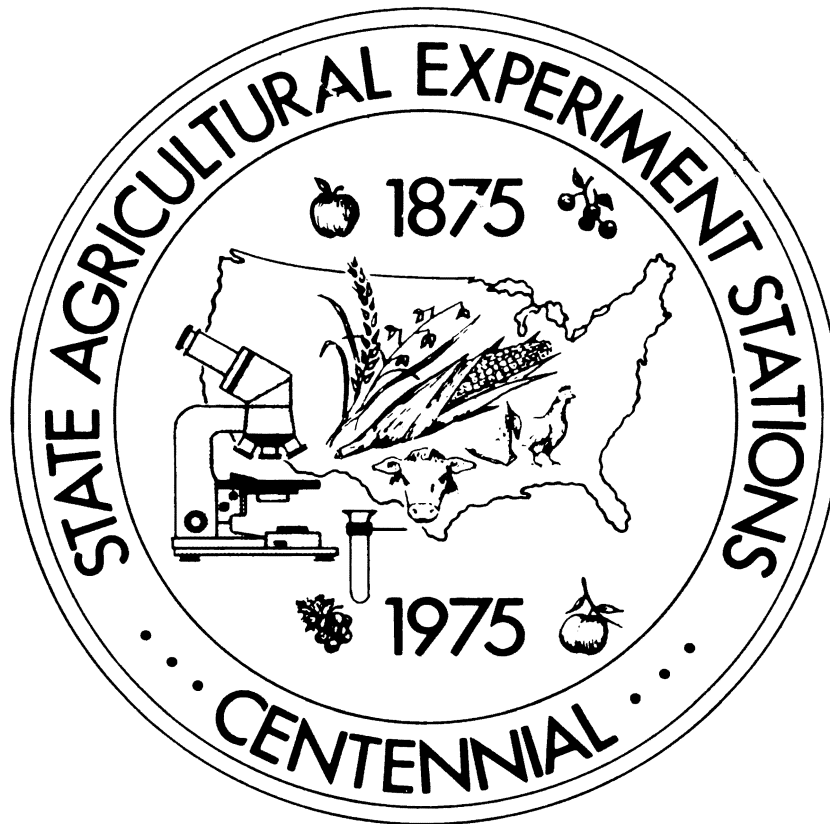


Research
in
**The College of Agriculture
and Life Sciences**
1973-74



Research Division
Virginia Polytechnic Institute and State University
Research Division Report 161
December 1974

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FOREWORD

This report provides a brief description of research projects in the College of Agriculture and Life Sciences for the fiscal year 1974. The report does not completely describe the scope of the work. However, to fully describe each project would make the report too lengthy. It was prepared to assist the citizens of the Commonwealth of Virginia in developing a better understanding of the research being conducted on resources and commodities that are important to the state and to serve as the basis for planning and developing improved research programs.

The objectives of the Virginia Polytechnic Institute and State University's agricultural programs are: (1) to provide safe, nutritious, palatable food supply and adequate, varied fibers, (2) to increase job opportunities in rural areas, (3) to contribute to the aesthetic satisfaction of rural and urban people, and (4) to improve and maintain the environment at an acceptable level of quality.

Both basic and applied research is currently being conducted on all commodities, as well as on resources related to the development of rural areas.

Most projects are classified under a commodity or resource. But, the total research contribution to a given commodity or resource is not limited to the projects assigned to it. For example, the beef cattle industry shares in the benefits resulting from research on pastures, forages, and corn. Many other examples could be cited. In many instances, a project has been classified in more than one category, and therefore, the funds and personnel have been divided among the commodities involved in the research. Consequently, a particular

research project frequently occurs more than one time in this description. It is important to note that funds and manpower assigned to the project are never duplicated, but are allocated on a percentage basis that reflects the effort involved on each commodity.

The activity, Biological Efficiency, includes plant breeding, fertilizers, rotations and all other research, except pest control, designed to increase crop yields and breeding and feeding of livestock to increase rate of growth or efficiency of feed utilization. Other activities are self-explanatory.

SMY denotes Scientist Man Year. This is 12 months work by a scientist having the rank of Assistant Professor or higher.

Support personnel includes Instructors, Research Associates, Graduate Research Assistants, secretaries, clerks, technicians and other classified personnel in the various Departments.

The source of funds expended in the College of Agriculture and Life Sciences can be grouped in three categories: State--55%, Federal (Hatch, RRF, M.S.)--18%, and Grants and Contracts--27%. Expenditures include funds from all sources for salaries and other operations within the Department. Administrative costs are prorated to commodities or resources on a proportional basis. Costs shown for administration include appropriate research expenses in the offices of the Dean of the College and the Research Division in addition to regular fixed costs and charges for use of facilities, utilities, etc.

Those portions of the Agricultural Experiment Station's program that are conducted in the Colleges of Architecture, Arts and Sciences and Home Economics are not included.

If additional information is desired on these programs and projects, please write Dr. James E. Martin, Dean, College of Agriculture and Life Sciences, Dr. Coyt T. Wilson, Director, Virginia Agricultural Experiment Station, or Dr. P. Howard Massey, Jr., Associate Director, Virginia Agricultural Experiment Station. Your comments and suggestions on programs described in the report will be appreciated.

SUMMARY

<u>Commodity or Resource</u>	<u>SMY 1973-74</u>	<u>Support Personnel 1973-74</u>	<u>Expenditures 1973-74</u>
Soil and Land	9.2	27.4	\$ 520,804
Water and Watersheds	1.9	4.6	113,346
Forestry and Forest Products	7.8	24.6	603,949
Wildlife and Fish	2.9	15.5	355,835
Deciduous Fruits	8.4	27.6	525,664
Vegetables and Potatoes	3.4	7.8	180,275
Ornamentals and Turf	2.9	18.1	332,806
Corn	5.5	13.0	252,473
Wheat and Other Small Grains	1.9	5.2	113,201
Pasture	1.5	4.0	89,104
Forage Crops	3.9	8.1	186,183
Soybeans	6.3	14.3	270,050
Peanuts	4.1	14.5	287,453
Tobacco	9.3	26.4	508,944
Beef Cattle	11.0	46.8	804,479
Dairy Cattle	8.4	25.0	628,698
Poultry	9.9	37.5	676,541
Swine	5.1	17.6	406,712
Sheep and Wool	1.9	10.0	158,199
Other Animals	0.9	2.7	92,979
People As Individuals	1.8	2.9	93,866
Food	4.2	10.1	229,467
Communities, Areas and Regions	4.2	11.0	213,256

<u>Commodity or Resource</u>	<u>SMY 1973-74</u>	<u>Support Personnel 1973-74</u>	<u>Expenditures 1973-74</u>
Research not Oriented to Any Commodity or Resource	21.2	62.8	\$1,687,616
	<hr/>	<hr/>	<hr/>
TOTAL	137.6	437.5	\$9,331,900

ACKNOWLEDGEMENT

The College of Agriculture and Life Sciences hereby acknowledges with sincere appreciation the significant financial support provided for the research programs described in this publication by the following agencies in the Commonwealth of Virginia:

Virginia Agricultural Foundation

The Andrew W. Mellon Foundation

Dairy Foundation of Virginia

Department of Welfare and Institutions

Division of State Planning

Peanut Growers Cooperative Marketing Association

Pittsylvania County Community Action

Soil Survey--Spottsylvania, Hanover, Greensville, Gloucester,
and Isle of Wight Counties, City of Virginia
Beach

Soil Interpretation--Chesterfield, Prince William, and Loudoun
Counties

State Department of Health

Virginia Agricultural Chemical Industries

Virginia Beef Cattle Association

Virginia Bright Flue-Cured Tobacco Commission

Virginia-Carolina Peanut Association

Virginia Commission of Game and Inland Fisheries

Virginia Crop Improvement Association

Virginia Dairymen Fund

Virginia Dark-Fired Tobacco Commission

Virginia Game Commission

Virginia Horse Council
Virginia Pork Commission
Virginia Processors Association
Virginia Seafood Industry
Virginia Sheep Federation
Virginia Soil and Water Conservation Commission
Virginia Soybean Commission
Virginia State Department of Highways
Virginia State Poultry Federation
Virginia Sweet Potato Commission
Virginia Turfgrass Association
Virginia Turkey Association

SOIL AND LAND

This research includes field surveys and mapping and laboratory analyses to determine the physical and chemical characteristics of soils. In addition, field, laboratory and greenhouse studies relating to soil factors important to nutrition of agronomic crops are underway. The results of these studies provide a basis for improving the efficiency of land use and management in the production of food and fiber and for recreation. The results also are used outside of the agricultural sector. County Health Departments use detailed soil information as a basis for approving the installation of septic tanks and waste disposal lagoons. Urban planners use this information as an aid in zoning for industrial, residential and business areas. Municipal and County Governments use this information as an aid in locating schools, hospitals and other public buildings.

Summary of 1973-74 Programs

	<u>SMY</u>	<u>Support Personnel</u>	<u>Expenditures</u>
Resource Description	5.1	21.1	\$ 339,267
Resource Development and Conservation	2.2	4.5	54,954
Pollution Control	1.9	1.8	62,970
Administration	-	-	63,613
	<hr/>	<hr/>	<hr/>
Total	9.2	27.4	\$ 520,804

Resource Description

2000360, SOIL SURVEY OF VARIOUS COUNTIES IN VIRGINIA (D. E. Pettry - Agronomy)

The objective of this cooperative project with the U.S. Department of Agriculture is to complete a detailed soil survey of Virginia including the identification, mapping and characterization of soils.

Future Plans: Acceleration of progressive soil surveys will be emphasized with a goal of completing the soil survey of Virginia by 1990. Current soil characterization studies will be intensified and directed at specific soil parameters intricately related to environmental health and land use.

	<u>1973-74</u>
SMY -----	3.9
Support Personnel -----	18.3
Total Expenditures -----	\$292,085

200053, THE MOVEMENT OF SOLUBLE CONSTITUENTS OF FERTILIZERS IN CERTAIN SOILS OF VIRGINIA (J. D. Pendleton - Agronomy)

Objectives of this study are to determine (1) the storage of available water in certain soils and the movement of water through these soils; (2) the degree and direction of movement of salts of nitrogen, potassium, and phosphorus in certain soil profiles; and (3) the role of fertilizers in the content in ground water of nitrate, potassium, and phosphate.

Future Plans: Extent of downward diffusion of salts has not been determined. Special instruments for monitoring amounts of water and direction of movement of water in the soil profile after surface application of fertilizers have been installed.

	<u>1973-74</u>
SMY -----	0.3
Support Personnel -----	
Total Expenditures -----	\$8,536

2003170, PHYSICAL MODELING OF VIRGINIA SOILS (D. F. Amos - Agronomy)

The purpose of this research is to determine the physical parameters (particle size distribution, consistence, swelling potential, compaction and moisture desorption characteristics) necessary to establish central concept and range of characteristics for the important soils of Virginia.

In the future, this information along with chemical information on the same soils will be used to make recommendations on the use of these soils.

	<u>1973-74</u>
SMY -----	0.9
Support Personnel -----	2.8
Total Expenditures -----	\$38,646

Resource Development and Conservation

2002860, ALUMUNUM IN SOIL OF ACID SUBSOILS AS AFFECTED BY CATION
ACTIVITIES AND SOIL MINERALOGY (C. I. Rich and J. A. Lutz -
Agronomy)

The objective of this study is to determine the effect of added
fertilizer on the release into the soil solution of toxic quantities
of aluminum from soils. We plan to conduct a field experiment to
determine the efficacy of Ca++ in overcoming aluminum toxicity.

	<u>1973-74</u>
SMY -----	0.7
Support Personnel -----	2.2
Total Expenditures -----	\$37,180

616168, METHODOLOGY FOR DETECTING AND ALLEVIATING MICRONUTRIENT PROBLEMS
WITH AGRONOMIC CROPS (David C. Martens - Agronomy)

Field investigations were conducted to develop procedures for
correction of boron deficiency of alfalfa and corn plants.

Future Plans: Field research will be undertaken to develop pro-
cedures for correction of copper deficiency of corn and wheat plants.
Treatments in these experiments will consist of various levels and
sources of copper.

	<u>1973-74</u>
SMY -----	0.3
Support Personnel -----	1.1
Total Expenditures -----	\$12,216

333694-2a, SOIL AND WATER MANAGEMENT SYSTEMS FOR REVEGETATION OF STRIP
MINE SPOIL AND SOLID WASTE DISPOSAL AREAS (J. N. Jones, Jr. -
ARS; D. E. Pettry - Agronomy)

Field studies are evaluating: (1) revegetation techniques and
cultural practices that will provide herbaceous vegetative cover for
stabilization, erosion control, alternate land use and economic utili-
zation, (2) soil amendments and maintenance fertilization, (3) plant
species and persistence, and (4) environmental protection from pollution.

Future Plans: Continue data collection and analyses from the

various field studies. Identify and characterize physical and chemical parameters of major solid waste sites and initiate techniques for safe disposal of leachate emissions.

	<u>1973-74</u>
SMY -----	
Support Personnel -----	0.6
Total Expenditures -----	\$2,779

333694-2b, IMPROVED PLANT VARIETIES FOR FORAGES (John D. Miller -
Agronomy)

Research on breeding and genetics of birdsfoot trefoil, crown-vetch and white clover is in progress. Seed of three synthetics of birdsfoot trefoil and two of crownvetch is being produced. Numerous clones of these three species are being evaluated.

Future Plans: After final evaluation of synthetics of birdsfoot trefoil and crownvetch, work will be concentrated on white clover and its interspecific hybrids.

	<u>1973-74</u>
SMY -----	
Support Personnel -----	0.6
Total Expenditures -----	\$2,779

Pollution Control

626210, ANIMAL WASTE TREATMENT AND RECYCLING SYSTEMS (J. P. Fontenot, E. T. Kornegay and K. E. Webb, Jr. - Animal Science)

Research includes processing methods for animal wastes to be fed, human and animal health aspects of feeding animal wastes, nutritive value of swine wastes when fed to swine, nutritional value of cattle wastes when fed to cattle, and methods of disposal of swine wastes without contaminating water supplies.

Future Plans: Continued efforts will be directed toward identifying any health hazards of recycling animal wastes by feeding and methods of preventing these, if any should be found. Also, studies on recycling by feeding within and between species will be conducted. Engineering methods will be developed to utilize and dispose of animal wastes with minimum environmental contamination.

	<u>1973-74</u>
SMY -----	0.4
Support Personnel -----	0.4
Total Expenditures -----	\$26,419

848418-1, SUITABILITY OF SOILS FOR SEPTIC TANKS (R. B. Reneau, Jr. and D. E. Pettry - Agronomy)

The objectives of this project are to study the in situ movement of biological and chemical pollutants from septic tank effluent through natural soil systems with fluctuating seasonal water tables and/or restricting layers.

Future Plans: To study the movement of biological and chemical pollutants from septic tank effluent as influenced by agricultural tile drainage systems in soils with fluctuating seasonal water tables; to establish parameters considering the role of soil physical, chemical, and morphological properties on the movement of biological and chemical contaminants through natural soil systems.

	<u>1973-74</u>
SMY -----	1.0
Support Personnel -----	0.7
Total Expenditures -----	\$23,280

626171, FERTILIZER AND ORGANIC WASTES APPLIED TO SOILS IN RELATION TO
ENVIRONMENTAL QUALITY (W. Kroontje and J. A. Lutz, Jr. -
Agronomy)

Aims of present investigation are to assess the effect of ammonium
nitrate fertilizer applications on the composition of the soil solution
especially in areas of nitrate accumulations. Comparisons are also
made between irrigated and non-irrigated conditions on two soil types.

Future Plans: To study the complexation of heavy metals in natural
systems.

	<u>1973-74</u>
SMY -----	0.5
Support Personnel -----	0.7
Total Expenditures -----	\$13,271

WATER AND WATERSHEDS

These resources are inseparable. Watersheds receive the rainfall and replenish the surface and ground water supplies. In order for these resources to be managed wisely and conserved for use in the future, they must first be inventoried and described. Various management practices must be evaluated on watersheds to determine their effects on runoff, erosion and pollution. The quantity and quality of the water reaching streams and impoundments are influenced by the practices applied on the watersheds.

Summary of 1973-74 Programs

	<u>SMY</u>	<u>Support Personnel</u>	<u>Expenditures</u>
Resource Development and Conservation	1.7	4.3	\$ 81,924
Pollution Control	0.2	0.3	17,613
Administration	-	-	13,809
	<hr/>	<hr/>	<hr/>
Total	1.9	4.6	\$ 113,346

Resource Development and Conservation

6260270, (Contributing to RRF S-53), FACTORS AFFECTING WATER YIELDS FROM SMALL WATERSHEDS AND SHALLOW GROUND AQUIFERS (V. O. Shanholtz and J. C. Carr - Agricultural Engineering)

The objective of this project is to correlate runoff rates and yields to watershed characteristics and climatic factors. This data will be used to develop analytical procedures and mathematical models to predict flow regimes from small agricultural watersheds. The data obtained are freely exchanged among the nine cooperating states with each state (or small group of states) providing leadership for a specified phase of the program. Virginia is providing leadership in the field evaluation of parametric simulation models as well as making major contributions to other phases of the project.

Future Plans: Plans have been formulated to bring Regional Project S-53 to an orderly and successful termination June 30, 1975. Final completion reports will be made available for review by cooperating states November 1974. Virginia will provide the leadership for developing the final report on parametric modeling of small agricultural watersheds.

	<u>1973-74</u>
SMY -----	1.7
Support Personnel -----	3.2
Total Expenditures -----	\$76,364

333694-2a, SOIL AND WATER MANAGEMENT SYSTEMS FOR REVEGETATION OF STRIP MINE SPOIL AND SOLID WASTE DISPOSAL AREAS (J. N. Jones, Jr. - ARS; D. E. Pettry - Agronomy)

Field studies are evaluating: (1) revegetation techniques and cultural practices that will provide herbaceous vegetative cover for stabilization, erosion control, alternate land use and economic utilization, (2) soil amendments and maintenance fertilization, (3) plant species and persistence, and (4) environmental protection from pollution.

Future Plans: Continue data collection and analyses from the various field studies. Identify and characterize physical and chemical parameters of major solid waste sites and initiate techniques for safe disposal of leachate emissions.

	<u>1973-74</u>
SMY -----	
Support Personnel -----	0.6
Total Expenditures -----	\$2,780

333694-2b, IMPROVED PLANT VARIETIES FOR FORAGES (John D. Miller -
Agronomy)

Research on breeding and genetics of birdsfoot trefoil, crown-
vetch and white clover is in progress. Seed of three synthetics of
birdsfoot trefoil and two of crownvetch is being produced. Numerous
clones of these three species are being evaluated.

Future Plans: After final evaluation of synthetics of birdsfoot
trefoil and crownvetch, work will be concentrated on white clover and
its interspecific hybrids.

	<u>1973-74</u>
SMY -----	
Support Personnel -----	0.5
Total Expenditures -----	\$2,780

Pollution Control

626210, ANIMAL WASTE TREATMENT AND RECYCLING SYSTEMS (J. P. Fontenot,
E. T. Kornegay and K. E. Webb, Jr. - Animal Science)

Research includes processing methods for animal wastes to be fed, human and animal health aspects of feeding animal wastes, nutritive value of swine wastes when fed to swine, nutritional value of cattle wastes when fed to cattle, and methods of disposal of swine wastes without contaminating water supplies.

Future Plans: Continued efforts will be directed toward identifying any health hazards of recycling animal wastes by feeding and methods of preventing these, if any should be found. Also, studies on recycling by feeding within and between species will be conducted. Engineering methods will be developed to utilize and dispose of animal wastes with minimum environmental contamination.

	<u>1973-74</u>
SMY -----	0.2
Support Personnel -----	0.3
Total Expenditures -----	\$17,613

FORESTRY AND FOREST PRODUCTS

Forests cover about 64 percent of Virginia's land area and is, in many respects, the biggest business in Virginia. The forest-based industry is: first in number of establishments; first in terms of persons employed; and second in terms of total payroll. Forests provide raw material for the wood-using industries, habitat for wildlife, protection for watersheds, and esthetic and recreational values for man. They reduce air pollution and noise levels. Research in forestry is broad including all factors involved in the development and use of the Commonwealth's renewable natural resources.

Summary of 1973-74 Programs

	<u>SMY</u>	<u>Support Personnel</u>	<u>Expenditures</u>
Resource Description and Inventory	0.5	2.5	\$ 42,702
Resource Development and Conservation	1.7	4.0	93,393
Insect Control	0.7	1.2	23,482
Disease Control	1.0	5.5	77,154
Basic Biology	1.1	1.9	42,177
Biological Efficiency	0.3	2.5	35,183
Chemical and Physical Properties	1.0	3.5	71,743
Evaluation of Alternative Uses	0.5	0.5	23,192
Management of Labor and Capital	0.5	1.5	53,124
Analysis of Supply, Demand and Price	0.5	1.5	67,999
Administration	-	-	73,800
Total	<u>7.8</u>	<u>24.6</u>	<u>\$ 603,949</u>

Resource Description and Inventory

636206, FOREST YIELDS AND STAND STRUCTURAL PATTERNS (H. E. Burkhardt -
Forestry and Forest Products)

Diameter and height distribution equations were computed for loblolly pine grown in planted stands. Yield estimates (on a per acre basis) were computed from the diameter and height predictions, and these yields were compared to those obtained from multiple regression equations. The results have been made available for general use and are being utilized for making forest management decisions in the Virginia area.

