H. 1998	CVA, KAUC
The structure and function of the shell gland in Japanese quail under different levels of dietary calcium. Philomina, P T. 1994	CVA, KAUC
Vocational higher secondary education in agriculture in Kerala – a multidimensional analysis. Kumari Sushama, N P. 1993	COAT, KAUC
Work motivation – a multivariate analysis among teachers of the Kerala Agricultural University. Alexander George. 1996	COHT, KAUC

APPENDIX -11

LIST OF AUDIO-VISUAL RESOURCE ON AGRICULTURE AND RELATED AREAS HELD BY INSTITUTIONS IN KERALA

Title	Location
About bats: their conservation, fruit bats, echolocation, and desert bats	KAUC
Agricultural related technologies: a garden for you. In 2 Cassettes	KAUC
Agriculture and Biotechnology	KAUC
Agriculture growth in India: historical perspective	KAUC
Agriculture growth in India: post independence perspectives	KAUC
Agro forestry in watershed management	KAUC
Agro forestry: a new art in agriculture (23.12 min.)	KAUC
AIDS	KAUC
Alcohol from Cassava	KAUC
An Introduction with Dr. M S Swami Nathan	KAUC
Application of plant tissue culture/ animal tissue culture	KAUC
Arid zone ecology phase –I CAZRI	KAUC
Artificial insemination//primary chick embryo cell culture/ Genetic basis of sex	KAUC
Ascorbic acid/Preservation of fruits & vegetables using sugar/ Thiamine	KAUC
Assessment of nutritional status I&II /Energy I &II / Riboflavin	KAUC
Ayurveda in 2 cassettes	KAUC
Ayurveda self sufficient	KAUC
Bamboo a crop	KAUC
Behavior disorders of children/visual impairment/habit training	KAUC
Bio – Farming: in dialogue with nature	KAUC
Biodiversity of India (17.min.)	KAUC
BIOGAS ((21.41 min.)	KAUC
BIOGAS ((21.41 min.)	KAUC
Biological Control of Rice Diseases 1-2	KAUC
Biotechnology the future	KAUC
Birds of no frontier (28.17min.)	KAUC
Birds: how we identify them?	KAUC
Brain and nervous System 1-2	KAUC
Building from below (BAIF, Pune)	KAUC
Cash in Shell: Agriculture Coconut (Coconut Development Board, Kerala)	KAUC
Cereals- I: wheat/maize &other cereals/weaning foods/Food preservation / Pulses	KAUC
Chance for survival	KAUC
Chilly: botanical aspect	KAUC
Chromosomes and sex determination/ sex determination in man /dosage compensation:	KAUC
Cockroaches/ Frogs	KAUC
Coconut cultivation (Coconut Development Board, Kerala)	KAUC
Coconut in development (Coconut Development Board (CDB), Kerala)	KAUC
Coconut production technology (20.07 min.), CDB	KAUC
Computers and operations research	KAUC

Title	Location
Consumer problem/standard of living/consumer education/environmental pollution	KAUC
Cytoskeleton on mobility: Drug and xenophobic metabolism	KAUC
Desert locusts / desert wild life	KAUC
Desert locusts 1 & 2; desert wild life etc.	KAUC
Diabetes /Diet in fever/	KAUC
Pest control in food service industries/sanitation & safety in handling food	KAUC
Dietary management in cardio vascular diseases, liver diseases, renal disorders	KAUC
Dietary management in renal diseases –food adulteration/natural cellulose fibers	KAUC
Digestion and excretion	KAUC
Digital presentation techniques	CAGI
Discovering insects: Butterflies	KAUC
Discovering snakes	KAUC
Dispersal of mycorrhizal fungi / conservation of edible fungi	KAUC
DNA /zoology/plasmid /DNA activator	KAUC
Drip System	KAUC
Dry land horticulture a sustainable land use option	KAUC
Earthworm as animal feed and fisheries (7 min.)	KAUC
Earthworms - in 5 Cassettes	KAUC
Earthworms for better water management	KAUC
Echo from the hills	KAUC
Ecosystem I: the whispering brook	KAUC
Educating mentally retarded/planning the home	KAUC
Education through art (19.03 Min.)	KAUC
Elephant: Lord of the jungle (53 min.)	KAUC
Endangered birds of India	KAUC
Endangered mammals in India	KAUC
Energy III/ Carbohydrates I&II/Lipids I&II	KAUC
Environment shapes: National culture – in 5 cassettes	KAUC
Environment statement: an overview (Centre for Environmental Education, Ahemedabad)	KAUC
Environmental mutogenesis	KAUC
Evolution of insect societies/ the life of a social wasp and pattern: Dragon fly reproduction	KAUC
Extension education process/rural basic industries/extension approaches/communications/	KAUC
Fitting/pattern making/ cutting construction of jatti/–line frock -I	KAUC
Flacon (folic acid)/iodine in human nutrition/Nutrition in old age/vitamin B12	KAUC
Flower	KAUC
Flower: a modified shoot	KAUC
Food preservation – - in 3 cassettes	KAUC
Food preservation, drying, dehydration/fluorine/canning of fruits &Vegetables. /cereals: rice/e	KAUC
Forests in peril - in 2 cassettes	KAUC
From tradition to technology: Coconut	KAUC