Future Plans: Yield prediction equations developed thus far have been for stands without intermediate cultural treatments such as thinning and fertilization. Future work will center on prediction systems for intensively cultured forest stands.

	<u>1973-74</u>
SMY -----	0.5
Support Personnel -----	2.5
Total Expenditures -----	\$42,702

Resource Development and Conservation

636134, DRY MATTER PRODUCTION MODELS OF FOREST STANDS (P. P. Feret,
H. A. I. Madgwick and D. W. Smith - Forestry and Forest Products)

The objectives of this project are to improve yield estimates for components of pine stands and provide inputs for growth models to predict yield under a variety of management regimes.

Work has been completed which quantified the distribution of above-ground dry matter production in twenty families of Pinus virginiana Mill. Presently underway are studies to quantify the distribution of N, P, K and Ca of the above-ground portion trees from ten families of Virginia pine.

	<u>1973-74</u>
SMY -----	1.2
Support Personnel -----	2.5
Total Expenditures -----	\$76,631

636219, SILVICULTURE IN STEEP DRY SITES IN THE APPALACHIAN MOUNTAINS
(D. W. Smith - Forestry and Forest Products)

The objectives of this research are to develop biological criteria from which to base silvicultural recommendations for dry sites that dominate on steep western and southern aspects in the Valley and Ridge geomorphic province of Virginia.

Future Plans: Plans are to continue soil physical property characterization and to commence work on tree nutrient studies.

	<u>1973-74</u>
SMY -----	0.5
Support Personnel -----	1.5
Total Expenditures -----	\$16,762

Insect Control

616143, THE BIOLOGY AND CONTROL OF THE MORE IMPORTANT SPECIES OF BARK BEETLES (SCOLYTIDAE) IN VIRGINIA (H. J. Heikkinen - Entomology and Forestry & Wildlife)

The objectives of this project are to correlate the biology, development, flight patterns and response to stimuli of the major species of bark beetles in Virginia with the physiology of the host trees and to develop techniques for preventing and detecting bark beetle outbreaks.

Future Plans: The project will be revised in 1975 to place more emphasis on the southern pine beetle which is currently a very serious pest of pines in the southeastern states.

	<u>1973-74</u>
SMY -----	0.7
Support Personnel -----	1.2
Total Expenditures -----	\$23,482

Disease Control

200277, PHYSIOLOGICAL PROCESSES AND CHEMICAL SUBSTANCES ASSOCIATED WITH THE CAUSE AND CONTROL OF DISEASES OF TREES (R. J. Stipes - Plant Pathology and Physiology)

The objectives of this project are to (1) study uptake, translocation, metabolic fate, persistence and therapeutic patterns of fungicides when applied to trees, (2) develop techniques for the extraction and identification of resistance factors from tissues of diseased-resistant landscape trees and (3) determine factors affecting the general physiology and toxin production by vascular wilt and other shade tree pathogens.

Future Plans: The project will be modified, when revised, to exclude objectives 2 and 3. New emphasis will be placed on soil factors and application techniques affecting movement and persistence of the fungi toxicant.

	<u>1973-74</u>
SMY -----	0.8
Support Personnel -----	2.6
Total Expenditures -----	\$41,793

200276, ROLE OF ROOT INHABITING INSECTS AND EDAPHIC FACTORS IN THE SPREAD OF FOMES ANNOSUS (J. M. Skelly - Plant Pathology and Physiology)

The objectives of this study are to determine the incidence and severity of disease in loblolly pine and to determine the associated growth losses on various soil types. Transmission of F. annosus by root and lower stem invading insects is also being investigated.

Future Plans: Transmission studies will be completed this year.

	<u>1973-74</u>
SMY -----	0.2
Support Personnel -----	2.9
Total Expenditures -----	\$35,361

Basic Biology

636174, CONTROL OF PROTEIN SYNTHESIS IN GERMINATING P. LAMBERTIANA
(R. E. Adams - Forestry and Forest Products)

Completed studies aimed at quantifying effects of stratification upon in vitro protein synthesis using components from sugar pine (Pinus lambertiana) seeds. Changes in the pH-5 fraction from embryos are clearly the cause of the large increase in amino acid incorporation observed during stratification. The embryo pH-5 fraction increased seven fold in capacity to support incorporation as stratification progressed up to 60 days. The gametophyte pH-5 fraction was never active. Translational control that varies with stratification appears to be present in the in vitro system from embryos.

Future Plans: Project was completed this year.

	<u>1973-74</u>
SMY -----	0.4
Support Personnel -----	1.5
Total Expenditures -----	\$20,819

616161, CONTROL OF DORMANCY OF PINUS LAMBERTIANA (Lewis B. Barnett - Biochemistry and Nutrition; Robert E. Adams - Forestry and Forest Products)

The objective of this research is to investigate the control mechanism for dormancy in the seeds of the sugar pine, Pinus lambertiana. Seeds will be stratified to break dormancy and then germinated. During these developmental stages of the seed, studies will be made on RNA synthesis, ribosomal characterization, and protein synthesizing capacity of the seed tissues.

	<u>1973-74</u>
SMY -----	0.7
Support Personnel -----	0.4
Total Expenditures -----	\$21,358

Biological Efficiency

636159, GENETIC EVALUATION OF AILANTHUS ALTISSIMA (MILL.) SWINGLE
(P. P. Feret - Forestry and Forest Products)

The tree of heaven is being studied as a possible suitable species for short-rotation fiber production on forest sites of low quality. Research elucidating the genecology of natural stands in the United States has been completed, as has a greenhouse study comparing genetic variability in select naturalized stands and Chinese stands. Research results indicate the genetic selection will have a significant impact on growth and yield of soon-to-be-established pilot study plots. Analysis of three-year old seed-source trials continues.

Future Plans: Establishment of several 1/4-acre trials to determine stand establishment methods and management techniques.

	<u>1973-74</u>
SMY -----	0.3
Support Personnel -----	2.5
Total Expenditures -----	\$35,183

Chemical and Physical Properties

636175, STRUCTURE AND PHYSICAL-MECHANICAL PROPERTIES OF EASTERN TREE
BARKS RELATED TO THEIR UTILIZATION (Geza Ifju - Forestry and
Forest Products)

Bark is the major, largely unused, residue generated by the forest products industry. Earlier studies under this project dealt with the compatibility of bark with industrial adhesives with specific emphasis on gluability of bark particles into board-type products. On the basis of the results, bark boards were made using urea-formaldehyde as binder and the optimum particle size and size distribution were determined to obtain boards of good physical and mechanical properties.

The results of the experiments were very encouraging. At present they are being prepared for publication. After publication of all results, the project will be considered completed and will be closed.

	<u>1973-74</u>
SMY -----	1.0
Support Personnel -----	3.5
Total Expenditures -----	\$71,743

Evaluation of Alternative Uses

636186, PSYCHOMETRIC EVALUATION OF EVEN-AGED FOREST MANAGEMENT (C.
M. Newton - Forestry and Forest Products)

Objectives of this project have been (1) to design and administer a semantic differential test in an attempt to determine if there is a difference in management and user group attitudes toward the principle, or theory, of even-aged forest management, as achieved by clearcutting; and (2) to provide sufficient substantive material and insight for further meaningful analysis of the even-aged management controversy and for extensions of this type of study to other practices in classical forest management.

Future Plans: This project will be terminated.

	<u>1973-74</u>
SMY -----	0.5
Support Personnel -----	0.5
Total Expenditures -----	\$23,192

Management of Labor and Capital

636183, ECONOMIC ASPECTS OF DECISIONS INVOLVING INTENSIVE FOREST
MANAGEMENT IN VIRGINIA (W. A. Leuschner and H. E. Burkhardt -
Forestry and Forest Products)

Testing has been completed on a model to aid in investment decisions
on the intensive management of loblolly pine in Virginia. Criteria for
decision are internal rate of return, present net worth and equivalent
annual income. A publication has been issued (FWS-4-73) describing
the model and explaining how a landowner may use the results.

Future Plans: This project will be terminated.

	<u>1973-74</u>
SMY -----	0.5
Support Personnel -----	1.5
Total Expenditures -----	\$53,124

Analysis of Supply, Demand and Price

636205, ECONOMETRIC STUDIES OF TIMBER PRODUCTS MARKETS IN THE SOUTHEAST
(W. A. Leuschner - Forestry and Forest Products)

Literature review completed and partial results presented in
Leuschner, W. A. and James E. Hotvedt, A survey of econometric models
of forest products markets, The Virginia Journal of Science, 25(2):50.
1974. Preliminary short-term market models have been specified and
regressions run.

Future Plans: Specify long-term market models. Test and finalize
model for Virginia. Test Virginia model by applying to data from other
southeastern states.

	<u>1973-74</u>
SMY -----	0.5
Support Personnel -----	1.5
Total Expenditures -----	\$67,999

WILDLIFE AND FISH

Fish and wildlife constitute one of Virginia's valuable resources and will become more important as the population increases and the demands for outdoor recreation increase. However, as the population increases, the problems of protecting and using this renewable natural resource become more complex. Our knowledge of fisheries and wildlife ecology and management is limited. Major problem areas include population dynamics, ecological and physiological requirements, disease and parasite control, reproduction and longevity, pollution effects and habitat improvement.

Summary of 1973-74 Programs

	<u>SMY</u>	<u>Support Personnel</u>	<u>Expenditures</u>
Resource Development and Conservation	2.0	11.0	\$ 242,380
Biological Efficiency	0.9	4.5	69,990
Administration	-	-	43,465
	<hr/>	<hr/>	<hr/>
Total	2.9	15.5	\$ 355,835

Resource Development and Conservation

636184-0, HABITAT MANIPULATION EFFECTS ON FOREST WILDLIFE PRODUCTION
AND HARVEST (H. S. Mosby - Fisheries and Wildlife Sciences)

The investigation of the energy flow through a gray squirrel population in an over-mature woodlot indicates that about 23% of the available food energy produced in this woodlot is metabolized. Food energy adequate to meet the requirements of the squirrel was available, even in a year of mast failure, except for a short period during the winter. Mast availability in this woodlot was measured for the third year of mast scarcity. A year-round supplemental food supply increased the reproduction attainment slightly for several gray squirrel populations but this increase in young produced was not of practical magnitude. The determination of available deer foods, including caloric determinations, in an uncut, 40-60 year old, oak hickory stand was made.

Future Plans: The small mammal populations in clear-cut, 7-year following clear-cut and uncut forest stands will be measured. Vegetative changes following clear-cutting will be determined. Measurements of mast availability will be continued.

	<u>1973-74</u>
SMY -----	0.4
Support Personnel -----	4.5
Total Expenditures -----	\$52,719

636153, A MODEL FOR IMPROVING ALLOCATIONS OF WILDLIFE MANAGEMENT
(Warren Flick - Forestry and Forest Products)

A thorough analysis of the model was completed and an application to the Michigan system was attempted. The analysis showed that more economic and social factors need to be included in the model to reliably predict the impact that marginal changes in wildlife programs have on man days of hunting.

Future Plans: This project will be terminated.

	<u>1973-74</u>
SMY -----	0.5
Support Personnel -----	0.5
Total Expenditures -----	\$25,563

616191, CATFISH FARMING AS SUPPLEMENTAL INCOME IN RURAL VIRGINIA: USE
OF CATFISH STRAINS TO INCREASE PRODUCTION (R. T. Lackey -
Fisheries and Wildlife Sciences)

Strains of catfish from Kansas, Mississippi and northern Virginia were cultured in two ponds during the summer. These ponds were harvested in October. The increase in feed costs from \$198 a ton to \$400 a ton coupled with the poor growth rate, probably because of low usable protein levels in the feed, indicated that cage culture of channel catfish is not feasible in Virginia under the current economic situation. The results have been analyzed and statistical comparisons among the strains regarding total weight gain, average weight, food conversion, survival and percent marketable fish have been made. Given the current economic constraints, free fishing ponds give a greater potential for supplemental income for rural Virginia farmers than cage catfish culture operations.

A final report has been submitted. The project has been completed.

	<u>1973-74</u>
SMY -----	0.8
Support Personnel -----	1.5
Total Expenditures -----	\$87,424

636136-0, SIMULATION OF FOREST GAME POPULATION DYNAMICS (R. H. Giles -
Fisheries and Wildlife Sciences)

Several manuscripts of past progress have been submitted to journals. Current progress is being made on a deer population natality or birth rate simulator. A first-phase model is complete and allows the relations of energy in seasonal forage to be studied interactively with ovulation, fertilization, implantation, terratogens and forest-environment stresses during deer pregnancy. The completion of this simulator will allow (a) an educational game to be developed for use in inservice education of forest-wildlife managers and wildlife students, and (b) a meaningful expansion of the simulator, DEER, completed last year by M. L. Walls. Both systems are united with the forest environment through energy in forage in the forest understory or in the young forest.

Future Plans: Plans for next year are to complete the natality simulator and unite it with DEER.

	<u>1973-74</u>
SMY -----	0.3
Support Personnel -----	4.5
Total Expenditures -----	\$76,674

Biological Efficiency

636201-0, ECOLOGICAL INFLUENCES ON HEALTH AND REPRODUCTION OF WILDLIFE
IN SOUTHERN FOREST HABITATS (R. L. Kirkpatrick and P. F.
Scanlon - Fisheries and Wildlife Sciences)

Considerable progress has been made in understanding the relationships between environmental factors and the reproductive success of forest game and non-game species. Host-parasite relationships in cottontail rabbit populations are being studied from the points of view of devising physiological monitoring procedures for heavy parasitic infections, of developing procedures for controlling ectoparasites on free ranging animals and of increasing huntable populations.

Future plans will involve (1) research on development of control procedures for nuisance species based on reproductive inhibition, (2) further evaluation of impacts of environmental contaminant and under-nutrition on reproduction efficiency of forest mammals, and (3) management implications of environmental influences on reproduction and of parasite-host interactions in game species.

	<u>1973-74</u>
SMY -----	0.9
Support Personnel -----	4.5
Total Expenditures -----	\$69,990

DECIDUOUS FRUITS

Virginia is an important fruit producing state. It ranks fourth or fifth in national apple production. In Virginia, apples provide about 80 percent of the total value of all fruits. Major problems of producers fall in the categories of protection from insects, diseases, weeds, pine mice, cultivar and rootstock selection and the high cost or unavailability of labor for harvesting and marketing. Major problems of processors, marketing firms and consumers are in the categories of pricing, storage and quality.

Summary of 1973-74 Programs

	<u>SMY</u>	<u>Support Personnel</u>	<u>Expenditures</u>
Insect Control	1.4	5.2	\$ 61,363
Disease Control	1.7	5.1	95,790
Weed Control	0.3	1.0	14,213
Mouse Control	0.2	0.5	22,769
Biological Efficiency	2.2	7.5	108,628
Improving Consumer Acceptability	0.5	3.9	56,229
Mechanized Harvesting	0.3	0.9	14,378
New and Improved Products	0.2	0.4	7,943
Maintaining Quality During Marketing	1.4	2.3	49,539
Marketing Efficiency	0.2	0.8	26,534
Administration	-	-	68,278
	<hr/>	<hr/>	<hr/>
Total	8.4	27.6	\$ 525,664

Insect Control

200220, BIOLOGICAL AGENTS IN CONTROL OF APPLE PESTS, AND IN TRANSMISSION
OF CERTAIN DISEASES (C. H. Hill - Entomology)

The objectives of this project are to search for naturally occurring pathogenic agents, predators, and parasites that influence population densities of phytophagous mites. An additional objective is to study arthropod vectors in the transmission of latent viruses in apple.

Future Plans: This project has been replaced by project #2003530 which involves studies of the leafroller, Platynota flavedana, and biological agents in control of insects and mites attacking tree fruits.

	<u>1973-74</u>
SMY -----	0.3
Support Personnel -----	1.4
Total Expenditures -----	\$9,090

616213, SEASONAL DEVELOPMENT AND MANAGEMENT OF INSECTS AND MITES
AFFECTING THE PRODUCTION OF STONE FRUITS (R. L. Horsburgh -
Entomology)

The objectives of this project are to monitor the seasonal development of insects and mites attacking stone fruits in the principal production areas of Virginia, and to test insecticides and acaricides on pest species. Special attention is being given to the use of parasites and predators in biological control, and in the development of pest management systems for stone fruit production.

Future Plans: This is a relatively new project with a new project leader; emphasis will be upon carefully developing insect and mite management systems, using all available factors for pest suppression.

	<u>1973-74</u>
SMY -----	0.4
Support Personnel -----	1.2
Total Expenditures -----	\$13,217

200353, CONTROL OF APPLE PESTS, AND THE LIFE HISTORY OF A LEAFROLLER,
PLATYNOTA FLAVEDANA (CLEM.) (C. H. Hill - Entomology)

The objectives of this project are to search for disease-causing

agents, parasites and predators that are capable of suppressing populations of leaf-feeding mites; and to study the life history, habits, and behavior of a leafroller that is currently a major pest in apple orchards.

Future Plans: This is a new project; emphasis will be placed on studies of the leafroller because of its current importance in tree fruit orchards.

	<u>1973-74</u>
SMY -----	
Support Personnel -----	
Total Expenditures -----	\$7,859

200331, PEST MANAGEMENT IN RELATION TO DECIDUOUS FRUIT TREES (C. H. Hill - Entomology)

The objectives of this project are to evaluate new insecticides and acaricides in management programs involving insect and mite pests attacking tree fruits, especially apples; to observe the effects on fruit and foliage of new materials, both alone and in combination with other pesticides; and to evaluate various application systems as to effectiveness, economy and contamination of non-target areas.

Future Plans: Emphasis will be upon evaluating new pesticides, monitoring standard ones for continued effectiveness, and in adapting these to suitable application systems.

	<u>1973-74</u>
SMY -----	0.7
Support Personnel -----	2.6
Total Expenditures -----	\$31,197

Disease Control

616026, EFFECT OF POME AND STONE FRUIT VIRUS DISEASES ON GROWTH, YIELD AND FRUIT QUALITY (K. D. Hickey - Plant Pathology and Physiology)

The objectives of this project are: 1) to determine the effect of latent viruses in apple trees grown on clonal rootstocks on growth, yield, fruit finish and susceptibility to collar and root infecting fungi; 2) to study possible spread of the prunus stem pitting virus in peach orchard.

Future Plans: Single- and multiple-virus mixtures will be inoculated into trees grown on Malling 106, 111 and 26 rootstocks. Annual growth and yield measurements will be made for several years. Virus infected trees inoculated with Phytophthora cactorum, the crown root organism, will be studied. Peach trees will be established in fumigated and unfumigated soil to study possible spread of the stem pitting virus by soil vectors.

	<u>1973-74</u>
SMY -----	0.5
Support Personnel -----	2.0
Total Expenditures -----	\$37,410

200287, ETIOLOGY AND CONTROL OF DISEASES OF TREE FRUITS (C. R. Drake and K. D. Hickey - Plant Pathology and Physiology)

The objectives of this project are to develop effective, safe, and economical fruit disease control programs and practices through the use of pesticides and integrated cultural practices. Determine the influence of the physical environment on the development of the collar and root rot of apples and design a satisfactory control program for these diseases.

Future Plans: This project has been revised 7/1/74 to meet the needs of a changing industry. Objectives will be made whenever necessary to provide Virginia fruit growers with the latest information on current disease problems.

	<u>1973-74</u>
SMY -----	0.7
Support Personnel -----	2.1
Total Expenditures -----	\$34,510

200275, PRINCIPLES OF DISEASE DEVELOPMENT IN TREE FRUIT (C. R. Drake -
Plant Pathology and Physiology)

The objectives of this project are to clarify the disease cycle of the peach scab fungus, Cladosporium carpophilum, on nectarines so that a more effective control program can be designed for this most desirable fruit. Further clarify the disease cycle and host-parasite relations of the apple rot fungi, Botryosphaeria ribis and Physalospora obtuse, so that integrated cultural practices can be worked into the control program.

Future Plans: The project will be revised, effective 1/1/75. The revised project will include the study of the etiology of the cause of Golden Delicious leaf blotch and the epiphytology of powdery mildew of peach. Both diseases have become a major economical concern to Virginia fruit growers.

	<u>1973-74</u>
SMY -----	0.5
Support Personnel -----	1.0
Total Expenditures -----	\$23,870

Weed Control

200129, CONTROL OF UNWANTED PLANT GROWTH IN CROPS, FORESTS, WATER AND RECREATIONAL AREAS (S. W. Bingham, C. L. Foy, W. E. Chappell and J. S. Coartney - Plant Pathology and Physiology)

The primary objective is to develop economical programs of weed control associated with Virginia crop production, water and recreational areas. Emphasis is directed toward lowering production cost, increasing yields, improving product quality and minimizing chemical residues in the environment.

Future Plans: The objectives of this project remain the same and are continual testing of new herbicides for all crop and non-crop areas and developing practical weed control information that is used as a basis for grower recommendations.

	<u>1973-74</u>
SMY -----	0.3
Support Personnel -----	1.0
Total Expenditures -----	\$14,213

Mouse Control

2001060, ORCHARD MOUSE CONTROL (Ross E. Byers - Horticulture)

The objectives of this project are to (1) evaluate Chlorophacinone Dithacinone, and other compounds for effectiveness as lethal agents of pine mice when applied in various ways and using various baiting techniques including encapsulation, (2) to determine if preferences exist for various rootstocks as a food source by the mice, (3) and to investigate alternate methods of chemical, cultural and biological control of this rodent in the orchards, (4) and to design a control procedure based on the caching instinct.

	<u>1973-74</u>
SMY -----	0.2
Support Personnel -----	0.5
Total Expenditures -----	\$22,769

Biological Efficiency

6161350, FRUIT VARIETY IMPROVEMENT (G. D. Oberle - Horticulture)

The objectives of this project have been primarily to develop new and improved varieties of fruits adapted to Virginia environment and needs and which may have value and adaptation in other areas of similar environmental conditions.

Future Plans: This project was terminated August 1974. Evaluation of existing plant material is to be completed under a new project.

	<u>1973-74</u>
SMY -----	1.0
Support Personnel -----	5.0
Total Expenditures -----	\$54,476

2002680, FACTORS AFFECTING THE GROWTH AND PHOTOSYNTHESIS OF APPLE TREES (J. A. Barden - Horticulture)

This project is designed to evaluate the influence of environmental factors, cultural practices, pesticides and growth regulators on the morphology and functioning of apple foliage and to relate these effects to growth and productivity.

Emphasis is being placed on the influence of light as a major factor in leaf development, morphology, net photosynthesis, respiration and growth. A study evaluating pesticide effects has been completed and the results will be published soon.

Future Plans: This project will be continued to further evaluate factors which are found to be of major consequence.

	<u>1973-74</u>
SMY -----	0.8
Support Personnel -----	1.5
Total Expenditures -----	\$36,992

200113, APPLE PRODUCTION AND HARVEST EFFICIENCY (George R. Williams, John A. Barden and Ross E. Byers - Horticulture)

Major emphasis in 1974 involved work with chemical thinning sprays to reduce the use of hard labor for this important task. The cultivars

used for this test were STARKRIMSON RED DELICIOUS and GOLDEN DELICIOUS. Several replicated treatments were made both with concentrate and dilute rates. Pesticides were also included to determine if they have any influence on the thinning action of NAA. If pesticides can be included with the thinning agents, this should eliminate one complete spray for the machines and labor cost, which should add up to considerable savings to the growers. Thinning materials used were NAA, Sevin and Tween-20.

These tests have been made for two years, and one more year will be needed before recommendations can be made to growers.

	<u>1973-74</u>
SMY -----	0.2
Support Personnel -----	0.5
Total Expenditures -----	\$7,538

2001120, STONE FRUIT PRODUCTION (Ross E. Byers - Horticulture)

The objectives of this project are to evaluate critically new cultural practices, mechanical aids, and chemicals used in the production of stone fruits with respect to their effect on yield, vigor, longevity of the tree, quality of the fruit produced, and overall efficiency of the operation. The growth and fruiting response of several varieties of stone fruit cultured on various rootstocks will be determined. Evaluation of advanced lines and newly released varieties will be continued.

	<u>1973-74</u>
SMY -----	0.2
Support Personnel -----	0.5
Total Expenditures -----	\$9,622

Improving Consumer Acceptability

616130, APPLE CONDITION AT HARVEST, IN STORAGE AND IN THE MARKET (G.
E. Mattus - Horticulture)

This project is being conducted to determine what treatment or handling practices reduce wastage and improve apple market life. Treatments are being made to reduce apple scale, breakdown, decay, and bitter pit in and after storage.

Future Plans: Three year project to be conducted until 1976.

	<u>1973-74</u>
SMY -----	0.5
Support Personnel -----	3.9
Total Expenditures -----	\$56,229

Mechanized Harvesting

200113, APPLE PRODUCTION AND HARVEST EFFICIENCY (George R. Williams,
John A. Barden and Ross E. Byers - Horticulture)

Major emphasis in 1974 involved work with chemical thinning sprays to reduce the use of hard labor for this important task. The cultivars used for this test were STARKRIMSON RED DELICIOUS and GOLDEN DELICIOUS. Several replicated treatments were made both with concentrate and dilute rates. Pesticides were also included to determine if they have any influence on the thinning action of NAA. If pesticides can be included with the thinning agents, this should eliminate one complete spray for the machines and labor cost, which should add up to considerable savings to the growers. Thinning materials used were NAA, Sevin and Tween-20.

These tests have been made for two years, and one more year will be needed before recommendations can be made to growers.

	<u>1973-74</u>
SMY -----	0.2
Support Personnel -----	0.7
Total Expenditures -----	\$11,308

200289, MACHINERY FOR CROPS MECHANIZATION (M. E. Wright - Agricultural Engineering)

The objective of this project is to develop new principles, procedures and machines related to crops and process mechanization that will reduce the labor requirements, increase production efficiency, and/or increase the quality of products of Virginia agriculture. One current objective is the development of new washers for leafy vegetables that will increase washing effectiveness and reduce water requirements. Another is the development of a system to harvest and crush sweet sorghum to provide juice for syrup production.

Future Plans: To incorporate water quality and waste treatment studies with the vegetable washing studies and demonstrate an improved system in a commercial food processing plant. To redesign the present sorghum harvesting facility to increase its reliability and productivity.

	<u>1973-74</u>
SMY -----	0.1
Support Personnel -----	0.2
Total Expenditures -----	\$3,070

New and Improved Products

6161480, EFFECT OF CONSISTENCY OF APPLESAUCE UPON ITS QUALITY AND SHELF-LIFE (Anthony Lopez and Charles B. Wood - Food Science and Technology)

The objectives of this project are concerned with the effects that variability in consistency and in degree and rate of serum separation have on quality and shelf-life of commercially canned applesauce.

Future Plans: Determination of the effect that processing conditions, particularly steam cooking, and calcium content of fruit have upon applesauce consistency and serum separation during storage under commercial conditions.

	<u>1973-74</u>
SMY -----	0.2
Support Personnel -----	0.4
Total Expenditures -----	\$6,504

2002740, QUALITY IMPROVEMENT OF PROCESSED FRUIT AND VEGETABLE PRODUCTS (F. W. Cooler - Food Science and Technology)

The objectives of this study are to determine the suitability and selection of new varieties of fruits and vegetables for processing and to determine the effect of postharvest changes on the physiological quality of processed products.

Future Plans: The processing characteristics of newly developed varieties of fruit and vegetable products will be determined as they are introduced. The effect of initial product quality of new and older varieties on finished processed product quality will be evaluated.

	<u>1973-74</u>
SMY -----	
Support Personnel -----	
Total Expenditures -----	\$1,439

Maintaining Quality During Marketing

6161480, EFFECT OF CONSISTENCY OF APPLESAUCE UPON ITS QUALITY AND SHELF-LIFE (Anthony Lopez and Charles B. Wood - Food Science and Technology)

The objectives of this project are concerned with the effects that variability in consistency and in degree and rate of serum separation have on quality and shelf-life of commercially canned applesauce.

Future Plans: Determination of the effect that processing conditions, particularly steam cooking, and calcium content of fruit have upon applesauce consistency and serum separation during storage under commercial conditions.

	<u>1973-74</u>
SMY -----	0.7
Support Personnel -----	1.4
Total Expenditures -----	\$26,017

626164-0, POSTHARVEST PHYSIOLOGY OF POMOLOGICAL FRUITS: HANDLING, STORAGE AND UTILIZATION IN THE MARKETING CHANNELS (G. E. Mattus - Horticulture)

The primary objectives being studied are the condition of apples in the marketing channels and minimum firmness levels needed for adequate shelf-life in marketed apples.

Future Plans: Regional project is scheduled for revision in 1975.

	<u>1973-74</u>
SMY -----	0.6
Support Personnel -----	0.7
Total Expenditures -----	\$20,163

2002740, QUALITY IMPROVEMENT OF PROCESSED FRUIT AND VEGETABLE PRODUCTS (F. W. Cooler - Food Science and Technology)

The objectives of this study are to determine the suitability and selection of new varieties of fruits and vegetables for processing and to determine the effect of postharvest changes on the physiological quality of processed products.

Future Plans: The processing characteristics of newly developed varieties of fruit and vegetable products will be determined as they are introduced. The effect of initial product quality of new and older varieties on finished processed product quality will be evaluated.

	<u>1973-74</u>
SMY -----	0.1
Support Personnel -----	0.2
Total Expenditures -----	\$3,359

Marketing Efficiency

6161560, COMPUTER TECHNIQUES IN OPTIMIZING UTILIZATION OF RECEIPTS IN
APPLE PROCESSING PLANTS (J. M. Johnson and Foo-Shiung Ho -
Agricultural Economics)

Computer programs for fully utilizing inspection information in deciding which loads should be utilized from day to day in the processing line have been developed and operating results have been determined with a full season's assumed receipts. These results compare favorably with operating results obtained from utilizing receipts at random as they arrived during the season with excess receipts stored and utilized on a last in-first out basis. The results of this study are being prepared for publication.

Further work should be done on replacing assumed technical coefficients with up-to-date research based coefficients.

	<u>1973-74</u>
SMY -----	0.2
Support Personnel -----	0.8
Total Expenditures -----	\$26,534

VEGETABLES AND POTATOES

The commercial vegetable industry in Virginia is concentrated in the Eastern Shore section. The research program of the Virginia Truck Experiment Station, a separate state agency, is oriented toward production problems. V.P.I. and State University's research program is primarily directed toward improving cultural methods, maintaining quality during marketing, increasing the efficiency of marketing, and varietal evaluation for both the processing industry and fresh market utilization.

Summary of 1973-74 Programs

	<u>SMY</u>	<u>Support Personnel</u>	<u>Expenditures</u>
Basic Biology	0.2	0.2	\$ 21,593
Biological Efficiency	0.9	1.4	29,795
Improving Consumer Acceptability	0.8	2.5	40,941
Mechanized Harvesting	0.5	1.8	25,197
New and Improved Products	0.9	1.8	37,318
Maintaining Quality During Marketing	0.1	0.1	3,359
Administration	-	-	22,072
Total	<u>3.4</u>	<u>7.8</u>	<u>\$ 180,275</u>

Basic Biology

200347-0, THE PHYSIOLOGY AND BIOCHEMISTRY OF THE TOMATO (LYCOPERSICON ESCULENTUM MILL.) (L. H. Aung - Horticulture)

The objectives of this project are to determine: (1) changes in the endogenous phytohormonal levels of seeds and in different component organs of tomato seedlings during early vegetative development and floral initiation; (2) the alteration in the content of these phytohormonal substances in relation to environmental stimuli; and (3) the physiological and biochemical differences between tall and dwarf tomatoes. The results will aid in the selection and breeding of varieties suited to different localities and for different needs.

Future Plans: Research will be directed to characterizing the nature of the bioactive chemicals regulating vegetative and reproductive growth.

1973-74

SMY -----	
Support Personnel -----	
Total Expenditures -----	\$14,683

200262, CONTROL OF AMINO ACID METABOLISM AS RELATED TO CELLULAR COMPARTMENTATION (John L. Hess - Biochemistry and Nutrition)

We attempt to evaluate the importance of cellular compartmentation to amino acid and protein synthesis in higher plants. Glutamate oxalacetate aminotransferase functions in relating cytoplasmic and organelle pools of carbon metabolism and reducing power in C₃ and C₄ plants. Having completed purification and aspects of protein characterization on forms of this enzyme from oat seedlings, we plan to evaluate cellular location more completely. These studies should improve our understanding of how metabolism of amino acids and proteins is controlled in plant cells.

1973-74

SMY -----	0.2
Support Personnel -----	0.2
Total Expenditures -----	\$6,910

Biological Efficiency

2002660, VEGETATION AND REPRODUCTION IN THE TOMATO (LYCOPERSICON
ESCULENTUM MILL.) (L. H. Aung - Horticulture)

The objectives of this project are to determine the influence and role of some environmental and chemical stimuli on vegetative growth, flowering and fruiting of tomatoes. The environmental factors include the effects of long and short days and the effects of low and high temperatures. The chemical factors are the effects of gibberellins on tomato dwarfs, abscisic acid and steriod inhibitors on tall and dwarf tomatoes.

Future Plans: This project has been terminated.

	<u>1973-74</u>
SMY -----	0.7
Support Personnel -----	1.4
Total Expenditures -----	\$26,454

616149-0, NICOTINE SYNTHESIS--A MECHANISM FOR AMMONIUM TOLERANCE IN
SOLANACEAE (H. E. Hohlt - Horticulture)

The objectives of this project are: (1) to elucidate a specific causal agent for an ammonium induced stem lesion in tomato, (2) to explain the natural tolerance of other cultivars in the solanaceae family to this stem lesion because their ability to utilize the causal agent in nicotine synthesis thereby preventing its accumulation.

Future Plans: The project has been terminated and the analyses are being completed on the final crop.

	<u>1973-74</u>
SMY -----	0.2
Support Personnel -----	
Total Expenditures -----	\$3,341

Improving Consumer Acceptability

6161510, PREHARVEST CONDITIONING AND HARVEST HANDLING OF ROOT AND
TUBER CROPS (M. E. Austin - Horticulture)

The objectives of this project are to (1) conduct preharvest treatments for reducing incidence of potato skinning during harvest, and to improve the marketing grades of early harvested potatoes; (2) determine the effects of soil environment, such as temperature and moisture, on sweet potato skin development to improve market and storage quality; and (3) evaluate modified sweet potato size-grader constructed on a proto-type harvester for fresh market sweet potatoes.

Future Plans: This project was terminated in August 1974.

	<u>1973-74</u>
SMY -----	0.8
Support Personnel -----	2.5
Total Expenditures -----	\$40,941

Mechanized Harvesting

200228, GREENHOUSE AND FIELD USE OF PLASTICS IN HORTICULTURAL CROP PRODUCTION (M. Marshall - Agricultural Engineering)

The objectives of this project were: Development of new designs and refinements for plastic greenhouse growing facilities; study of plant growth rates, responses, and yields when (a) grown under glass and compared to like specimens grown under selected plastic greenhouse coverings, (b) grown as field crops under modified micro climatic conditions as obtained by mulching with plastic films; and study the use of plastic films for plant-bed and row-crop covers as a protective means from early spring cold weather conditions.

Future Plans: This project was terminated August 31, 1973.

1973-74

SMY -----	
Support Personnel -----	
Total Expenditures -----	\$643

200289, MACHINERY FOR CROPS MECHANIZATION (M. E. Wright - Agricultural Engineering)

The objective of this project is to develop new principles, procedures and machines related to crops and process mechanization that will reduce the labor requirements, increase production efficiency, and/or increase the quality of products of Virginia agriculture. One current objective is the development of new washers for leafy vegetables that will increase washing effectiveness and reduce water requirements. Another is the development of a system to harvest and crush sweet sorghum to provide juice for syrup production.

Future Plans: To incorporate water quality and waste treatment studies with the vegetable washing studies and demonstrate an improved system in a commercial food processing plant. To redesign the present sorghum harvesting facility to increase its reliability and productivity.

1973-74

SMY -----	0.4
Support Personnel -----	1.8
Total Expenditures -----	\$24,554

New and Improved Products

6161380, FACTORS AFFECTING QUALITY AND SHELF-LIFE OF PRE-COOKED, DEHYDRATED SWEET POTATO FLAKE PRODUCTS (A. Lopez, C. B. Wood and E. N. Boyd - Food Science and Technology)

The objectives of this project are concerned with the development of information on factors that affect product quality, shelf-life, and certain nutritions, as well as to find product packaging requirements.

Future Plans: The chemical nature of degradation products formed during processing and storage will be investigated in an attempt to explain and inhibit the formation of off-flavors and odors that have been found to develop.

	<u>1973-74</u>
SMY -----	0.9
Support Personnel -----	1.8
Total Expenditures -----	\$35,879

2002740, QUALITY IMPROVEMENT OF PROCESSED FRUIT AND VEGETABLE PRODUCTS (F. W. Cooler - Food Science and Technology)

The objectives of this study are to determine the suitability and selection of new varieties of fruits and vegetables for processing and to determine the effect of postharvest changes on the physiological quality of processed products.

Future Plans: The processing characteristics of newly developed varieties of fruit and vegetable products will be determined as they are introduced. The effect of initial product quality of new and older varieties on finished processed product quality will be evaluated.

	<u>1973-74</u>
SMY -----	
Support Personnel -----	
Total Expenditures -----	\$1,439

Maintaining Quality During Marketing

2002740, QUALITY IMPROVEMENT OF PROCESSED FRUIT AND VEGETABLE PRODUCTS
(F. W. Cooler - Food Science and Technology)

The objectives of this study are to determine the suitability and selection of new varieties of fruits and vegetables for processing and to determine the effect of postharvest changes on the physiological quality of processed products.

Future Plans: The processing characteristics of newly developed varieties of fruit and vegetable products will be determined as they are introduced. The effect of initial product quality of new and older varieties on finished processed product quality will be evaluated.

	<u>1973-74</u>
SMY -----	0.1
Support Personnel -----	0.1
Total Expenditures -----	\$3,359

ORNAMENTALS AND TURF

Turf has developed into a large industry in Virginia. Turf is a very broad program involving species adaptation, cultural management practices, fertilization and liming, water control, thatch accumulation, reconstituting soils, and other management interrelationships that will minimize problems with insects, diseases, and weeds in diverse micro-climates in Virginia. The importance of turf is expected to increase due to suburbanization and emphasis on recreation and beautification.

Nursery crop production is one of the fastest growing segments of agriculture. With a nationwide increase in demand for nursery stock, much of the research is oriented toward solving production problems. Labor shortage and cost has influenced the industry towards container production with the attendant problems of optimum fertilization, media composition, porosity, and water holding characteristics, winter hardiness and the determination of cultural methods which will shorten the time required to produce saleable plants. Much in the nature of basic information is still needed by the nursery industry to take full advantage of changing technology in this period of rapid expansion.

Summary of 1973-74 Programs

	<u>SMY</u>	<u>Support Personnel</u>	<u>Expenditures</u>
Disease Control	0.3	3.5	\$ 61,301
Weed Control	0.1	0.5	7,106
Basic Biology	-	5.8	94,580
Biological Efficiency	2.4	8.3	122,923
Efficiency Marketing	0.1	-	3,131

	<u>SMY</u>	<u>Support Personnel</u>	<u>Expenditures</u>
Analysis of Supply, Demand and Price	-	-	\$ 3,130
Administration	-	-	40,635
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Total	2.9	18.1	\$ 332,806

Disease Control

200130, NATURE AND CONTROL OF DISEASES OF HERBACEOUS AND WOODY ORNAMENTAL PLANTS, SHADE TREES AND TURFGRASSES (G. J. Griffin, R. C. Lambe and R. J. Stipes - Plant Pathology and Physiology)

The objectives of this project are to identify the causes of important diseases of ornamental plants, shade trees and turfgrasses in Virginia and develop programs for their control.

Future Plans: The turfgrass segment of the project will be deleted and developed as a separate project. Major emphasis will be placed on the cause and control of landscape tree diseases.

	<u>1973-74</u>
SMY -----	0.3
Support Personnel -----	3.5
Total Expenditures -----	\$61,301

Weed Control

200129, CONTROL OF UNWANTED PLANT GROWTH IN CROPS, FORESTS, WATER AND RECREATIONAL AREAS (S. W. Bingham, C. L. Foy, W. E. Chappell and J. S. Coartney - Plant Pathology and Physiology)

The primary objective is to develop economical programs of weed control associated with Virginia crop production, water and recreational areas. Emphasis is directed toward lowering production cost, increasing yields, improving product quality and minimizing chemical residues in the environment.

Future Plans: The objectives of this project remain the same and are continual testing of new herbicides for all crop and non-crop areas and developing practical weed control information that is used as a basis for grower recommendations.

	<u>1973-74</u>
SMY -----	0.1
Support Personnel -----	0.5
Total Expenditures -----	\$7,106

Basic Biology

848666-1, STABILIZING DISTURBED AREAS DURING HIGHWAY CONSTRUCTION FOR POLLUTION CONTROL (D. L. Wright, J. T. Green, Jr. and R. E. Blaser - Agronomy)

The major objectives are to obtain vegetative cover to avoid siltation and pollution of ditches, streams, and drainage ways by soil and rocky materials from newly disturbed areas in highway construction corridors.

Experiments are under way to stabilize seed and fertilizer and bare soils with mulches and chemical binders. A handbook to facilitate the implementation of the research is being prepared.