Title	Location
Frontier topics in biology - 4 to 6	KAUC
Fruits & vegetables - in 2 cassettes /	KAUC
Functional finishes/color in fabrics/dyeing & printing techniques/smoking – various uses/.	KAUC
Genetic engineering/ lysosome; Wonderful world of cells	KAUC
Girl child in India/Late childhood years/mothering during early years of life	KAUC
Give trees a chance (34.34 min.)	KAUC
Global changes: lecture by Prof. M G K Menon	KAUC
Global warming	KAUC
Gokak Goes Green (BAIF, Pune)	KAUC
Green health: a film on using medicinal plants for primary healthcare	KAUC
Green house effect (15.30 min.)	KAUC
Herbarium - in 4 cassettes	KAUC
Home lighting/flooring materials/wall finishes//family life cycle on resource management	KAUC
Home science education/characteristics of rural society/agriculture & role of women/	KAUC
Home science goes to the village (25 min.)	KAUC
Horticulture: Ornamental Gardening	KAUC
If you care for this planet – I	KAUC
Impact of information technology in library and information science	KAUC
In Gandhi's foot steps (BAIF, Pune)	KAUC
In search of rare cranes	KAUC
In the eye of an insect; taste and smell perception in insects etc.	KAUC
Indian wetlands	KAUC
Industrial green belt: a war on urban pollution (BAIF, Pune)	KAUC
Introduction to Dewey Decimal Classification 1	KAUC
Irrigated horticulture: Fruit culture	KAUC
Judging a cow (10.47 min.)	KAUC
King of oils: Coconut oil	KAUC
Kshara Sutra - A new treatment for fistula	KAUC
Ladakh: the forbidden wildness (53 Min)	KAUC
Learning from nature: back to nature	KAUC
Learning from nature: neglected nectar	KAUC
Learning skills for information professionals	KAUC
Line frock II construction/sari petticoat I&II/blouse –I&II	KAUC
Machine printing/yokes/application of decorative stitches in design/s	KAUC
Making/ cutting construction of jatti/drafting & construction of jabla/A – line frock -I	KAUC
Male reproductive physiology/ reproduction in animals/female reproductive physiology	KAUC
Mallik, CP. Talk with Prof. C.P Malik (180 min) in 4Cassets	KAUC
Man made cellulose fibers – rayon/natural protein fibers - silk/ Thermoplastic fibers	KAUC
Management information systems	KAUC
Managing digital libraries in agriculture	CAGI
Man-eating tigers (53 min)	KAUC

Title	Location
Mangrove: facts and policies (14.57 min.)	KAUC
Marriage customs in different culture/the family/problems of adolescent girls/p	KAUC
Marshes and their ecological importance	KAUC
Meat - in 2 cassettes	KAUC
Medicinal plants	KAUC
Microbiology of milk –in 2 cassettes	KAUC
Milk	KAUC
Modern Irrigation Systems	KAUC
Mushroom: preparation of pure culture & motur spawn	KAUC
Mushrooms	KAUC
Mushrooms: a delicacy for health	KAUC
Mushrooms: Cultivation & Culture	KAUC
Mutation breeding in plants	KAUC
Mycotoxins	KAUC
Naming the plants – I	KAUC
Narmada Diary (60 min.), film by Simantini Dhuru & Anand Patwardhan	KAUC
Nature, time and man	CAGI
Nature's Child – “ Adivasi”	KAUC
Nature's finest drink: agriculture coconut	KAUC
Need and scope of nutrition research - nutrition problems and challenges	KAUC
Neem: a miraculous tree	KAUC
Neem: The garden gold mine	KAUC
New products from coconut	KAUC
Non-projected visual aids/writing for rural families/projected aids/rural development programs.	KAUC
Nutrition education in India; Nutritional blindness	KAUC
Nutrition for children, adolescents /low temp. Storage of food/fuels in food.	KAUC
Nuts & oil seeds/food poisoning & food infection/food allergy/food cost control	KAUC
Old age/breast feeding and weaning/gifted children/problems & care of aged	KAUC
Organic farming: a hope for better tomorrow	KAUC
Organizing rural markets	KAUC
Orthodontics	KAUC
Oyster mushroom: cultivation	KAUC
Panchacarma 1-2	KAUC
Panchayath Raj/rural development administration/programme building/women & development.	KAUC
Perm culture in 2 cassettes	KAUC
Personal Computers and Managers	KAUC
Personal functions	KAUC
Physical & motor development during infancy/prenatal development child care/nutritional depravation	KAUC
Planet Earth: AIR	KAUC
Planet Earth: Sand	KAUC
Planet earth: Water	KAUC

Title	Location
Planning and development in Kerala	SPB
Plant fossils - in 5 cassettes	KAUC
Plants as resources – I	KAUC
Plants in our neighborhood - in 8 cassettes	KAUC
Pomology the science of fruits: Seeds	KAUC
Pomology: the science of fruits in 2 cassettes	KAUC
Pond of plenty	KAUC
Preserving the ecosystem	KAUC
Principles of biosystematics in 5 cassettes	KAUC
Project evaluation: perception and practice	KAUC
Pyridoxine & biotin	KAUC
Race to save the planet: Do you really want to live this way	KAUC
Race to save the planet: In the name of progress	KAUC
Race to save the planet: It needs political decisions	KAUC
Race to save the planet: More for less	KAUC
Race to save the planet: Now or never	KAUC
Race to save the planet: Only one atmosphere	KAUC
Race to save the planet: Remains of Eden	KAUC
Race to save the planet: Save the earth; feed the word	KAUC
Race to save the planet: The environmental revolution	KAUC
Race to save the planet: Waste not wants more	KAUC
Research on Bet vine Cultivation – in 2 cassettes	KAUC
Right to Information. Proceedings of the Seminar	CAGI
Role of iron in human nutrition/nutrition education/ therapeutic nutrition/Vit.A/green leafy vegetables.	KAUC
Role of teachers in personality development Parents in producing a conducive environment	KAUC
Rural development programme III/folk media in communication I - III/leadership development.	KAUC
Saffron saga/ Thumba - a plant with future/ The Tree grass/Cactus	KAUC
Save the Elephant (24.17 min.)	KAUC
Save your grain - from insects	KAUC
Save your grain – from rodents	KAUC
Save your grain – structures for storing grains	KAUC
Saving the tiger (56 Min)	KAUC
Science & technology for rural women/rural sanitation: problems & measures/ youth clubs	KAUC
Scientific cultivation of coconut	KAUC
Scientific storage of food grains	KAUC
Seed processing	KAUC
Selection and arrangement of furniture/work space for selected household activities	KAUC
Seven sholas	KAUC
Side Effects of pesticide	KAUC
Sleeve variations/body measurements I&II/romper/sewing machine	KAUC
Snakes of India (22 min)	KAUC
Soil testing	KAUC
Solar energy for household use/safe drinking water//egg a dietary	KAUC

Title	Location
asset/food groups	
Domiciliary mgt of illness in children/children with hearing impairment and their education	KAUC
Spring of hope (BAIF, Pune)	KAUC
Sprouted foods: food of future	KAUC
Standardization ... recipe filing systems/nutrition for nursing mothers/diet-counseling	KAUC
Story of rice	KAUC
Sustainable agriculture by daring farmers – in 2 cassettes	KAUC
Teak defoliator	KAUC
Threatened ecosystems in India	KAUC
Thumba: a plant with future	KAUC
Time, Nature and Man	KAUC
Tissue culture by Dr. Madhuri Shavoni	KAUC
To save our environment: conservation	KAUC
Tree and creeper money for the repair – in 2 Cassettes	KAUC
Use of isotopes in nutrition:	KAUC
Vermicompost – I the might of the small	KAUC
Vermicompost – II the two roads	KAUC
Versatile coconut	KAUC
Viruses: The waterborne diseases	KAUC
Viswanathan, T. Talk on Information Infrastructures by Prof. T. Visvanthan	CAGI
Water and water pollution	KAUC
Water hyacinth (16.39 min.)	KAUC
Wealth from waste	KAUC
What on earth are we doing to our environment?	KAUC
What on earth are we doing? (17 min.)	KAUC
White button mushroom cultivation	KAUC
Why conserve wild animals (12.42 min.)	KAUC
Why social forestry? (11 min)	KAUC
Wild life in connection with nature (14.08 min.)	KAUC
Winds of change – I: Rural development introduction	KAUC
World of insects: Introducing insects	KAUC
Yarn formation/yarn classification/fabric construction: other weavers	KAUC
Youth programme/extension training/peoples participation in rural development/social welfare	KAUC