1973-74

SMY -----	
Support Personnel -----	2.9
Total Expenditures -----	\$43,470

818514-1, PRODUCING VEGETATION ON STEEP SLOPES CONCURRENT WITH AND SUBSEQUENT TO HIGHWAY CONSTRUCTION (H. D. Perry and R. E. Blaser - Agronomy)

Major objectives are: (1) To find the best mulches and rates of application in combination with chemical binding agents to stabilize soil materials during spring, summer, and autumn seasons of seeding while species become established, (2) To improve grading methods on cut slopes, where stairstep grading is compared with smooth bench grading; on fill slopes rocks and materials are left in place in a loose, natural falling condition without smoothing, leveling, or packing with equipment and tractors; for comparison, other parts of fill slopes are to be tracked with tractors for smoothing and compacting of surfaces.

Future Plans: On slopes with degenerating vegetation, because of low organic matter and low soil nitrogen, investigations are under way to improve plant cover for obtaining perennial persistent leguminous vegetation. Laboratory procedures are to obtain reliable comparable data of various organic mulches and chemical stabilizing agents.

1973-74

SMY -----	
Support Personnel -----	2.9
Total Expenditures -----	\$51,110

Biological Efficiency

200326-0, INCREASING CROP PRODUCTION THROUGH ENVIRONMENTAL CONTROL
(R. S. Lindstrom - Horticulture)

The objectives of this study are: (1) to determine threshold optimum and excess levels of carbon dioxide on glasshouse crops in relation to various light intensities and temperature; (2) to evaluate several growth regulators in relation to chemical pinching and height control on various glasshouse crops and (3) to investigate research problems presented by the commercial flower growers in Virginia.

Future Plans: Research is planned to study the influence of selected surfactants on uptake of growth regulators.

	<u>1973-74</u>
SMY -----	0.4
Support Personnel -----	1.7
Total Expenditures -----	\$27,766

6261120, BREEDING AND EVALUATION OF KY BLUEGRASS FOR TURF (R. E. Schmidt - Agronomy)

Various techniques were used to evaluate more than 65 Ky blue-grasses for heat tolerance, rhizome development, thatch accumulation, and rooting potential in full sun and under shade.

Future Plans: Continued emphasis will be placed on studying blue-grasses for heat, drought, and shade tolerance in order to develop Ky bluegrasses for better turf usage under the conditions of Virginia.

	<u>1973-74</u>
SMY -----	0.2
Support Personnel -----	0.3
Total Expenditures -----	\$9,517

616180, IMPROVING GENETIC POTENTIAL OF PERENNIAL GRASSES FOR TURF
AND FORAGE USE (L. H. Taylor and R. E. Schmidt - Agronomy)

This project investigates methods and potential of improving Kentucky bluegrass for turf and orchardgrass for forage use.

Future Plans: Collections of Kentucky bluegrass ecotypes will

be continued and promising hybrids from the crossing program will be evaluated. Orchardgrass F₁ hybrids will be grown in forage performance trials.

	<u>1973-74</u>
SMY -----	0.4
Support Personnel -----	0.6
Total Expenditures -----	\$12,362

6161500, ECOLOGICAL FACTORS IN TURF MANAGEMENT (R. E. Schmidt - Agronomy)

Both warm and cool season turfgrasses are being evaluated in different ecological areas in the state. Emphasis is being placed on mixture performance of Ky bluegrass and the newly improved perennial ryegrasses. These ryegrasses when overseeded on bermudagrasses have also been found to provide superior winter turf.

Future Plans: Studies dealing with the interactions of climate, edaphic, biotic, management, and usage factors on various types of turf will be continued. Knowledge from this research will be used to improve turf areas in Virginia.

	<u>1973-74</u>
SMY -----	0.7
Support Personnel -----	3.6
Total Expenditures -----	\$48,131

200278-0, MINERAL NUTRIENT REQUIREMENTS OF FLORICULTURAL PLANTS (R. S. Lindstrom - Horticulture)

The objectives of this study are: (1) to determine by foliar analysis the threshold, optimal and excess values of macro- and micro-elements for floricultural crops and (2) to investigate the antagonistic effects of some micro-elements in relation to plant growth.

Future Plans: The findings on nutritional needs will be translated into recommendations for the floricultural industry.

	<u>1973-74</u>
SMY -----	0.7
Support Personnel -----	2.1
Total Expenditures -----	\$25,147

Efficient Marketing

6261570, FACTORS AFFECTING UTILIZATION AND EXPANSION POTENTIAL FOR
ORNAMENTAL PLANTS AND TURF (Robert Wright - Horticulture)

The objectives of this regional research project are to (1) describe and quantify characteristics of major final consumer of ornamental plants and turf and the use of these plants for environmental improvement; (2) analyze regulations and requirements of states, municipalities, other governmental agencies and financial institutions for landscaping; (3) develop projections of future ornamental plant usage and recommend changes in current production, marketing and merchandising procedures. The purpose of the research is to obtain statistical information on both the demand for and supply available of turf and ornamentals in the southeast.

Future Plans: This project has been extended until June 1975.

	<u>1973-74</u>
SMY -----	0.1
Support Personnel -----	
Total Expenditures -----	\$3,131

Analysis of Supply, Demand and Price

6261570, FACTORS AFFECTING UTILIZATION AND EXPANSION POTENTIAL FOR
ORNAMENTAL PLANTS AND TURF (Robert Wright - Horticulture)

The objectives of this regional research project are to (1) describe and quantify characteristics of major final consumer of ornamental plants and turf and the use of these plants for environmental improvement; (2) analyze regulations and requirements of states, municipalities, other governmental agencies and financial institutions for landscaping; (3) develop projections of future ornamental plant usage and recommend changes in current production, marketing and merchandising procedures. The purpose of the research is to obtain statistical information on both the demand for and supply available of turf and ornamentals in the southeast.

Future Plans: This project has been extended until June 1975.

1973-74

SMY -----

Support Personnel -----

Total Expenditures ----- \$3,130

CORN

Corn is grown on more acres than any other crop cultivated in Virginia, and it is grown in every area of the state. The use of corn silage is increasing as farmers try to obtain maximum utilization of their resources. Yields have been increased dramatically through research but along with the progress have come new problems -- diseases, insects, weeds and inadequate fertility and management practices for specific hybrids under Virginia growing conditions. Mechanized harvesting creates problems of maintaining quality and reducing harvest losses. The need for grain with higher nutritive value is even greater than ever.

Summary of 1973-74 Programs

	<u>SMY</u>	<u>Support Personnel</u>	<u>Expenditures</u>
Disease Control	0.5	0.6	\$ 15,842
Basic Biology	1.0	2.0	47,741
Biological Efficiency	2.1	6.4	90,196
Mechanization and Labor Efficiency	1.8	3.8	63,613
Management to Maximize Income	0.1	0.2	4,180
Administration	-	-	30,901
Total	<u>5.5</u>	<u>13.0</u>	<u>\$ 252,473</u>

Disease Control

616058, GENETICS OF HOST-PARASITE INTERACTIONS AND CONTROL OF CEREAL AND SOYBEAN DISEASES (C. W. Roane - Plant Pathology and Physiology)

The objectives of this project are to study the genetics of host reaction to pathogens causing diseases of cereals and soybeans and to apply genetic principles to the control of such diseases. Other avenues of control are also subject to investigation.

Current corn investigations pertain to seeking and utilizing resistance to maize dwarf mosaic virus and the gray leaf spot fungus. The genetics of maize dwarf mosaic resistance is being studied in F₂ and F₃ populations.

With small grains, the principle activity is cooperation with a plant breeder to develop small grains with multiple disease resistance. Genetic studies of barley leaf rust and scald resistance are also under way.

Future Plans: We will continue programs described above and seek ways to control *Cylindrocladium* root rot and brown stem rot of soybeans. There will be a genetic study of resistance to soybean mosaic virus.

	<u>1973-74</u>
SMY -----	0.2
Support Personnel -----	0.2
Total Expenditures -----	\$7,565

616065, IDENTIFICATION--INFECTING CERTAIN CROPS (Sue A. Tolin - Plant Pathology and Physiology)

Viruses infecting field crops in Virginia, primarily corn, soybean, peanut and tobacco, are isolated and identified. Diagnosis are based on host reactions, physico-chemical properties, serological relationships and virion morphology as determined by electron microscopy. Similarities and differences between related viruses and strains, and the reaction of these viruses with various genotypes of recommended varieties and breeding lines are determined.

Future Plans: The project will be revised during the coming year, but the major areas of research will continue unchanged. More emphasis is to be placed on interaction of viruses with different hosts, and on the genetic basis for variability of viruses.

	<u>1973-74</u>
SMY -----	0.3
Support Personnel -----	0.4
Total Expenditures -----	\$8,277

Basic Biology

616181, METHODS OF BREEDING TO DEVELOP PRODUCTIVE INBRED AND HYBRID
POPULATIONS OF MAIZE (C. F. Genter - Agronomy)

Selective inbreeding methods are used to increase the frequencies of desirable genes of maize as inbreeding progresses. Improvement is sought in population grain yield, disease resistance, standability, and other desirable traits and the ability to transmit these traits to hybrids. The genetics of inbreeding and crossbreeding responses are being investigated.

Future Plans: Evaluation of inbred lines and advanced populations will be continued. Populations derived from productive first-generation inbred lines will be slowly inbred to attempt to retain or increase their vigor and yield. Methods of inbreeding will be compared for effectiveness in population improvement.

	<u>1973-74</u>
SMY -----	1.0
Support Personnel -----	2.0
Total Expenditures -----	\$47,741

Biological Efficiency

200054, SOIL PLANT NUTRIENT RELATIONSHIPS AS AFFECTED BY APPLIED NUTRIENTS, CROPPING AND IRRIGATION (J. A. Lutz, Jr., G. D. Jones and Wybe Kroontje - Agronomy)

The objectives of this project are to evaluate the effects of liming, fertilization, and irrigation on crop yields and quality, on certain soil properties, to investigate the ability of numerous varieties of several crops to tolerate high acidity (Al toxicity) in soils and to determine the amounts of sulfur in the atmosphere and in the precipitation in Virginia.

Future Plans: This project will be continued with increased emphasis being placed on the effects of irrigation, rates and placement of lime, fertilizer, and micronutrients on soybean seed quality and yield and on certain chemical and physical properties of the soil.

	<u>1973-74</u>
SMY -----	1.4
Support Personnel -----	4.1
Total Expenditures -----	\$61,634

616168, METHODOLOGY FOR DETECTING AND ALLEVIATING MICRONUTRIENT PROBLEMS WITH AGRONOMIC CROPS (David C. Martens - Agronomy)

Field investigations were conducted to develop procedures for correction of boron deficiency of alfalfa and corn plants.

Future Plans: Field research will be undertaken to develop procedures for correction of copper deficiency of corn and wheat plants. Treatments in these experiments will consist of various levels and sources of copper.

	<u>1973-74</u>
SMY -----	0.6
Support Personnel -----	2.1
Total Expenditures -----	\$24,431

2002860, ALUMUNUM IN SOIL OF ACID SUBSOILS AS AFFECTED BY CATION
ACTIVITIES AND SOIL MINERALOGY (C. I. Rich and J. A. Lutz -
Agronomy)

The objective of this study is to determine the effect of added
fertilizer on the release into the soil solution of toxic quantities
of aluminum from soils. We plan to conduct a field experiment to
determine the efficacy of Ca^{++} in overcoming aluminum toxicity.

	<u>1973-74</u>
SMY -----	0.1
Support Personnel -----	0.2
Total Expenditures -----	\$4,131

Mechanization and Labor Efficiency

616204, IMPROVING NO-TILLAGE CULTURAL METHODS IN VIRGINIA FOR CORN, SOYBEANS AND TOBACCO (W. W. Moschler - Agronomy; R. W. Young - Biochemistry and Nutrition)

The research seeks to increase field crop yields, fertilizer and lime efficiency and improve the physical properties of the soil through no-tillage culture.

Future Plans: The objectives enumerated above have been largely reached with corn, partially with soybeans, and tobacco shows some promise. The use of slow-release nitrogen fertilizers, better methods of seeding cover crops, better crop varieties for no-tillage culture, and improved herbicides and insecticides would seem to be the most promising areas of research.

	<u>1973-74</u>
SMY -----	1.4
Support Personnel -----	3.0
Total Expenditures -----	\$45,394

2003290, NO TILLAGE PLANTING MACHINERY REQUIREMENTS FOR CORN AND SOYBEANS (J. H. Lillard and E. S. Smith - Agricultural Engineering)

This research focused on the evaluation of a wide array of row openers and assist tools for no tillage planting of corn and soybeans. These findings provide the basis for recommendations to growers regarding the machinery alternatives available for their use in the no tillage production of these crops; with special emphasis on the planting problems associated with double cropping soybeans after small grain.

Future Plans: This project was completed in fiscal year 1973-74.

	<u>1973-74</u>
SMY -----	0.4
Support Personnel -----	0.8
Total Expenditures -----	\$18,219

Management to Maximize Income

6162210, ALTERNATIVE MARKETING AND HEDGING STRATEGIES FOR VIRGINIA
GRAIN AND LIVESTOCK PRODUCERS (David Kenyon - Agricultural
Economics)

In this project the economic potential of alternative marketing strategies using the futures market for grain and livestock producers and handlers in Virginia will be evaluated. The project will involve developing a data bank on prices and basis to be placed on the Computerized Management Network (CMN), price prediction equations, evaluation of alternative hedging strategies, and presentation of workshops on how to effectively use the futures market as a marketing tool.

Future Plans: Present workshops on futures trading and continue analysis on alternative hedging strategies.

	<u>1973-74</u>
SMY -----	0.1
Support Personnel -----	0.2
Total Expenditures -----	\$4,180

WHEAT AND OTHER SMALL GRAINS

These crops are an important segment of the cropping system in the areas where they are grown, particularly as minimum tillage practices expand. Research is necessary to determine the varieties best adapted to Virginia conditions, methods of controlling diseases and insects, biologically and chemically, and the fertilizer and other production practices.

Summary of 1973-74 Programs

	<u>SMY</u>	<u>Support Personnel</u>	<u>Expenditures</u>
Disease Control	0.8	2.1	\$ 41,264
Basic Biology	0.1	0.1	3,455
Biological Efficiency	1.0	3.0	54,623
Administration	-	-	13,809
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Total	1.9	5.2	\$ 113,201

Disease Control

616086, BREEDING AND GENETICS OF BARLEY AND WHEAT (T. M. Starling and H. M. Camper, Jr. - Agronomy; C. W. Roane - Plant Pathology and Physiology)

The objectives of this project are the development of superior disease-resistant varieties for use in Virginia and other Mid-Atlantic states, the investigation of the genetics of disease resistance, and the evaluation of genotype-environment interactions.

Future Plans: Short straw and improved standing ability in barley and improved grain quality in semi-dwarf types of wheat will be areas of emphasis in breeding, along with resistance to the major diseases of each crop. Characteristics needed in barley and wheat varieties for efficient doublecropping with soybeans will be investigated. Studies on the genetics of disease resistance in barley will be continued.

	<u>1973-74</u>
SMY -----	0.6
Support Personnel -----	1.9
Total Expenditures -----	\$33,700

616058, GENETICS OF HOST-PARASITE INTERACTIONS AND CONTROL OF CEREAL AND SOYBEAN DISEASES (C. W. Roane - Plant Pathology and Physiology)

The objectives of this project are to study the genetics of host reaction to pathogens causing diseases of cereals and soybeans and to apply genetic principles to the control of such diseases. Other avenues of control are also subject to investigation.

Current corn investigations pertain to seeking and utilizing resistance to maize dwarf mosaic virus and the gray leaf spot fungus. The genetics of maize dwarf mosaic resistance is being studied in F₂ and F₃ populations.

With small grains, the principle activity is cooperation with a plant breeder to develop small grains with multiple disease resistance. Genetic studies of barley leaf rust and scald resistance are also under way.

Future Plans: We will continue programs described above and seek ways to control *Cylindrocladium* root rot and brown stem rot of soybeans. There will be a genetic study of resistance to soybean mosaic virus.

	<u>1973-74</u>
SMY -----	0.2
Support Personnel -----	0.2
Total Expenditures -----	\$7,564

Basic Biology

200262, CONTROL OF AMINO ACID METABOLISM AS RELATED TO CELLULAR COMPARTMENTATION (John L. Hess - Biochemistry and Nutrition)

We attempt to evaluate the importance of cellular compartmentation to amino acid and protein synthesis in higher plants. Glutamate oxalacetate aminotransferase functions in relating cytoplasmic and organelle pools of carbon metabolism and reducing power in C_3 and C_4 plants. Having completed purification and aspects of protein characterization on forms of this enzyme from oat seedlings, we plan to evaluate cellular location more completely. These studies should improve our understanding of how metabolism of amino acids and proteins is controlled in plant cells.

	<u>1973-74</u>
SMY -----	0.1
Support Personnel -----	0.1
Total Expenditures -----	\$3,455

Biological Efficiency

616086, BREEDING AND GENETICS OF BARLEY AND WHEAT (T. M. Starling and H. M. Camper, Jr. - Agronomy; C. W. Roane - Plant Pathology and Physiology)

The objectives of this project are the development of superior disease-resistant varieties for use in Virginia and other Mid-Atlantic states, the investigation of the genetics of disease resistance, and the evaluation of genotype-environment interactions.

Future Plans: Short straw and improved standing ability in barley and improved grain quality in semi-dwarf types of wheat will be areas of emphasis in breeding, along with resistance to the major diseases of each crop. Characteristics needed in barley and wheat varieties for efficient doublecropping with soybeans will be investigated. Studies on the genetics of disease resistance in barley will be continued.

	<u>1973-74</u>
SMY -----	0.9
Support Personnel -----	2.8
Total Expenditures -----	\$50,550

616178, SOIL-PLANT NUTRIENT RELATIONSHIPS IN VIRGINIA TYPE PEANUTS, SOYBEANS, AND GRAIN CROPS (D. L. Hallock - Agronomy - Tidewater Research and Continuing Education Center)

This project is directed toward elucidation of forms, contents and ratios of plant nutrient cations and/or anions in the fruiting zone of peanuts on the incidence of peanut pod breakdown.

Future work will include additional field greenhouse experiments concerned with the above objective but containing appropriate revisions based on present results. New emphasis will be placed on evaluation of micronutrient status of peanuts and soybeans as native soil supplies of micronutrients diminish through intensive production of high yielding varieties.

	<u>1973-74</u>
SMY -----	0.1
Support Personnel -----	0.2
Total Expenditures -----	\$4,123

PASTURE

Pasture is the basis for beef cattle and sheep enterprises on many farms and is an important supplement for dairy enterprises. Virginia has much land that is suitable for pasture but which is not suitable for row crops or hay. The per-acre returns from pasture are low in comparison to most crops. Thus, the opportunities for a return on investments for fertilizer and other production practices are limited. Pasture research is oriented toward developing improved grass or grass-legume mixtures and toward increasing the efficiency of utilizing the forage that is produced.

Summary of 1973-74 Programs

	<u>SMY</u>	<u>Support Personnel</u>	<u>Expenditures</u>
Insect Control	0.2	0.8	\$ 14,417
Weed Control	0.4	1.4	21,524
Biological Efficiency	0.9	1.8	42,297
Administration	-	-	10,866
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Total	1.5	4.0	\$ 89,104

Insect Control

200290, BIOCONTROL OF INSECT AND WEED PESTS OF FORAGE AND FIELD CROPS
IN VIRGINIA (L. T. Kok - Entomology)

The objectives of this project are to search for organisms, both native and non-native, that will be useful in biological control of weed pests of forage and field crops in Virginia, with emphasis on pasture thistles; to evaluate the effectiveness of beneficial species; and to develop artificial diets for use in mass rearing of important insects or other biocontrol agents.

Future Plans: To enhance the spread of the head-feeding weevil which appears very promising in control of musk thistle; to begin a field-release program of the rosette-feeding weevil which has now been approved for release in Virginia.

	<u>1973-74</u>
SMY -----	0.2
Support Personnel -----	0.8
Total Expenditures -----	\$14,417

Weed Control

200290, BIOCONTROL OF INSECT AND WEED PESTS OF FORAGE AND FIELD CROPS
IN VIRGINIA (L. T. Kok - Entomology)

The objectives of this project are to search for organisms, both native and non-native, that will be useful in biological control of weed pests of forage and field crops in Virginia, with emphasis on pasture thistles; to evaluate the effectiveness of beneficial species; and to develop artificial diets for use in mass rearing of important insects or other biocontrol agents.

Future Plans: To enhance the spread of the head-feeding weevil which appears very promising in control of musk thistle; to begin a field-release program of the rosette-feeding weevil which has now been approved for release in Virginia.