APPENDIX - 12

COMPUTER HARDWARE, SOFTWARE FOR THE AGFISNET DEMONSTRATION SITES/ PARTICIPANTS

In AGFISNET libraries of AGFIS Central Hub at DAGI Campus and Demonstration sites at six specialized institutes for six subjects will have a premised LAN and Digital Library/Archives, as well as training facilities. The hardware configuration recommended in the study is based on Feasibility Reports on Electronic Information Network for IARI campus; Delhi as well as KAULIS project at Kerala Agricultural University, both has since been implemented successfully. The detailed specification of the equipments required for the Premised LAN and their approximate cost is provided below.

A. AGFIS Central Hub/DSs Premises LAN Stacks and Solutions: Foreign Equipments

Component description	Quantity	Unit Price \$	Total
DEC hub 900 with one power supply	1	05,450	05,450
Power Supply for DecHUB 900(additional)	1	01,350	01,350
DEC repeater 900 TM 32 port Ethernet Module (UTP)	1	04,090	04,090
DEC server 900 TM Remote Access Server (32 ports)	1	06,390	06,390
DEC Route About Access EW with multiprotocol software	2	02,680	05,360
Clear VISN Multi-Chassis Manager with Router Configurator	1	01,320	01,320
Digital Venturis FX Workstations (detailed specification in Section B below)	25	01,870	46750
Digital Prioris 5150 LX (detailed specification in Section B below)	1	04,785	04,785
Alpha Station 1000 A 5/300 Base System Bundle (base configuration attached): 64 MB Memory, 2 MB ECC cache, 600 MB CD ROM drive, UNIX base (2 user) licence, Integrated Graphics Card, UNIX Keyboard and 3 button Mouse (detailed specification in Section B below)	1	12,805	12,805
15" Colour Monitor	1	00,600	00,600
4 GB Wide SCI Hard Disc for Alpha 1000A	1	01,725	01,725
Table-top 8 GB DAT Drive	1	01,555	01,555
SCSI Cable for DAT Drive	1	00,045	00,045
UNIX Licence-24 Users	1	01,800	01,950
NT License 50-Users	1	01000	01000
VXL 4310 ASCII VT220 dumb terminals: 25 Nos.	5	14500	72500
CD Server with 50 drives. (Detailed specification in Section B below)	1	15000	15000
Jukebox (detailed specification in Section B below) for 500 CDs	1	20000	20000
CD Networking Software	1	05000	05000
Digital Library Solutions	1	05000	05000
Library House keeping Package	1	02500	02500
LCD Projector	1	10000	10000

B. AGFIS Central Hub/Demonstration Sites Premises LAN Stacks and Solutions: Indian Equipments

Component description	Quantity	Unit Price Rs	Total
RAD ASM-20 V35.64 kbps Modem Two Nos.	2	46500	9300
Power Tel Boca MV 34 ED V34 28.8 kbps MNP-10 Modems Four Nos.	4	13850	55400
Patch Panel: One no.	1	2750	2750
Patch Panel Inserts: Six Nos.	6	2750	16500
Patch Cables: 80 Nos.	80	120	9600
Wall boxes, face plates (kit of eight): 80 Nos.	16	2850	45600
CAT 5 UTP cables PVC wire reel 303 metres: 5 Nos.	5	8500	42500
19 Inch Industry Rack President systems with two fans: -1.	1	48000	48000
Barcode Scanner	1	45,150	45,150
Data Capturing Unit	1	42000	42,000
Software	1	10815	10,815
Other essential components for the total solution	1		