	<u>1973-74</u>
SMY -----	0.2
Support Personnel -----	0.9
Total Expenditures -----	\$14,418

200129, CONTROL OF UNWANTED PLANT GROWTH IN CROPS, FORESTS, WATER AND
RECREATIONAL AREAS (S. W. Bingham, C. L. Foy, W. E. Chappell
and J. S. Coartney - Plant Pathology and Physiology)

The primary objective is to develop economical programs of weed control associated with Virginia crop production, water and recreational areas. Emphasis is directed toward lowering production cost, increasing yields, improving product quality and minimizing chemical residues in the environment.

Future Plans: The objectives of this project remain the same and are continual testing of new herbicides for all crop and non-crop areas and developing practical weed control information that is used as a basis for grower recommendations.

	<u>1973-74</u>
SMY -----	0.2
Support Personnel -----	0.5
Total Expenditures -----	\$7,106

Biological Efficiency

6161390, DRY MATTER ACCUMULATION OF FORAGE PLANTS (D. D. Wolf, H. T. Bryant and R. E. Blaser - Agronomy)

Investigations in various field environments, greenhouse cultures and controlled environmental chambers are under way to find why yields of perennial forages are not higher and to find cultural practices to improve yield potentials, seasonal distribution and good nutritional forage. Management research with forages is directed toward special and flexible utilization by animals to minimize mechanization and labor. Because of the alfalfa persistence problem, varieties are evaluated on soils that have and have not grown alfalfa. Red clover longevity and yields are compared with mild to severe fall cutting managements. Accumulating summer canopies for winter grazing include treatments with and without nitrogen.

	<u>1973-74</u>
SMY -----	0.9
Support Personnel -----	1.8
Total Expenditures -----	\$42,297

FORAGE CROPS

Forage crops are continually occupying a more important place in the economic production of beef and sheep. Harvested forages and corn silage are the basis for dairy feeding programs. Yields of total digestible nutrients from forage crops are considerably higher than those of pasture and this justifies more intensive research effort dealing with profitable production practices. Further improvements in yield and nutritive value of forage crops is essential to increase the profitability of beef, dairy and sheep production in Virginia.

Summary of 1973-74 Programs

	<u>SMY</u>	<u>Support Personnel</u>	<u>Expenditures</u>
Insect Control	1.2	3.3	\$ 61,753
Weed Control	0.1	0.5	7,106
Biological Efficiency	2.6	4.3	94,573
Administration	-	-	22,751
Total	<u>3.9</u>	<u>8.1</u>	<u>\$ 186,183</u>

Insect Control

616146, BIOLOGICAL AND ECOLOGICAL STUDIES ON FORAGE INSECTS FOR POPULATION MANAGEMENT (R. L. Pienkowski and L. T. Kok - Entomology)

The objective of this project is to collect the necessary information for planning effective pest management practices.

Future Plans: An intensive sampling program will be conducted to determine the actual effects of present physical and biological control agents under several different conditions. Studies of economic thresholds, initially working with the alfalfa weevil, will be conducted. Efforts will be made to develop a method by which the farmer can accurately predict the intensity of an alfalfa weevil infestation. This information should contribute toward an effective pest management program in alfalfa.

	<u>1973-74</u>
SMY -----	0.9
Support Personnel -----	2.7
Total Expenditures -----	\$31,417

616145, BEHAVIOR OF CERTAIN INSECTS OF FORAGE CROPS (R. L. Pienkowski - Entomology)

The objectives of this project are to study the reproductive and dispersal behavior of the most important forage crop insects, and to study prey orientation and utilization by the more important parasites and predators of forage pests.

Future Plans: This project is scheduled for revision or replacement in 1975.

	<u>1973-74</u>
SMY -----	0.3
Support Personnel -----	0.6
Total Expenditures -----	\$30,336

Weed Control

200129, CONTROL OF UNWANTED PLANT GROWTH IN CROPS, FORESTS, WATER AND RECREATIONAL AREAS (S. W. Bingham, C. L. Foy, W. E. Chappell and J. S. Coartney - Plant Pathology and Physiology)

The primary objective is to develop economical programs of weed control associated with Virginia crop production, water and recreational areas. Emphasis is directed toward lowering production cost, increasing yields, improving product quality and minimizing chemical residues in the environment.

Future Plans: The objectives of this project remain the same and are continual testing of new herbicides for all crop and non-crop areas and developing practical weed control information that is used as a basis for grower recommendations.

	<u>1973-74</u>
SMY -----	0.1
Support Personnel -----	0.5
Total Expenditures -----	\$7,106

Biological Efficiency

200043, BREEDING, GENETICS AND CYTOGENETICS OF ALFALFA (G. R. Buss -
Agronomy)

The objectives of this study are (1) to develop alfalfa germplasm sources possessing superior yielding potential and increased resistance to the important insects and diseases in Virginia; (2) to evaluate genotype x environment interactions for various agronomic characteristics, using standard varieties and experimental varieties and populations; and (3) to conduct genetic and cytogenetic studies on diploid and tetraploid alfalfas directed toward determining the mode of inheritance and linkage relationships of various traits and marker genes.

Future Plans: The recurrent selection populations will be screened for resistance to anthracnose and bacterial wilt and evaluated each generation for agronomic performance. If appropriate, they will be considered for release as new varieties. Variety testing will be continued to provide current information for variety recommendations.

	<u>1973-74</u>
SMY -----	1.0
Support Personnel -----	1.6
Total Expenditures -----	\$33,731

6161390, DRY MATTER ACCUMULATION OF FORAGE PLANTS (D. D. Wolf, H. T.
Bryant and R. E. Blaser - Agronomy)

Investigations in various field environments, greenhouse cultures and controlled environmental chambers are under way to find why yields of perennial forages are not higher and to find cultural practices to improve yield potentials, seasonal distribution and good nutritional forage. Management research with forages is directed toward special and flexible utilization by animals to minimize mechanization and labor. Because of the alfalfa persistence problem, varieties are evaluated on soils that have and have not grown alfalfa. Red clover longevity and yields are compared with mild to severe fall cutting managements. Accumulating summer canopies for winter grazing include treatments with and without nitrogen.

	<u>1973-74</u>
SMY -----	1.0
Support Personnel -----	1.7
Total Expenditures -----	\$42,298

616180, IMPROVING GENETIC POTENTIAL OF PERENNIAL GRASSES FOR TURF
AND FORAGE USE (L. H. Taylor and R. E. Schmidt - Agronomy)

This project investigates methods and potential of improving
Kentucky bluegrass for turf and orchardgrass for forage use.

Future Plans: Collections of Kentucky bluegrass ecotypes will
be continued and promising hybrids from the crossing program will be
evaluated. Orchardgrass F₁ hybrids will be grown in forage performance
trials.

	<u>1973-74</u>
SMY -----	0.6
Support Personnel -----	1.0
Total Expenditures -----	\$18,544

SOYBEANS

The USDA and the Midwestern States are expanding research on soybeans at a rapid rate. However, the soybean is a peculiar crop in that varieties tend to be best adapted to restricted areas. Production practices, likewise, have to be developed for local areas. Therefore, Virginia will continue to conduct considerable research to develop and evaluate varieties; to improve quality; to control diseases, insects and weeds; and to determine production practices for local conditions.

Summary of 1973-74 Programs

	<u>SMY</u>	<u>Support Personnel</u>	<u>Expenditures</u>
Disease and Nematode Control	2.8	4.5	\$ 83,944
Insect Control	0.4	1.3	19,267
Weed Control	0.5	1.8	27,703
Basic Biology	0.1	0.1	3,455
Biological Efficiency	1.9	5.4	77,673
Mechanization and Labor Efficiency	0.6	1.2	20,777
Management to Maximize Income	-	-	4,180
Administration	-	-	33,051
Total	<u>6.3</u>	<u>14.3</u>	<u>\$ 270,050</u>

(1) Less than 0.1

Disease and Nematode Control

626147, NATURE AND EXTENT OF VARIATION IN CYST NEMATODES (L. I. Miller - Plant Pathology and Physiology)

The objectives of the project are to determine morphological and physiological variation within the lemon-shaped soybean cyst nematodes and to study the reproductive compatibility between populations of the round cyst nematode.

Future Plans: This project will be complete on June 30, 1975. With the knowledge gained of the nature and extent of variation in cyst nematodes, it is anticipated that a new project will be initiated to determine the most efficient methods for plant breeders to develop new varieties of crop plants resistant to cyst-forming nematodes.

	<u>1973-74</u>
SMY -----	0.9
Support Personnel -----	2.3
Total Expenditures -----	\$37,693

616058, GENETICS OF HOST-PARASITE INTERACTIONS AND CONTROL OF CEREAL AND SOYBEAN DISEASES (C. W. Roane - Plant Pathology and Physiology)

The objectives of this project are to study the genetics of host reaction to pathogens causing diseases of cereals and soybeans and to apply genetic principles to the control of such diseases. Other avenues of control are also subject to investigation.

Current corn investigations pertain to seeking and utilizing resistance to maize dwarf mosaic virus and the gray leaf spot fungus. The genetics of maize dwarf mosaic resistance is being studied in F₂ and F₃ populations.

With small grains, the principle activity is cooperation with a plant breeder to develop small grains with multiple disease resistance. Genetic studies of barley leaf rust and scald resistance are also under way.

Future Plans: We will continue programs described above and seek ways to control *Cylindrocladium* root rot and brown stem rot of soybeans. There will be a genetic study of resistance to soybean mosaic virus.

	<u>1973-74</u>
SMY -----	0.5
Support Personnel -----	0.3
Total Expenditures -----	\$15,128

200309, IMPROVING GENETIC POTENTIAL FOR YIELD AND QUALITY OF SOYBEANS
(T. J. Smith and H. M. Camper, Jr. - Agronomy)

This project is concerned primarily with identifying, isolating and using genetic materials with high yield potential and superior seed quality. Special emphasis is placed upon evaluating widely different genetic materials and plant types including those that are short and compact with restricted vegetative growth under various population densities and planting dates.

Future Plans: Identification of factors associated with yield will continue with special emphasis on performance of different plant types under various population densities. Emphasis also will continue on evaluation of the production potential and need for varieties especially adapted for late, no-tillage planting after small grain. Attempts are being made to locate early maturing genotypes suitable for double-cropping.

	<u>1973-74</u>
SMY -----	0.2
Support Personnel -----	0.4
Total Expenditures -----	\$6,815

423663-1, THE ROLE OF SOYBEAN STEROLS IN RESISTANCE TO HETERODERA
GLYCINES (J. A. Fox and D. M. Orcutt - Plant Pathology and
Physiology; L. H. Aung - Horticulture)

The objectives are to identify the sterols of resistant and susceptible plants and their role in resistance to heterodera glycines.

Future Plans: The growth, development and sex ratios of the nematode races as affected by certain sterols and sterol antimetabolites will continue as a prime objective of the research.

	<u>1973-74</u>
SMY -----	1.2
Support Personnel -----	1.5
Total Expenditures -----	\$24,308

Insect Control

616172, DEVELOPMENT OF PEST MANAGEMENT SYSTEMS FOR MAJOR ARTHROPOD
PESTS OF PEANUTS AND SOYBEANS (J. C. Smith - Entomology -
Tidewater Research & Continuing Education Center)

Economic threshold of injury values for the major insect pests of soybeans are being utilized in a pilot pest management program. Refined criteria for control are being obtained to maximize benefits of biological and systemic chemical control. Preventative and curative control methods are being developed to combat an increasing spider mite problem in Virginia peanuts. Cyclodiene-resistant southern corn rootworms are being controlled by resistant plant cultivars and by effective chemical means.

Future Plans: To develop alternative and more effective means of insect control for pests of peanuts and soybeans.

	<u>1973-74</u>
SMY -----	0.4
Support Personnel -----	1.3
Total Expenditures -----	\$19,267

Weed Control

200129, CONTROL OF UNWANTED PLANT GROWTH IN CROPS, FORESTS, WATER AND RECREATIONAL AREAS (S. W. Bingham, C. L. Foy, W. E. Chappell and J. S. Coartney - Plant Pathology and Physiology)

The primary objective is to develop economical programs of weed control associated with Virginia crop production, water and recreational areas. Emphasis is directed toward lowering production cost, increasing yields, improving product quality and minimizing chemical residues in the environment.

Future Plans: The objectives of this project remain the same and are continual testing of new herbicides for all crop and non-crop areas and developing practical weed control information that is used as a basis for grower recommendations.

	<u>1973-74</u>
SMY -----	0.3
Support Personnel -----	1.2
Total Expenditures -----	\$17,766

200288, ENVIRONMENTAL EFFECTS ON THE HERBICIDE COMPONENT OF WEED CONTROL SYSTEMS IN PEANUTS AND SOYBEANS (O. E. Rud - Plant Pathology and Physiology - Tidewater Research & Continuing Education Center)

The objectives are to evaluate and characterize the residual characteristics of certain herbicides used in crop rotations and to relate them to some of the environmental parameters.

Project revision is due and will include expanded studies on pH, soil organic matter and plant nutrient level effects on phytotoxic expression.

	<u>1973-74</u>
SMY -----	0.2
Support Personnel -----	0.6
Total Expenditures -----	\$9,937

Basic Biology

200262, CONTROL OF AMINO ACID METABOLISM AS RELATED TO CELLULAR COMPARTMENTATION (John L. Hess - Biochemistry and Nutrition)

We attempt to evaluate the importance of cellular compartmentation to amino acid and protein synthesis in higher plants. Glutamate oxalacetate aminotransferase functions in relating cytoplasmic and organelle pools of carbon metabolism and reducing power in C3 and C4 plants. Having completed purification and aspects of protein characterization on forms of this enzyme from oat seedlings, we plan to evaluate cellular location more completely. These studies should improve our understanding of how metabolism of amino acids and proteins is controlled in plant cells.

	<u>1973-74</u>
SMY -----	0.1
Support Personnel -----	0.1
Total Expenditures -----	\$3,455

Biological Efficiency

200309, IMPROVING GENETIC POTENTIAL FOR YIELD AND QUALITY OF SOYBEANS
(T. J. Smith and H. M. Camper, Jr. - Agronomy)

This project is concerned primarily with identifying, isolating and using genetic materials with high yield potential and superior seed quality. Special emphasis is placed upon evaluating widely different genetic materials and plant types including those that are short and compact with restricted vegetative growth under various population densities and planting dates.

Future Plans: Identification of factors associated with yield will continue with special emphasis on performance of different plant types under various population densities. Emphasis also will continue on evaluation of the production potential and need for varieties especially adapted for late, no-tillage planting after small grain. Attempts are being made to locate early maturing genotypes suitable for double-cropping.

	<u>1973-74</u>
SMY -----	1.4
Support Personnel -----	4.0
Total Expenditures -----	\$61,334

616163, METHODOLOGY FOR DETECTING AND ALLEVIATING MICRONUTRIENT PROBLEMS
WITH AGRONOMIC CROPS (David C. Martens - Agronomy)

Field investigations were conducted to develop procedures for correction of boron deficiency of alfalfa and corn plants.

Future Plans: Field research will be undertaken to develop procedures for correction of copper deficiency of corn and wheat plants. Treatments in these experiments will consist of various levels and sources of copper.

	<u>1973-74</u>
SMY -----	0.3
Support Personnel -----	1.1
Total Expenditures -----	\$12,216

616178, SOIL-PLANT NUTRIENT RELATIONSHIPS IN VIRGINIA TYPE PEANUTS,
SOYBEANS, AND GRAIN CROPS (D. L. Hallock - Agronomy - Tidewater
Research and Continuing Education Center)

This project is directed toward elucidation of forms, contents and ratios of plant nutrient cations and/or anions in the fruiting zone of peanuts on the incidence of peanut pod breakdown.

Future work will include additional field greenhouse experiments concerned with the above objective but containing appropriate revisions based on present results. New emphasis will be placed on evaluation of micronutrient status of peanuts and soybeans as native soil supplies of micronutrients diminish through intensive production of high yielding varieties.

	<u>1973-74</u>
SMY -----	0.2
Support Personnel -----	0.3
Total Expenditures -----	\$4,123

Mechanization and Labor Efficiency

616204, IMPROVING NO-TILLAGE CULTURAL METHODS IN VIRGINIA FOR CORN,
SOYBEANS AND TOBACCO (W. W. Moschler - Agronomy; R. W. Young -
Biochemistry and Nutrition)

The research seeks to increase field crop yields, fertilizer and
lime efficiency and improve the physical properties of the soil through
no-tillage culture.

Future Plans: The objectives enumerated above have been largely
reached with corn, partially with soybeans, and tobacco shows some
promise. The use of slow-release nitrogen fertilizers, better methods
of seeding cover crops, better crop varieties for no-tillage culture,
and improved herbicides and insecticides would seem to be the most
promising areas of research.

	<u>1973-74</u>
SMY -----	0.4
Support Personnel -----	0.9
Total Expenditures -----	\$12,969

2003290, NO TILLAGE PLANTING MACHINERY REQUIREMENTS FOR CORN AND SOY-
BEANS (J. H. Lillard and E. S. Smith - Agricultural
Engineering)

This research focused on the evaluation of a wide array of row
openers and assist tools for no tillage planting of corn and soybeans.
These findings provide the basis for recommendations to growers
regarding the machinery alternatives available for their use in the
no tillage production of these crops; with special emphasis on the
planting problems associated with double cropping soybeans after
small grain.

Future Plans: This project was completed in fiscal year 1973-74.

	<u>1973-74</u>
SMY -----	0.2
Support Personnel -----	0.3
Total Expenditures -----	\$7,808

Management to Maximize Income

6162210, ALTERNATIVE MARKETING AND HEDGING STRATEGIES FOR VIRGINIA
GRAIN AND LIVESTOCK PRODUCERS (David Kenyon - Agricultural
Economics)

In this project the economic potential of alternative marketing strategies using the futures market for grain and livestock producers and handlers in Virginia will be evaluated. The project will involve developing a data bank on prices and basis to be placed on the Computerized Management Network (CMN), price prediction equations, evaluation of alternative hedging strategies, and presentation of workshops on how to effectively use the futures market as a marketing tool.

Future Plans: Present workshops on futures trading and continue analysis on alternative hedging strategies.

1973-74

SMY -----	
Support Personnel -----	
Total Expenditures -----	\$4,180

PEANUTS

There are three peanut producing areas in the United States. These are the Virginia-Carolina area, the Georgia-Florida-Alabama area, and the Southwestern area in which Texas and Oklahoma are the principal states. Research done in one area has limited value in the other two areas. Problems in North Carolina and Virginia are similar and a coordinated program has been developed by the Agricultural Experiment Stations of the two states and the USDA. USDA expenditures at the Tidewater Research Station are not included.

Summary of 1973-74 Programs

	<u>SMY</u>	<u>Support Personnel</u>	<u>Expenditures</u>
Insect Control	0.6	2.3	\$ 35,781
Disease and Nematode Control	1.6	3.1	57,441
Weed Control	1.0	2.0	33,848
Biological Efficiency	0.6	5.9	100,931
Mechanization and Labor Efficiency	0.2	0.5	17,048(1)
Management of Labor, Capital and Other Inputs	0.1	0.3	2,926
Evaluation of Public Programs	-	0.3	2,926
Analysis of Supply, Demand and Price	-	0.1	1,463
Administration	-	-	35,089
Total	<u>4.1</u>	<u>14.5</u>	<u>\$ 287,453</u>

(1) Provided by ARS, USDA under Cooperative Agreement. These funds were spent in support of the CRIS work units.

Insect Control

616172, DEVELOPMENT OF PEST MANAGEMENT SYSTEMS FOR MAJOR ARTHROPOD
PESTS OF PEANUTS AND SOYBEANS (J. C. Smith - Entomology -
Tidewater Research & Continuing Education Center)

Economic threshold of injury values for the major insect pests of soybeans are being utilized in a pilot pest management program. Refined criteria for control are being obtained to maximize benefits of biological and systemic chemical control. Preventative and curative control methods are being developed to combat an increasing spider mite problem in Virginia peanuts. Cyclodiene-resistant southern corn rootworms are being controlled by resistant plant cultivars and by effective chemical means.

Future Plans: To develop alternative and more effective means of insect control for pests of peanuts and soybeans.

	<u>1973-74</u>
SMY -----	0.6
Support Personnel -----	2.3
Total Expenditures -----	\$35,781

Disease and Nematode Control

616142, SPORE GERMINATION AND SURVIVAL IN SOIL OR MICROFLORA COLONIZING
PEANUT FRUITS AND PLANT ROOTS (G. J. Griffin - Plant Pathology
and Physiology)

The objectives of this project are to investigate the carbon and nitrogen requirements for spore germination of peanut fruit-colonizing fungi and the role of peanut fruit and root exudate components in the spore germination process; and to study the influence of the peanut geocarposphere, plant rhizosphere and saprophytic substrates in soil on spore germination and survival of fruit-colonizing and root-colonizing microflora.

Future Plans: In addition to work with the above fungi, a major research effort will be undertaken with the destructive peanut black rot pathogen, Cylindrocladium crotolariae.

	<u>1973-74</u>
SMY -----	0.6
Support Personnel -----	1.9
Total Expenditures -----	\$17,296

616065, IDENTIFICATION--INFECTING CERTAIN CROPS (Sue A. Tolin - Plant
Pathology and Physiology)

Viruses infecting field crops in Virginia, primarily corn, soybean, peanut and tobacco, are isolated and identified. Diagnoses are based on host reactions, physico-chemical properties, serological relationships and virion morphology as determined by electron microscopy. Similarities and differences between related viruses and strains, and the reaction of these viruses with various genotypes of recommended varieties and breeding lines are determined.

Future Plans: The project will be revised during the coming year, but the major areas of research will continue unchanged. More emphasis is to be placed on interaction of viruses with different hosts, and on the genetic basis for variability of viruses.

	<u>1973-74</u>
SMY -----	0.6
Support Personnel -----	0.8
Total Expenditures -----	\$16,557

626202, RHIZOSPHERE ECOLOGY AS RELATED TO PLANT HEALTH AND VIGOR (G. J. Griffin and M. G. Hale - Plant Pathology and Physiology)

The objectives of this project are to quantitatively and qualitatively determine peanut root and fruit exudates, their interactions in nutrient uptake and with rhizosphere and geocarposphere microorganism.

Future Plans: Determine the quantitative contribution of sloughed cells and tissues as carbon and nitrogen sources for rhizosphere microorganisms. Determine the role of peanut fruit exudates in spore germination and colonization of peanut fruits by Asperigullus flavus and Fusarium solani and root and fruit exudates in microsclerotial germination of Cylindrocladium crotalaris. Develop cooperative work with scientists at other locations in root exudation research.

	<u>1973-74</u>
SMY -----	0.4
Support Personnel -----	0.4
Total Expenditures -----	\$11,654

A Cooperative Agreement with ARS, USDA provided 0.3 Support Personnel and \$11,934 financial support in addition to figures listed above for Disease and Nematode Control.

Weed Control

200288, ENVIRONMENTAL EFFECTS ON THE HERBICIDE COMPONENT OF WEED CONTROL SYSTEMS IN PEANUTS AND SOYBEANS (O. E. Rud - Plant Pathology and Physiology - Tidewater Research & Continuing Education Center)

The objectives are to evaluate and characterize the residual characteristics of certain herbicides used in crop rotations and to relate them to some of the environmental parameters.

Project revision is due and will include expanded studies on pH, soil organic matter and plant nutrient level effects on phytotoxic expression.

	<u>1973-74</u>
SMY -----	0.7
Support Personnel -----	1.3
Total Expenditures -----	\$23,186

200129, CONTROL OF UNWANTED PLANT GROWTH IN CROPS, FORESTS, WATER AND RECREATIONAL AREAS (S. W. Bingham, C. L. Foy, W. E. Chappell and J. S. Coartney - Plant Pathology and Physiology)

The primary objective is to develop economical programs of weed control associated with Virginia crop production, water and recreational areas. Emphasis is directed toward lowering production cost, increasing yields, improving product quality and minimizing chemical residues in the environment.

Future Plans: The objectives of this project remain the same and are continual testing of new herbicides for all crop and non-crop areas and developing practical weed control information that is used as a basis for grower recommendations.

	<u>1973-74</u>
SMY -----	0.3
Support Personnel -----	0.7
Total Expenditures -----	\$10,662

Biological Efficiency

626176, PEANUT VARIETY AND QUALITY EVALUATION (R. W. Mozingo - Agronomy - Tidewater Research and Continuing Education Center)

The objectives of this project are: (1) To evaluate the production potential of new varieties and advanced lines of peanuts through field testing at multiple locations over the environmental conditions of the North Carolina-Virginia Peanut Belt. (2) To evaluate the processing quality of new varieties and advanced lines of peanuts. (3) To provide information as a basis of decision for release of new varieties. (4) To utilize in peanut breeding programs the basic information obtained on the advanced lines.

Future Plans: The duration of this project is for two years ending June 30, 1976, at which time it will be renewed with changes to fit the needs at that time.

	<u>1973-74</u>
SMY -----	0.1
Support Personnel -----	2.9
Total Expenditures -----	\$49,901

616168, METHODOLOGY FOR DETECTING AND ALLEVIATING MICRONUTRIENT PROBLEMS WITH AGRONOMIC CROPS (David C. Martens - Agronomy)

Field investigations were conducted to develop procedures for correction of boron deficiency of alfalfa and corn plants.

Future Plans: Field research will be undertaken to develop procedures for correction of copper deficiency of corn and wheat plants. Treatments in these experiments will consist of various levels and sources of copper.

	<u>1973-74</u>
SMY -----	0.4
Support Personnel -----	1.0
Total Expenditures -----	\$12,216

616178, SOIL-PLANT NUTRIENT RELATIONSHIPS IN VIRGINIA TYPE PEANUTS;
SOYBEANS, AND GRAIN CROPS (D. L. Hallock - Agronomy - Tidewater
Research and Continuing Education Center)

This project is directed toward elucidation of forms, contents and ratios of plant nutrient cations and/or anions in the fruiting zone of peanuts on the incidence of peanut pod breakdown.

Future work will include additional field greenhouse experiments concerned with the above objective but containing appropriate revisions based on present results. New emphasis will be placed on evaluation of micronutrient status of peanuts and soybeans as native soil supplies of micronutrients diminish through intensive production of high yielding varieties.

	<u>1973-74</u>
SMY -----	0.1
Support Personnel -----	2.0
Total Expenditures -----	\$33,700

A Cooperative Agreement with ARS, USDA provided an additional \$5,114 support for Biological Efficiency.

Management of Labor, Capital and Other Inputs

333308, ANALYSIS OF THE VIRGINIA-NORTH CAROLINA PEANUT PRODUCTION
SECTOR (R. G. Kline and J. Paxton Marshall - Agricultural
Economics)

General objectives of this study are to describe the structure of the farm production sector of the peanut industry in the Virginia-North Carolina area, and evaluate the impact which each of five proposed alternatives to the present peanut price support program would have on peanut production, on the income of farm operators in different farm size and tenure classes, and on government costs associated with peanut support measures.

This project was terminated June 30, 1974.

	<u>1973-74</u>
SMY -----	0.1
Support Personnel -----	0.3
Total Expenditures -----	\$2,926

Evaluation of Public Programs

333308, ANALYSIS OF THE VIRGINIA-NORTH CAROLINA PEANUT PRODUCTION
SECTOR (R. G. Kline and J. Paxton Marshall - Agricultural
Economics)

General objectives of this study are to describe the structure of the farm production sector of the peanut industry in the Virginia-North Carolina area, and evaluate the impact which each of five proposed alternatives to the present peanut price support program would have on peanut production, on the income of farm operators in different farm size and tenure classes, and on government costs associated with peanut support measures.

This project was terminated June 30, 1974.

	<u>1973-74</u>
SMY -----	
Support Personnel -----	0.3
Total Expenditures -----	\$2,926

Analysis of Supply, Demand and Price

333308, ANALYSIS OF THE VIRGINIA-NORTH CAROLINA PEANUT PRODUCTION
SECTOR (R. G. Kline and J. Paxton Marshall - Agricultural
Economics)

General objectives of this study are to describe the structure of the farm production sector of the peanut industry in the Virginia-North Carolina area, and evaluate the impact which each of five proposed alternatives to the present peanut price support program would have on peanut production, on the income of farm operators in different farm size and tenure classes, and on government costs associated with peanut support measures.

This project was terminated June 30, 1974.

	<u>1973-74</u>
SMY -----	
Support Personnel -----	0.1
Total Expenditures -----	\$1,463

U.S.D.A. Cooperative Research Conducted at Tidewater Research and Continuing Education Center, Holland, Virginia

CRIS Work Unit 702-037-C209, DEVELOPMENT AND IMPROVEMENT OF PEANUT HARVESTING AND FIELD HANDLING EQUIPMENT (F. S. Wright - Southern Region, ARS, USDA)

The objectives of this project are to: (1) Study present equipment and methods to determine extent and nature of damage to peanuts during harvesting and handling; (2) evaluate the effect of harvesting freshly dug, high-moisture peanuts as compared to conventionally harvested peanuts; (3) continue development and field testing of the experimental "direct harvesting" machine in order to minimize peanut damage and losses; and (4) evaluate the susceptibility of mechanically harvested peanuts to mold contamination as related to hull damage.

Future Plans: Continue present investigations and continue development of the experimental machine.

CRIS Work Unit 702-037-C206, DEVELOP AND IMPROVE DRYING AND CURING SYSTEMS FOR VIRGINIA-TYPE PEANUTS (J. L. Steele - Southern Region, ARS, USDA)

The objectives are 1) relate environmental conditions, peanut temperatures and soil temperatures to rate of drying, mold growth and aflatoxin production on peanuts in the field in three types of windrows; 2) evaluate and improve allowable drying time recommendations for freshly dug and semi-cured peanuts based upon mold growth, aflatoxin production and commercial grade; 3) quantify the rate of deterioration of peanuts during drying with time, temperature, moisture content and mechanical damage using carbon dioxide production as an index of deterioration; and 4) determine drying and curing recommendations for direct harvested peanuts based on germination and flavor.

Future Plans: Continue present investigations.

CRIS Work Unit 308-040-C205, DEVELOPMENT OF PEANUT DIGGING AND SALVAGING EQUIPMENT (G. B. Duke - Southern Region, Raleigh Area, ARS, USDA)

Peanut digging investigations involve the development of equipment to salvage detached peanuts from the soil and equipment to reclean peanuts salvaged from the soil. The study further includes determining the effects of digging time on vine and salvage yield and comparing the quality of the salvaged peanuts with the quality of the peanuts picked from the vines.

Future Plans: Make improvements on digging and cleaning equipment constructed in 1973 and test these machines to determine their efficiency and performance characteristics.

CRIS Work Unit 7812-10630-001, BREEDING PEANUTS WITH IMPROVED YIELD,
PEST RESISTANCE AND QUALITY (Terry A. Coffelt - Southern
Region, Raleigh Area, ARS, USDA)

The objectives is to develop peanut varieties with higher yield potential; resistance to pathogenic fungi, viruses, peanut attacking insects, and other pests; desirable agronomic attributes; enhanced shelling, processing, nutritional and "consumer appeal" quality.

Future Plans: Continue the program at its present pace.

CRIS Work Unit 7812-15970-004, PEANUT FRUIT MICROFLORA INVESTIGATIONS
(D. Morris Porter and Kenneth H. Garren - Southern Region,
Raleigh Area, ARS, USDA)

The objective is to determine nonpathogenic fungi that infest peanut pods and seed and devise procedures for suppressing those that are mycotoxin producers or are otherwise undesirable. The approach is to conduct laboratory, greenhouse, and field studies on the nature and development of the natural microflora of peanut fruits. Identify toxigenic organisms that colonize peanut fruits during fruit development, harvesting and curing. Evaluate ecological reactions in peanut rhizosphere from viewpoint of control of mycotoxin-producing fungi.

Future Plans: Continue the program at its present pace.

CRIS Work Unit 7812-10630-005, PEANUT DISEASE INVESTIGATIONS (Kenneth
H. Garren and D. Morris Porter - Southern Region, Raleigh Area,
ARS, USDA)

The objective is to develop control measures for peanut diseases. Determine pathogenic fungi that infect peanut plants and pods and devise procedures for suppressing them.

Future Plans: Continue the program at its present pace.

TOBACCO

Tobacco is the major farm income producing crop grown in Virginia. The four types, flue-cured, burley, fire-cured and sun-cured produced in the state account for about 1/3 of the farm income from crops and over 15% of the income from all agricultural commodities. It provides employment for about 1/3 of the farm population, being grown in significant amounts in 44 of Virginia's counties and some is grown in 55 of the 96 counties. The acreage allotments on individual farms are small which has restricted opportunities for mechanization. Quality is influenced to a considerable extent by variety, production practices, method of harvest and curing. Therefore, field research in these areas must be supported by an adequate program of laboratory testing and basic research.

Summary of 1973-74 Programs

	<u>SMY</u>	<u>Support Personnel</u>	<u>Expenditures</u>
Insect Control	1.8	2.7	\$ 50,173
Disease and Nematode Control	3.6	12.3	191,986
Weed Control	0.2	0.5	7,106
Biological Efficiency	2.5	9.1	143,894
Mechanization and Labor Efficiency	1.0	1.6	44,089
Chemical and Physical Properties	0.2	0.2	7,289
Administration	-	-	64,407
Total	<u>9.3</u>	<u>26.4</u>	<u>\$ 508,944</u>

Insect Control

616132, BIONOMICS AND CONTROL OF INSECTS ATTACKING TOBACCO AND STUDIES ON INSECT VECTORS OF POTATO VIRUS Y (PVY) ON TOBACCO (P. J. Semtner - Southern Piedmont Research and Continuing Education Center and Entomology)

The objectives of this project are: to obtain additional information on the biology of the tobacco flea beetle; to improve the control of tobacco insects by chemical and non-chemical means or by a combination of the two; to study the virus-vector relationship of potato virus y (PVY) on tobacco; and to collect information on the species of cutworms and wireworms attacking tobacco in Virginia.

Future Plans: Fruther attention will be given to integrated tobacco insect control, safer and less persistent chemicals, possible resistance in Nicotiana to the tobacco flea beetle, vectors of potato virus y (PVY) on tobacco and biology studies.

	<u>1973-74</u>
SMY -----	1.1
Support Personnel -----	1.8
Total Expenditures -----	\$23,196

2000200, EFFECT OF PHYSICAL STIMULI ON INSECTS (U. F. Earp and J. V. Perumpral - Agricultural Engineering)

The objectives of this project are to determine the responses of insects to physical stimuli, to determine the feasibility of using these stimuli either singly or in combination as a potential insect suppressant, and to develop equipment required to control insects using these stimuli. Studies on the effects of low energy magnetic and electrostatic fields on insects are in progress.

Future Plans: To study the effect of electrostatic and magnetic fields on insect catch using light traps.

	<u>1973-74</u>
SMY -----	0.7
Support Personnel -----	0.9
Total Expenditures -----	\$26,977

Disease and Nematode Control

200131, PATHOGENIC POTENTIAL AND CONTROL OF PLANT DISEASES INCITED BY NEMATODES AND OTHER PATHOGENS (W. W. Osborne - Plant Pathology and Physiology)

The objectives of this project are to determine the pathogenic capability of certain nematode species alone and in combination with other pathogens and to develop and evaluate plant disease control measures employing biological and/or chemical methods.

Future Plans: To develop and evaluate improved methods of chemical control of plant diseases with emphasis on control of nematodes and complex diseases. These crops will be soybeans, peanuts, tobacco and ornamentals. Information obtained will be used as a basis for grower recommendations.

	<u>1973-74</u>
SMY -----	0.3
Support Personnel -----	3.1
Total Expenditures -----	\$53,123

200048, TOBACCO GENETICS AND BREEDING (T. R. Terrill - Southern Piedmont Research and Continuing Education Center and Agronomy)

The objective of this project is to utilize current genetic and statistical procedures to efficiently improve tobacco populations for several quantitatively inherited agronomic and chemical factors, individually and simultaneously.

Future Plans: Further development of appropriate grade distribution analyses will be made. Percentages of group grades, quality score and color grades will be used to measure quality. True canonical correlations from genetic and cultural investigations will be utilized to further interpret the importance of a number of commonly measured characters in discriminating among genetic and cultural treatments. The importance of type with regard to crossing tobaccos to broaden the gene base will be investigated and related to the disease resistance level of the parents. Selection programs for disease resistance, nicotine level and other agronomic characters will be continued and measurements will be made to determine the remaining level of genetic variability after two cycles of very intensive selection for specific characters.

	<u>1973-74</u>
SMY -----	0.5
Support Personnel -----	2.7
Total Expenditures -----	\$39,742

616098, DEVELOPMENT OF TOBACCO BREEDING LINES RESISTANT TO THE OSBORNE CYST NEMATODE (J. A. Fox - Plant Pathology and Physiology; T. R. Terrill - Agronomy)

The objectives of this project are to determine the genetics of resistance and develop tobacco breeding lines resistant to the Osborne Cyst Nematode.

Future Plans: Studies will be made on the relative effectiveness of tolerance and resistance in developing tobacco breeding lines and varieties resistant to the Osborne Cyst Nematode.

	<u>1973-74</u>
SMY -----	0.1
Support Personnel -----	0.8
Total Expenditures -----	\$20,022

616066, INHERITANCE OF PARASITISM IN PLANT PARASITIC NEMATODES (J. A. Fox - Plant Pathology and Physiology)

The objectives of this project are to study the mode of inheritance of parasitism and population genetics of cyst nematodes in relation to their pathogenic potential on susceptible and resistant hosts.

Future Plans: The emphasis in the immediate future will be to study host-parasite systems in which the genes controlling parasitism seem to coincide with genes for sex determination.

	<u>1973-74</u>
SMY -----	0.7
Support Personnel -----	0.8
Total Expenditures -----	\$20,667

616065, IDENTIFICATION--INFECTING CERTAIN CROPS (Sue A. Tolin - Plant Pathology and Physiology)

Viruses infecting field crops in Virginia, primarily corn, soybean, peanut and tobacco, are isolated and identified. Diagnoses are based on host reactions, physico-chemical properties, serological relationships and virion morphology as determined by electron microscopy. Similarities and differences between related viruses and strains, and the reaction of these viruses with various genotypes of recommended varieties and breeding lines are determined.

Future Plans: The project will be revised during the coming year, but the major areas of research will continue unchanged. More emphasis is to be placed on interaction of viruses with different hosts, and on the genetic basis for variability of viruses.

	<u>1973-74</u>
SMY -----	0.2
Support Personnel -----	0.3
Total Expenditures -----	\$8,277

616063, GENETICS OF HOST PATHOGEN INTERACTION IN TOBACCO AND THE DEVELOPMENT OF DISEASE RESISTANT VARIETIES (R. G. Henderson - Plant Pathology and Physiology)

Through this project, a number of varieties of flue cured, fire cured, sun cured and burley tobacco have been released. Superior germ plasm is being developed that may be used in further variety improvements.

Future Plans: This project was terminated during the 1973-74 fiscal year.

	<u>1973-74</u>
SMY -----	0.9
Support Personnel -----	3.4
Total Expenditures -----	\$14,496

616056, PRE-INFECTION ROOT-FUNGUS RELATIONS AND BARRIERS TO POST-INFECTION COLONIZATION OF TOBACCO PLANTS BY ROOT-INFECTING FUNGI (W. H. Wills - Plant Pathology and Physiology)

The objectives of this project have been to study the effects of treatments which alter host resistance on membrane permeability and on prepenetration activities, penetration and colonization of plant tissue

by fungus pathogens, and to study the possible role of naturally-occurring toxic substances in preventing tissue colonization of tobacco by fungus pathogens.

Future Plans: This project was terminated during the 1973-74 fiscal year and a new project (616228) has been initiated.

	<u>1973-74</u>
SMY -----	0.9
Support Personnel -----	1.2
Total Expenditures -----	\$35,659

Weed Control

200129, CONTROL OF UNWANTED PLANT GROWTH IN CROPS, FORESTS, WATER AND RECREATIONAL AREAS (S. W. Bingham, C. L. Foy, W. E. Chappell and J. S. Coartney - Plant Pathology and Physiology)

The primary objective is to develop economical programs of weed control associated with Virginia crop production, water and recreational areas. Emphasis is directed toward lowering production cost, increasing yields, improving product quality and minimizing chemical residues in the environment.

Future Plans: The objectives of this project remain the same and are continual testing of new herbicides for all crop and non-crop areas and developing practical weed control information that is used as a basis for grower recommendations.

	<u>1973-74</u>
SMY -----	0.2
Support Personnel -----	0.5
Total Expenditures -----	\$7,106

Biological Efficiency

200048, TOBACCO GENETICS AND BREEDING (T. R. Terrill - Southern Piedmont Research and Continuing Education Center and Agronomy)

The objective of this project is to utilize current genetic and statistical procedures to efficiently improve tobacco populations for several quantitatively inherited agronomic and chemical factors, individually and simultaneously.

Future Plans: Further development of appropriate grade distribution analyses will be made. Percentages of group grades, quality score and color grades will be used to measure quality. True canonical correlations from genetic and cultural investigations will be utilized to further interpret the importance of a number of commonly measured characters in discriminating among genetic and cultural treatments. The importance of type with regard to crossing tobaccos to broaden the gene base will be investigated and related to the disease resistance level of the parents. Selection programs for disease resistance, nicotine level and other agronomic characters will be continued and measurements will be made to determine the remaining level of genetic variability after two cycles of very intensive selection for specific characters.

	<u>1973-74</u>
SMY -----	1.1
Support Personnel -----	6.4
Total Expenditures -----	\$92,733

200050, GROWTH REGULATION IN FLUE-CURED TOBACCO (M. J. Rogers - Southern Piedmont Research and Continuing Education Center and Agronomy)

The objectives of this project are to study the influence of plant growth regulators on tobacco with emphasis on chemical topping, sucker control, ripening and/or wilting, and the influence of chemicals on the harvesting and curing schedules of flue and dark-fired tobaccos. Agronomic performance, chemical effects and the chemical composition of cured leaves represent the principal measurement criteria.