C: Internet server for the Library: Detailed Specification

64 Bit RISC processor 300 Mhz or more with 2MB ECC onboard Cache, pedestal enclosure with 7 PCI slots, 2 EISA slots, 1 PCI/EISA slot, integrated fast wide single-ended SCSI-2 controller supports wide and narrow devices, integral SVGA graphics controller, 20 SIMM memory slots, 10 storage slots, 1 diskette drive slot, 1 CDROM drive slot, 1 additional removable media slot, 7 storage works hard drive slots, 450 watt power supply, 2 serial ports, support full duplex asynchronous modem control, 1 bi-directional enhanced parallel port, PS/2 style keyboard port and mouse port, 3 button mouse, EISA configuration utility, integrated advanced server management features including server works manager kit, NAS 200 license, 64 bit Unix base user license, AS: Electronic Locker, Mail Works, Net site Communication Server software, World Wide Web(CERN), Pine Mail, POP3 Mail, WAIS, News Reader(TIN), News Server(INN), NCSA Mosaic Browser for X terminal use, LYNX 64 MB memory, 2GB SCSI HDD, 15" colour monitor, keyboard, 600 MB CD ROM, 8GB table top DAT drive, SCSI cable, power cord, 10 Mbps PCI Ethernet card, Performance spec int 95 >8.4, spec fp 95 >9.8, transaction per second,

D: Library Management System Server: Detailed Specification

: Pentium IV 2.8 GHZ, 528 MB memory, 256 KB async cache standard, PCI fast SCSI-2 (Narrow) controller, PCI enhanced IDE four devices controller, PCI full duplex Ethernet controller, Cirrus 5428/5429 SVGA graphics controller with 512 KB DRAM standard, 2PCI full length 1PCI/EISA full length and 3 EISA full length (total 6) slots, 6 Bays (1 3.5" front accessible low profile with 1.44 MB diskette drive, 3 5.25 front accessible half height, 1 3.25 front accessible full height, and 1 3.25" front accessible low profile, external ports: 1 enhanced parallel (ECP/EPP) 2 high speed 16550 compatible serial , 1 SVGA graphics, 1 key board, 1mouse, 1 fast SCSI-2, 2 Ethernet(10Base-T, 10Base-2), SCSI 10x CD ROM Drive, HDD PCI E- IDE 2.5 GB or above/Fast SCSI 2GB/Fast ,wide SCSI-2 2GB, Adaptors: Fast wide PCI SCSI -2

host adaptor/ADAPTEC SCSI 1542, Raid controller 1 Channel/Terminal controller specialix card 16 ports, Ethernet card Dlink 250, Tape Drive 5.25, necessary software, OS support: NIC Unix SVR 4.0 and above, UnixWare 1.1 and above, Netware, Windows -NT, Server, Pathworks, SCO UNIX, Windows for Workgroup, MSDOS, Windows 95, and Windows NT work station, Mechanical Chassis lock, case lock down ring, two level or power on password protection, key board, mouse and other components. Documentation and software should preferably in CD

E: CD Server to Host High Level Usage Information

CD/DVD Server/hard disk based 250 GB HDD with DVD drive and DVD Writer 52X/48X speeds or above; SCSI interface; capable of digital audio extraction 8x or above, USB Ports, Windows 98 and Windows NT Clients supported; TCP/IP compatible Protocol with CD Networking Software; minimum PIV 2.8 Ghz, 528 MB RAM Server.

F: CD Server to Host Middle Level Usage Information

CD/DVD -ROM Server Drive based with 50 drives 52 speed or above; SCSI interface; capable of digital audio extraction 8x or above, USB 2 Ports, Windows 98 and Windows NT Clients supported; TCP/IP compatible Protocol with CD Networking Software; minimum PIV 2.8 Ghz, 528 MB RAM Server.

G: CD-ROM Storage/Access Solution for Less Used Information

Juke Box with 500 Disc capacity; SCSI interface; minimum 2 DVD Reader Drives, 2 CD Reader Drives, 2 DVD writers, USB Ports, Windows 98 and Windows NT compatible with Juke box management software, CD Networking Software.

H. Workstation for Participating Institutions/Centers

Pentium IV 2.6.GHA, 564 RAM, 80GB HDD, CDD 54x, CDRW 48x, 17 Inch Color Monitor, Speakers, Scanner, Web Camera, Internal Modem. Windows 98/ME/2000, CDS/ISIS, MS Office.

Note: the specification is based on Digital Library and LAN developed at KAUC with necessary improvements necessitated since its implementation.