Future Plans: Full cooperation in the regionally conducted growth regulation investigations will be continued and the use of chemicals prior to harvest and at harvest time will be evaluated with regard to plant maturation patterns and effects during curing with special emphasis on reduction of labor and fuel input during harvest and curing operations.

	<u>1973-74</u>
SMY -----	1.0
Support Personnel -----	2.1
Total Expenditures -----	\$34,704

200352, BURLEY TOBACCO INVESTIGATIONS (Leo A. Link and T. R. Terrill - Southern Piedmont Research and Continuing Education Center and Agronomy)

The objectives of this project are to study factors controlling the production of tobacco transplants; to investigate plant growth regulators as they relate to sucker control uniformity of growth and ripening; to evaluate breeding lines of burley tobacco for yield, acre value and quality factors, to study the relationship between nitrogen and potassium fertilization levels; and to determine the feasibility of growing no-till burley tobacco.

Future Plans: Work in the immediate future will be concerned with comparison of new plant bed covers such as nylon and newer plastics with the conventional cheesecloth cover; evaluation of ripening agents with emphasis on time of application; evaluation of breeding lines with disease resistance from intertype crosses; a study of the interaction of nitrogen and potassium fertilization rates; and the timing of herbicide applications with reference to the ease of establishing tobacco in a killed sod.

	<u>1973-74</u>
SMY -----	0.3
Support Personnel -----	0.6
Total Expenditures -----	\$13,116

616149-0, NICOTINE SYNTHESIS--A MECHANISM FOR AMMONIUM TOLERANCE IN SOLANACEAE (H. E. Hohlt - Horticulture)

The objectives of this project are: (1) to elucidate a specific causal agent for an ammonium induced stem lesion in tomato, (2) to explain the natural tolerance of other cultivars in the solanaceae family to this stem lesion because their ability to utilize the causal agent in nicotine synthesis thereby preventing its accumulation.

Future Plans: The project has been terminated and the analyses are being completed on the final crop.

	<u>1973-74</u>
SMY -----	0.1
Support Personnel -----	
Total Expenditures -----	\$3,341

Mechanization and Labor Efficiency

200352, BURLEY TOBACCO INVESTIGATIONS (Leo A. Link and T. R. Terrill - Southern Piedmont Research and Continuing Education Center and Agronomy)

The objectives of this project are to study factors controlling the production of tobacco transplants; to investigate plant growth regulators as they relate to sucker control uniformity of growth and ripening; to evaluate breeding lines of burley tobacco for yield, acre value and quality factors, to study the relationship between nitrogen and potassium fertilization levels; and to determine the feasibility of growing no-till burley tobacco.

Future Plans: Work in the immediate future will be concerned with comparison of new plant bed covers such as nylon and newer plastics with the conventional cheesecloth cover; evaluation of ripening agents with emphasis on time of application; evaluation of breeding lines with disease resistance from intertype crosses; a study of the interaction of nitrogen and potassium fertilization rates; and the timing of herbicide applications with reference to the ease of establishing tobacco in a killed sod.

	<u>1973-74</u>
SMY -----	0.5
Support Personnel -----	0.8
Total Expenditures -----	\$29,675

616204, IMPROVING NO-TILLAGE CULTURAL METHODS IN VIRGINIA FOR CORN, SOYBEANS AND TOBACCO (W. W. Moschler - Agronomy; R. W. Young - Biochemistry and Nutrition)

The research seeks to increase field crop yields, fertilizer and lime efficiency and improve the physical properties of the soil through no-tillage culture.

Future Plans: The objectives enumerated above have been largely reached with corn, partially with soybeans, and tobacco shows some promise. The use of slow-release nitrogen fertilizers, better methods of seeding cover crops, better crop varieties for no-tillage culture, and improved herbicides and insecticides would seem to be the most promising areas of research.

	<u>1973-74</u>
SMY -----	0.2
Support Personnel -----	0.4
Total Expenditures -----	\$6,485

2003280, HARVESTING, HANDLING AND CURING VIRGINIA DARK-FIRED AND SUN-CURED TOBACCO (A. J. Lambert, E. R. Collins and E. S. Bell - Agricultural Engineering)

The objectives of this project are to investigate the factors important in curing dark-fired and sun-cured tobacco; to cure dark-fired tobacco in controlled environment laboratory cabinets; to study harvesting and handling methods for dark-fired tobacco; and to develop low-cost wilting and curing facilities for dark-fired tobacco.

Future Plans: Future studies will include controlled-environment laboratory curing, exploratory on farm curing and the development of labor-saving techniques for harvesting and curing dark-fired tobacco.

	<u>1973-74</u>
SMY -----	0.2
Support Personnel -----	0.2
Total Expenditures -----	\$4,859

200289, MACHINERY FOR CROPS MECHANIZATION (M. E. Wright - Agricultural Engineering)

The objective of this project is to develop new principles, procedures and machines related to crops and process mechanization that will reduce the labor requirements, increase production efficiency, and/or increase the quality of products of Virginia agriculture. One current objective is the development of new washers for leafy vegetables that will increase washing effectiveness and reduce water requirements. Another is the development of a system to harvest and crush sweet sorghum to provide juice for syrup production.

Future Plans: To incorporate water quality and waste treatment studies with the vegetable washing studies and demonstrate an improved system in a commercial food processing plant. To redesign the present sorghum harvesting facility to increase its reliability and productivity.

	<u>1973-74</u>
SMY -----	0.1
Support Personnel -----	0.2
Total Expenditures -----	\$3,070

Chemical and Physical Properties

2003280, HARVESTING, HANDLING AND CURING VIRGINIA DARK-FIRED AND SUN-CURED TOBACCO (A. J. Lambert, E. R. Collins and E. S. Bell - Agricultural Engineering)

The objectives of this project are to investigate the factors important in curing dark-fired and sun-cured tobacco; to cure dark-fired tobacco in controlled environment laboratory cabinets; to study harvesting and handling methods for dark-fired tobacco; and to develop low-cost wilting and curing facilities for dark-fired tobacco.

Future Plans: Future studies will include controlled-environment laboratory curing, exploratory on farm curing and the development of labor-saving techniques for harvesting and curing dark-fired tobacco.

	<u>1973-74</u>
SMY -----	0.2
Support Personnel -----	0.2
Total Expenditures -----	\$7,289

BEEF CATTLE

Virginia's beef cattle industry has grown rapidly in recent years and per capita consumption is at an all time high. Virginia is ideally situated for even more growth of this important animal industry. The close proximity to large population centers and Virginia's capacity to produce excellent forages and pastures combine to enhance beef cattle production in the State. Cow-calf operations in the State utilize pastures and other forage crops to a larger extent than is true with some other livestock species. Competition for grains is not as critical for this type of beef operation as it is for finishing cattle. Most of the research programs with beef is designed to take full advantage of this fact and to study optimum systems for beef production which will make most efficient use of available lands and feeds.

Several areas of investigation with beef include alternative sources of protein and non-protein nitrogen to reduce current high protein supplement costs, waste utilization and handling so as to help rather than harm the environment, pollution control, more economical systems of beef production for Virginia, more effective breeding programs and more efficient beef production systems including more efficient reproductive performance.

Summary of 1973-74 Programs

	<u>SMY</u>	<u>Support Personnel</u>	<u>Expenditures</u>
Insect Control	0.9	1.6	\$ 38,719
Disease Control	0.5	1.3	22,960
Basic Biology	0.8	2.0	35,783
Biological Efficiency	7.9	38.9	510,039

	<u>SMY</u>	<u>Support Personnel</u>	<u>Expenditures</u>
Chemical and Physical Properties	0.1	0.1	\$ 8,085
Analysis of Supply, Demand and Price	0.1	0.5	8,036
Management to Maximize Income	0.3	0.8	19,103
Increasing Consumer Acceptability	0.2	1.0	13,175
Maintaining Quality During Marketing	0.2	0.6	10,603
Administration	-	-	137,976
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Total	11.0	46.8	\$ 804,479

Insect Control

2000200, EFFECT OF PHYSICAL STIMULI ON INSECTS (U. F. Earp and J. V. Perumpral - Agricultural Engineering)

The objectives of this project are to determine the responses of insects to physical stimuli, to determine the feasibility of using these stimuli either singly or in combination as a potential insect suppressant, and to develop equipment required to control insects using these stimuli. Studies on the effects of low energy magnetic and electrostatic fields on insects are in progress.

Future Plans: To study the effect of electrostatic and magnetic fields on insect catch using light traps.

	<u>1973-74</u>
SMY -----	0.7
Support Personnel -----	0.9
Total Expenditures -----	\$26,977

616144, BIONOMICS AND POPULATION MANAGEMENT OF MAJOR PESTS OF MAN AND DOMESTIC ANIMALS (E. C. Turner, Jr. - Entomology)

The objectives of this project are to investigate the regulatory effect of most species of manure-breeding pest flies on dairy cattle and other flies located around dairy barns; to initiate field experiments on control of house flies in poultry laying houses; to evaluate several insecticide formulations and methods of application for control of pests of horses; and to continue ecological studies both in the field and the laboratory of Virginia species of Culicoides biting midges.

Future Plans: These will include a continuation of the evaluation of certain chemical and non-chemical methods for the management and control of external pests of cattle, horses and poultry. Of special interest will be the investigation of the practical effectiveness of juvenile hormones as a biological method for pest regulation of dipterous insects. Laboratory nutritional studies of Culicoides guttipennis will also be expanded.

	<u>1973-74</u>
SMY -----	0.2
Support Personnel -----	0.7
Total Expenditures -----	\$11,742

Disease Control

200327-0, DISEASE AS A DETERRENT TO INCREASED AND MORE EFFICIENT ANIMAL PRODUCTION (D. F. Watson - Veterinary Science)

Objectives of this research are (1) to investigate the disease process as it affects increased and more efficient production of animal origin food and fiber, (2) to continue our investigation of gastric and intestinal ulcers as they occur in animals and birds, (3) to continue our efforts to find a diagnostic method for liver diseases in animals, and (4) to investigate better methods for parasite control based on cultivation of parasites in vitro and in vivo.

Work on the Pink Eye vaccine evaluation will be continued as well as an evaluation of ultra violet radiation in the ceiling as a control of environmental bacteria in a confinement swine facility.

	<u>1973-74</u>
SMY -----	0.2
Support Personnel -----	0.6
Total Expenditures -----	\$11,076

616014, INFECTIOUS DISEASES AFFECTING REPRODUCTION IN CATTLE AND SHEEP (J. Clark Osborne, T. L. Bibb and D. F. Watson - Veterinary Science)

The objectives of this project are to determine the nutritional and diagnostic characteristics of Vibrio fetus, Vibrio bubulus, Vibrio coli and related organisms; to investigate the chemical composition of the cell wall of V. fetus, V. bubulus and related organisms as well as the ratio of guanine and cytosine to all purine and pyrimidine bases in their nucleic acids; to determine the mechanism and role of endotoxins from gram-negative bacteria (V. fetus) in abortion of cattle and sheep; to isolate and identify anaerobic bacteria and Streptococcus spp. from aborted cattle and sheep fetuses. Isolated organisms will be studied and tested for their ability to cause abortion. The end result of these investigations should lead to a fuller understanding of the infectious agents involved in reproductive failures and point to needed control measures.

Future Plans: This project was terminated 6-30-74 and replaced by a project dealing specifically with reproductive diseases of cattle.

	<u>1973-74</u>
SMY -----	0.3
Support Personnel -----	0.7
Total Expenditures -----	\$11,884

Basic Biology

626100, HETEROSIS FROM CROSSES AMONG BRITISH BREEDS OF BEET CATTLE (J. A. Gaines - Animal Science)

The objectives of this project are to measure: (1) heterosis obtained from crosses among the Angus, Hereford and Shorthorn breeds, as shown by fertility and livability, growth rate, fattening ability and carcass quality; and (2) differences between straightbred and crossbred cows on the basis of lifetime production.

Future Plans: To continue the study for at least one more calf crop and prepare to study "wider" crosses as cows and some "new" breeds.

	<u>1973-74</u>
SMY -----	0.8
Support Personnel -----	2.0
Total Expenditures -----	\$34,576

200065, EVALUATION OF THE EFFECTIVENESS OF SELECTION FOR ECONOMIC TRAITS IN BEEF CATTLE (T. J. Marlowe - Animal Science)

The objectives of this project were to: (1) estimate several genetic parameters of beef cattle from field data; (2) study location effects on performance records and adjustment factors needed; (3) study the factors influencing performance and sale price of ROP bulls, and (4) evaluate the effectiveness of selection under farm conditions.

Future Plans: This project will be replaced by a project to measure the genetic change in BCIA herds by comparing the performance of contemporary progenies produced in the same herd and year from two groups of tested bulls with birth dates differing by 2 to 3 cattle generations.

	<u>1973-74</u>
SMY -----	
Support Personnel -----	
Total Expenditures -----	\$1,207

Biological Efficiency

2000410, FORAGES FOR BEEF CATTLE PRODUCTION (R. C. Hammes, Jr., H. T. Bryant and R. E. Blaser - Agronomy)

Three major research objectives are: (1) To manage forage-animal systems for efficient calf raising, (2) To finish the fattening of cattle with high energy forages at 18 months, (3) To ascertain the nutritional value of tall fescue varieties. Ten intensive systems of forage-animal management are directed toward raising a 90% calf crop weighing 500 lbs. or more at weaning.

Future Plans: The nutritional values of corn silage, a short dwarf grain sorghum, a taller grain sorghum and a forage sorghum are being tested. Liveweight gains of steers grazing nitrogen fertilized Ky 31 fescue and Ken Hy fescue are being investigated.

	<u>1973-74</u>
SMY -----	1.9
Support Personnel -----	10.9
Total Expenditures -----	\$119,428

6161960, EVALUATION OF CHITINOUS SOURCES AS FEED FOR RUMINANTS (P. T. Chandler - Dairy Science)

The objectives of this project are to determine the nutritive value of chitinous waste material as well as other sources of waste, specifically cattle manure.

Future Plans: Fistulated steers will be fed rations containing chitinous waste until ration adaptation has been accomplished. Following adaptation rumen inoculum will be obtained and used to inoculate animals that have not received chitinous waste. These animals and comparable controls will then be fed chitinous rations to determine the benefit of inoculation.

	<u>1973-74</u>
SMY -----	0.1
Support Personnel -----	1.0
Total Expenditures -----	\$24,569

626100, HETEROSIS FROM CROSSES AMONG BRITISH BREEDS OF BEET CATTLE (J. A. Gaines - Animal Science)

The objectives of this project are to measure: (1) heterosis obtained from crosses among the Angus, Hereford and Shorthorn breeds, as shown by fertility and livability, growth rate, fattening ability and carcass quality; and (2) differences between straightbred and crossbred cows on the basis of lifetime production.

Future Plans: To continue the study for at least one more calf crop and prepare to study "wider" crosses as cows and some "new" breeds.

	<u>1973-74</u>
SMY -----	0.8
Support Personnel -----	2.0
Total Expenditures -----	\$34,576

616069, BASIC NUTRITION OF BEEF CATTLE (J. P. Fontenot - Animal Science)

The overall objective is to study fundamental aspects of the nutrition of ruminants.

Future Plans: To study interrelationships of certain dietary factors and magnesium utilization, toxicity of magnesium, biological availability of magnesium from natural feeds and supplemental sources of magnesium. Studies will be continued on methane production in cattle and methods of inhibiting it. Research will be directed toward improvement of utilization of non-protein nitrogen in ruminants fed low quality roughages.

	<u>1973-74</u>
SMY -----	1.6
Support Personnel -----	8.7
Total Expenditures -----	\$118,581

616051, TOP AND ROTATIONAL CROSSING WITH BEEF BULLS FROM INBRED AND SINGLE TRAIT SELECTION LINES (R. C. Carter - Animal Science)

The objective of this project is to test the breeding value of Shorthorn inbred and single trait selection lines developed at the Front Royal Beef Cattle Research Station.

Future Plans: The breeding work, in cooperation with the Mississippi Station, has been terminated and the resulting data will be analysed as

soon as practical. The matings in the Shorthorn lines at Blacksburg will be continued through the 1974 breeding season and this portion of the project will be complete except for analyses of data when the 1975 calf crop has been slaughtered.

	<u>1973-74</u>
SMY -----	0.8
Support Personnel -----	4.7
Total Expenditures -----	\$56,822

200227, EFFECT OF ENVIRONMENTAL, ENDOCRINE AND NUTRITION FACTORS ON REPRODUCTION IN FARM ANIMALS (T. N. Meacham - Animal Science)

The objectives of this project are (1) to study the reproductive performance of exotic beef breed crosses under four winter management systems (2) to evaluate the reproductive efficiency of Angus vs. Angus x Holstein cows wintered on two levels of energy intake (80 vs. 100% N.R.C. requirements) (3) to study the effects of physical (concrete vs. dirt lots) and social (individual rearing vs. group rearing with and without presence of females) environments on the reproductive development of boars and (4) to develop extenders for ram spermatozoa that will maintain fertility through the freeze - thaw process.

Future Plans: The project will be carried on with continued work under objectives one, two and three. A new area of work involving methods of evaluating the breeding potential of young beef bulls is being developed.

	<u>1973-74</u>
SMY -----	0.2
Support Personnel -----	1.3
Total Expenditures -----	\$14,811

200212, EVALUATING SIRE AND DAM BREEDS IN CROSSBREEDING PROGRAMS FOR MAXIMIZING BEEF PRODUCTION (T. J. Marlowe, T. L. Bibb and R. C. Carter - Animal Science)

This is a cooperative project with the Virginia Department of Welfare and Institutions. The objectives are to: (1) evaluate several sire breeds, including Charolais and Simmental, for crossbreeding on Angus and Hereford cows; (2) compare the productivity of several kinds of crossbred cows with each other and with straightbred cows when bred to different sire breeds; and (3) determine the combination of breeds most effective in maximizing beef production.

Future Plans: Plans are to carry the project through a minimum of four calf crops of single crosses and four calf crops comparing crossbred and straightbred dams. Comparison criteria will include fertility, birth weights, pre- and post-weaning growth rates and conformation scores, carcass quality and quantity and mature cow weights.

	<u>1973-74</u>
SMY -----	0.9
Support Personnel -----	1.9
Total Expenditures -----	\$16,090

200069, THE USE OF PURIFIED AND SEMI-PURIFIED RATIONS TO DETERMINE NUTRIENT FUNCTIONS, METABOLISM, REQUIREMENTS AND INTERRELATIONSHIPS IN RUMINANTS (K. E. Webb, Jr. - Animal Science)

The broad objective of this project is to determine, specifically, nutrient requirements, functions, metabolism and interrelationships in ruminants, with and without rumen fermentation, for maximum performance and normal health. Included in this objective is the development of cellulose-containing purified rations for studying the nutrient requirements and functions for maximum cellulose digestibility and nitrogen utilization and maximum rate and efficiency of gain as compared to commonly-fed natural rations.

Future Plans: This project is being replaced by a new project which will focus specifically on protein and nonprotein nitrogen utilization by ruminants.

	<u>1973-74</u>
SMY -----	0.2
Support Personnel -----	0.6
Total Expenditures -----	\$6,538

200066, HIGH SILAGE RATIONS FOR BEEF CATTLE AND SHEEP (J. P. Fontenot - Animal Science)

Research has been directed toward optimizing supplementation to silage for beef cattle and sheep. Present studies include different sources and forms of non-protein nitrogen supplements and levels of non-absorbable antibiotics.

Future Plans: Research will be conducted on various systems of fattening cattle with maximum use of forage. Value of grain preservatives and of administering growth stimulants will be investigated. Emphasis will be placed on evaluating new non-protein nitrogen sources.

	<u>1973-74</u>
SMY -----	0.5
Support Personnel -----	2.1
Total Expenditures -----	\$31,830

200065, EVALUATION OF THE EFFECTIVENESS OF SELECTION FOR ECONOMIC TRAITS
IN BEEF CATTLE (T. J. Marlowe - Animal Science)

The objectives of this project were to: (1) estimate several genetic parameters of beef cattle from field data; (2) study location effects on performance records and adjustment factors needed; (3) study the factors influencing performance and sale price of ROP bulls, and (4) evaluate the effectiveness of selection under farm conditions.

Future Plans: This project will be replaced by a project to measure the genetic change in BCIA herds by comparing the performance of contemporary progenies produced in the same herd and year from two groups of tested bulls with birth dates differing by 2 to 3 cattle generations.

	<u>1973-74</u>
SMY -----	0.1
Support Personnel -----	0.3
Total Expenditures -----	\$10,868

200064, IMPROVEMENT OF ECONOMIC TRAITS IN BEEF CATTLE THROUGH BREEDING
(K. P. Bovard and R. C. Carter - Animal Science; W. T. Butts -
Animal Science Research Division, ARS, USDA)

Objectives of this research are: (1) estimate progress to be expected from mass selection as compared with family selection in the improvement of beef cattle, (2) evaluate selection criteria and procedures and develop more precise and effective measures of quality and performance in beef cattle; and (3) simplify methods of progeny or sib testing whereby breeding cattle can be evaluated at comparatively young ages.

Future Plans: Examine postweaning performance and fertility data from the entire project with special interest in differences between the inbred and selection mating systems.

	<u>1973-74</u>
SMY -----	0.8
Support Personnel -----	5.4
Total Expenditures -----	\$75,926

Chemical and Physical Properties

616071, CARCASS TISSUE CHARACTERISTICS, COMPOSITION AND APPRAISAL OF
MEAT ANIMALS (R. F. Kelly - Food Science and Technology)

A major objective of this project is to develop procedures for
evaluation of beef, pork and lamb carcasses by new techniques.

Future Plans: Include the use of neutron activation analysis (NAA)
for trace elements in meat and a study of bone characteristics of the
present meat animal population.

	<u>1973-74</u>
SMY -----	0.1
Support Personnel -----	0.1
Total Expenditures -----	\$8,085

Analysis of Supply, Demand and Price

626127, EVALUATION OF THE BEEF INDUSTRY IN THE SOUTH (S-67) (R. G. Kline and Charles Cameron - Agricultural Economics)

The general objective of this regional study is to provide knowledge needed by decision makers in firm and policy levels when planning for future beef production in the South.

Future Plans: This project has been extended to June 30, 1975. Results of analyses made to evaluate alternative beef production systems will be published and made available to farmers, the beef industry, governmental agencies and other interested parties.

	<u>1973-74</u>
SMY -----	0.1
Support Personnel -----	0.5
Total Expenditures -----	\$8,036

Management to Maximize Income

6162210, ALTERNATIVE MARKETING AND HEDGING STRATEGIES FOR VIRGINIA
GRAIN AND LIVESTOCK PRODUCERS (David Kenyon - Agricultural
Economics)

In this project the economic potential of alternative marketing strategies using the futures market for grain and livestock producers and handlers in Virginia will be evaluated. The project will involve developing a data bank on prices and basis to be placed on the Computerized Management Network (CMN), price prediction equations, evaluation of alternative hedging strategies, and presentation of workshops on how to effectively use the futures market as a marketing tool.

Future Plans: Present workshops on futures trading and continue analysis on alternative hedging strategies.

1973-74

SMY -----	
Support Personnel -----	
Total Expenditures -----	\$4,180

626127, EVALUATION OF THE BEEF INDUSTRY IN THE SOUTH (S-67) (R. G.
Kline and Charles Cameron - Agricultural Economics)

The general objective of this regional study is to provide knowledge needed by decision makers in firm and policy levels when planning for future beef production in the South.

Future Plans: This project has been extended to June 30, 1975. Results of analyses made to evaluate alternative beef production systems will be published and made available to farmers, the beef industry, governmental agencies and other interested parties.

1973-74

SMY -----	0.3
Support Personnel -----	0.8
Total Expenditures -----	\$14,923

Increasing Consumer Acceptability

616069, BASIC NUTRITION OF BEEF CATTLE (J. P. Fontenot - Animal Science)

The overall objective is to study fundamental aspects of the nutrition of ruminants.

Future Plans: To study interrelationships of certain dietary factors and magnesium utilization, toxicity of magnesium, biological availability of magnesium from natural feeds and supplemental sources of magnesium. Studies will be continued on methane production in cattle and methods of inhibiting it. Research will be directed toward improvement of utilization of non-protein nitrogen in ruminants fed low quality roughages.

	<u>1973-74</u>
SMY -----	0.2
Support Personnel -----	1.0
Total Expenditures -----	\$13,175

Maintaining Quality During Marketing

616173, MICROBIOLOGICAL AND ENVIRONMENTAL FACTORS AFFECTING QUALITY OF MEAT PRODUCTS (Paul P. Graham - Food Science and Technology)

Objectives of this project are to investigate the interrelationships of bacteria, chemical properties and shelf-life characteristics of meat products.

Future Plans: To relate kinds of microorganisms present to processing conditions and to chemical properties of the product. Study the individual and associative effects of these final process flora on shelf-life characteristics to thus provide specific information for the establishment of workable guidelines concerning allowable bacteria in the various meat products.

	<u>1973-74</u>
SMY -----	0.2
Support Personnel -----	0.6
Total Expenditures -----	\$10,603

DAIRY CATTLE

Virginia's proximity to large centers of population and the present highly competitive position of its dairy industry to that in other southeastern states are just two of the important factors that give dairying a great potential. There are, however, many problems which must be solved through research if this potential is to be reached.

The industry is faced with rapid change, growing complexity, increased automation, increased biological demands on cattle and changing marketing patterns. Fewer but larger and more highly concentrated dairy farms, higher producing dairy cows, high capital investments per farm, high labor requirements, increased government regulations and controls, changing marketing patterns, lower per capita consumption, growing complexity of the total business enterprise, all present major challenges to the industry.

Research programs are designed to get the right answers to many questions affecting the dairy farmers and the continuation of an adequate supply of milk and milk products for Virginia. Among the more important research areas are: alternative protein feed sources, more rapid and effective utilization of available information and technology, increased reproductive efficiency, more effective labor utilization, and overall dairy herd and business management.

Summary of 1973-74 Programs

	<u>SMY</u>	<u>Support Personnel</u>	<u>Expenditures</u>
Insect Control	0.2	0.6	\$ 11,741
Disease and Parasite Control	0.6	2.0	34,843
Basic Biology	2.6	8.3	185,067
Biological Efficiency	3.5	11.3	259,613
Management to Maximize Income	0.3	1.0	12,590
New and Improved Products	1.1	1.7	43,299
Analysis of Supply, Demand and Price	-	-	1,894
Market Efficiency	0.1	0.1	2,795
Administration	-	-	76,856
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Total	8.4	25.0	\$ 628,698

Insect Control

616144, BIONOMICS AND POPULATION MANAGEMENT OF MAJOR PESTS OF MAN AND DOMESTIC ANIMALS (E. C. Turner, Jr. - Entomology)

The objectives of this project are to investigate the regulatory effect of most species of manure-breeding pest flies on dairy cattle and other flies located around dairy barns; to initiate field experiments on control of house flies in poultry laying houses; to evaluate several insecticide formulations and methods of application for control of pests of horses; and to continue ecological studies both in the field and the laboratory of Virginia species of Culicoides biting midges.

Future Plans: These will include a continuation of the evaluation of certain chemical and non-chemical methods for the management and control of external pests of cattle, horses and poultry. Of special interest will be the investigation of the practical effectiveness of juvenile hormones as a biological method for pest regulation of dipterous insects. Laboratory nutritional studies of Culicoides guttipennis will also be expanded.

	<u>1973-74</u>
SMY -----	0.2
Support Personnel -----	0.6
Total Expenditures -----	\$11,741

Disease and Parasite Control

200327-0, DISEASE AS A DETERRENT TO INCREASED AND MORE EFFICIENT ANIMAL PRODUCTION (D. F. Watson - Veterinary Science)

Objectives of this research are (1) to investigate the disease process as it affects increased and more efficient production of animal origin food and fiber, (2) to continue our investigation of gastric and intestinal ulcers as they occur in animals and birds, (3) to continue our efforts to find a diagnostic method for liver diseases in animals, and (4) to investigate better methods for parasite control based on cultivation of parasites in vitro and in vivo.

Work on the Pink Eye vaccine evaluation will be continued as well as an evaluation of ultra violet radiation in the ceiling as a control of environmental bacteria in a confinement swine facility.

	<u>1973-74</u>
SMY -----	0.1
Support Personnel -----	0.5
Total Expenditures -----	\$11,076

616014, INFECTIOUS DISEASES AFFECTING REPRODUCTION IN CATTLE AND SHEEP (J. Clark Osborne, T. L. Bibb and D. F. Watson - Veterinary Science)

The objectives of this project are to determine the nutritional and diagnostic characteristics of Vibrio fetus, Vibrio bubulus, Vibrio coli and related organisms; to investigate the chemical composition of the cell wall of V. fetus, V. bubulus and related organisms as well as the ratio of guanine and cytosine to all purine and pyrimidine bases in their nucleic acids; to determine the mechanism and role of endotoxins from gram-negative bacteria (V. fetus) in abortion of cattle and sheep; to isolate and identify anaerobic bacteria and Streptococcus spp. from aborted cattle and sheep fetuses. Isolated organisms will be studied and tested for their ability to cause abortion. The end result of these investigations should lead to a fuller understanding of the infectious agents involved in reproductive failures and point to needed control measures.

Future Plans: This project was terminated 6-30-74 and replaced by a project dealing specifically with reproductive diseases of cattle.

	<u>1973-74</u>
SMY -----	0.5
Support Personnel -----	1.5
Total Expenditures -----	\$23,767

Basic Biology

6161170, EVALUATION OF SELECTION FOR MILK YIELD AND ITS RELATION TO
MEASURES OF MEAT PRODUCTION, FERTILITY, AND OTHER TRAITS
IN DAIRY CATTLE (J. M. White - Dairy Science)

The objectives of this project are to evaluate the relative rate at which dairy herds may be improved genetically for milk yield and the effect that intensive selection for milk yield may have upon other characteristics of the dairy cows such as type, milk composition, growth, reproductive efficiency, and susceptibility to mastitis and other diseases.

Future Plans: During the next year two Masters candidates will complete their theses research on various aspects of this project. Continuation of the project according to the original plan is anticipated with continuing critical review.

	<u>1973-74</u>
SMY -----	0.2
Support Personnel -----	1.0
Total Expenditures -----	\$21,867

6162000, ARTIFICIAL INDUCTION OF LACTATION IN THE BOVINE:
CYTOLOGICAL CHANGES IN MAMMARY DEVELOPMENT (C. W.
Heald and R. G. Saacke - Dairy Science; T. L. Bibb -
Veterinary Science) Revision of Project 6160750

The objectives of this study are to establish the cytological and histological characteristics of the bovine mammary gland during the growth, differentiation, galactopoieses and involution of the normal mammary gland and hormonally manipulated mammary gland.

Future Plans: This project is being expanded to test factors which influence rate of gland development, gland infection, and gland involution thus providing insight into management factors which are important to efficient milk production in lactating animals. A major interest is to develop artificial induction of lactation without pregnancy to a point where it will be practical for dairymen to routinely apply.

	<u>1973-74</u>
SMY -----	0.7
Support Personnel -----	2.9
Total Expenditures -----	\$52,733

616198, ESTIMATING GENETIC MERIT OF DAIRY SIRES FROM PEDIGREE AND PROGENY TEST INFORMATION (W. E. Vinson - Dairy Science)

The objectives of this project are: (1) To determine the accuracy of pedigree evaluations and the response to pedigree selection in populations of laboratory mice; (2) To characterize the relationship of accuracy to both the amounts and sources of pedigree information in selected and unselected populations; and (3) To develop optimum systems of using pedigree information in the genetic improvement of dairy cattle for both type and production.

Future Plans: Preliminary analysis of results from the first eight generations of pedigree selection is underway. Analysis of pedigree evaluations for production traits is progressing while that for type traits is nearly complete. The effects of discontinuity of type measurements on pedigree evaluations and selection response is being investigated.

	<u>1973-74</u>
SMY -----	0.9
Support Personnel -----	1.2
Total Expenditures -----	\$13,632

616194, GERM CELL STRUCTURE AND FUNCTION (R. G. Saacke - Dairy Science)
Revision of Project 6160740

The objectives of this project are to establish critical laboratory tests capable of predicting fertility of bull semen used in artificial breeding. Aging characteristics of live spermatozoa, after ejaculation, are being quantitated using differential interference microscopy. Also, sperm morphology is being studied qualitatively using electron microscopy and quantitatively using bright field microscopy. Evaluation of bovine ova and young embryos are also underway with the hope of better understanding subfertility and embryonic death.

Future Plans: To use the semen evaluation criteria in understanding the role of the female genital fluids in sperm maintenance and preparation for fertilization.

	<u>1973-74</u>
SMY -----	0.8
Support Personnel -----	3.2
Total Expenditures -----	\$96,835

Biological Efficiency

626218, REPRODUCTIVE EFFICIENCY OF CATTLE (R. G. Saacke and J. M. White - Dairy Science)

The objectives of this project are to establish laboratory tests capable of predicting fertility of male germ cells and improving conception rate in cattle. This project is closely aligned with project 616194 and has as an additional purpose the dissemination of research information within the Southern Regional area of the United States.

Future Plans: To continue to work toward better methods of handling and evaluating semen and to continue to work closely with other research groups within the southeast United States.

	<u>1973-74</u>
SMY -----	0.3
Support Personnel -----	0.1
Total Expenditures -----	\$5,230

200069, THE USE OF PURIFIED AND SEMI-PURIFIED RATIONS TO DETERMINE NUTRIENT FUNCTIONS, METABOLISM, REQUIREMENTS AND INTERRELATIONSHIPS IN RUMINANTS (K. E. Webb, Jr. - Animal Science)

The broad objective of this project is to determine, specifically, nutrient requirements, functions, metabolism and interrelationships in ruminants, with and without rumen fermentation, for maximum performance and normal health. Included in this objective is the development of cellulose-containing purified rations for studying the nutrient requirements and functions for maximum cellulose digestibility and nitrogen utilization and maximum rate and efficiency of gain as compared to commonly-fed natural rations.

Future Plans: This project is being replaced by a new project which will focus specifically on protein and nonprotein nitrogen utilization by ruminants.

	<u>1973-74</u>
SMY -----	0.1
Support Personnel -----	0.4
Total Expenditures -----	\$4,903

6161170, EVALUATION OF SELECTION FOR MILK YIELD AND ITS RELATION TO
MEASURES OF MEAT PRODUCTION, FERTILITY, AND OTHER TRAITS
IN DAIRY CATTLE (J. M. White - Dairy Science)

The objectives of this project are to evaluate the relative rate at which dairy herds may be improved genetically for milk yield and the effect that intensive selection for milk yield may have upon other characteristics of the dairy cows such as type, milk composition, growth, reproductive efficiency, and susceptibility to mastitis and other diseases.

Future Plans: During the next year two Masters candidates will complete their theses research on various aspects of this project. Continuation of the project according to the original plan is anticipated with continuing critical review.

	<u>1973-74</u>
SMY -----	0.2
Support Personnel -----	1.7
Total Expenditures -----	\$32,800

616193, PLASMA HORMONAL RELATIONSHIPS IN DAIRY COWS DURING PARTURITION,
LACTATION, ESTROUS CYCLE AND PREGNANCY (G. C. Graf - Dairy
Science)

The objectives of this project have been to determine the relationships of progesterone, estradiol, prolactin and oxytocin in the plasma of cows during stress situations such as parturition, estrus, pregnancy and lactation and to relate the hormonal relationships to milk yields.

This project has been brought to a conclusion.

	<u>1973-74</u>
SMY -----	0.5
Support Personnel -----	
Total Expenditures -----	\$20,313

616195, COMPOSITION OF REPRODUCTIVE TRACT FLUIDS IN COWS WITH HIGH
AND LOW REPRODUCTIVE EFFICIENCY (J. A. Lineweaver - Dairy
Science)

The objectives of this project are to determine the chemical composition of oviduct and uterine secretions at various stages during the reproductive cycle of the reproductively normal cow, to compare

oviduct and uterine secretions between normal and repeat breeder cows and to develop methods for in vivo recovery of uterine fluids from the cow without physiological alterations.

Future Plans: This project is in its second year. After in vivo recovery techniques are perfected and the normal cows reproductive fluids are characterized, the female fluids-sperm viability relationship will be studied.

	<u>1973-74</u>
SMY -----	0.6
Support Personnel -----	1.3
Total Expenditures -----	\$32,754

6161960, EVALUATION OF CHITINOUS SOURCES AS FEED FOR RUMINANTS (P. T. Chandler - Dairy Science)

The objectives of this project are to determine the nutritive value of chitinous waste material as well as other sources of waste, specifically cattle manure.

Future Plans: Fistulated steers will be fed rations containing chitinous waste until ration adaptation has been accomplished. Following adaptation rumen inoculum will be obtained and used to inoculate animals that have not received chitinous waste. These animals and comparable controls will then be fed chitinous rations to determine the benefit of inoculation.

	<u>1973-74</u>
SMY -----	0.2
Support Personnel -----	1.0
Total Expenditures -----	\$24,570

616197, RESPONSES OF GROWING AND LACTATING RUMINANTS TO SUPPLEMENTAL AMINO ACIDS (P. T. Chandler, C. E. Polan, T. L. Bibb and C. N. Miller - Dairy Science) Revision of Project 616091

The objectives of this project are to determine responses of dairy cattle to supplementations of synthetic amino acids and to establish the effect of ration on level and balance of available amino acids for ruminants.

Future Plans: Nutritive evaluation of three varieties of corn

silage will be made (normal, high lysine and high lysine plus methionine). Ensiling, rumen fermentation and feeding values will be measured in growing heifers followed by lactation studies with cows. In an additional study a response curve to methionine analog supplementation will be generated for 12 to 16% crude protein rations. Tissue culture techniques will be utilized to continue the refinement of the quantitative requirements of the isolated mammary cell for amino acids.

	<u>1973-74</u>
SMY -----	0.5
Support Personnel -----	2.6
Total Expenditures -----	\$46,880

6161990, ROLES OF VOLATILE FATTY ACIDS, HORMONES AND CARNITINE ON REGULATING LIPID METABOLISM IN LACTATING COWS (C. E. Polan, P. T. Chandler and C. N. Miller - Dairy Science) Revision of Projects 6160930 and 6160940

The objectives of this project are to establish the factors controlling gluconeogenic-lipogenic activities in the lactating cow and the role of major energy sources and their relationships to the major hormones controlling metabolism.

Future Plans: Cows needed to be fed high grain rations on an equal energy basis with more conventional grain levels to compare the effects on blood values and milk fat production. This would pinpoint the energy contribution to milk fat compared to different ruminal volatile fatty acids.

	<u>1973-74</u>
SMY -----	1.0
Support Personnel -----	4.1
Total Expenditures -----	\$87,390

626137, GENETIC METHODS OF IMPROVING DAIRY CATTLE FOR THE SOUTH (J. M. White - Dairy Science)

This project contributes to the S-49 regional dairy cattle breeding research project. Its objective is to evaluate breeding systems that will result in optimal efficiency of milk production in the Southeastern region. The Virginia contribution to this project is designed to evaluate single trait (milk yield) selection as a breeding system.

Future Plans: This project will be continued next year. The regional project will be revised this year.

	<u>1973-74</u>
SMY -----	0.1
Support Personnel -----	0.1
Total Expenditures -----	\$4,773

Management to Maximize Income

6161890, DEVELOPMENT OF A MANAGEMENT INFORMATION AND CONTROL SYSTEM FOR FLUID MILK PLANTS (H. M. Harris, Jr. - Agricultural Economics)

The objective of this study is to design, test and implement an information system that will enable managers to improve in-plant efficiency in fluid milk operations. The model involves aspects of sales forecasting, labor and equipment scheduling, inventory and procurement policy and financial analysis.

Future Plans: Further testing of the model with additional plants is needed to develop general application. The model will be broadened to include management information on other key decision variables.

	<u>1973-74</u>
SMY -----	0.2
Support Personnel -----	0.8
Total Expenditures -----	\$8,853

626127, EVALUATION OF THE BEEF INDUSTRY IN THE SOUTH (S-67) (R. G. Kline and Charles Cameron - Agricultural Economics)

The general objective of this regional study is to provide knowledge needed by decision makers in firm and policy levels when planning for future beef production in the South.

Future Plans: This project has been extended to June 30, 1975. Results of analyses made to evaluate alternative beef production systems will be published and made available to farmers, the beef industry, governmental agencies and other interested parties.

	<u>1973-74</u>
SMY -----	0.1
Support Personnel -----	0.2
Total Expenditures -----	\$3,737

New and Improved Products

6160080, USE OF CONCENTRATED DRIED AND FROZEN MILK PRODUCTS (W. K. Stone - Food Science and Technology)

Objectives of this project are to improve thermal characteristics, increase bactericidal efficiency and reduce product damage by ultra-high temperature (UHT) treatments in high-pressure turbulent-flow heat transfer systems; develop methods for measuring bactericidal efficiency of UHT processes and for making fluorometric measurements of sulfhydryl and disulfide groups activated by UHT processes; determine effects of milk solids on bactericidal efficiency, enzyme inactivation and chemical changes by UHT treatments; and develop UHT processing procedures for making foam-spray dried milk products for use in fortified milks, cottage cheese and frozen desserts.

Future Plans: Continue research on development of UHT processes for manufacture of fluid, concentrated and dried milk products and on effects of UHT processes on nutritional properties, especially vitamin degradation by aseptic UHT processing and packaging.

	<u>1973-74</u>
SMY -----	1.1
Support Personnel -----	1.7
Total Expenditures -----	\$43,299

Analysis of Supply, Demand and Price

6261330, MARKET ORGANIZATION, POWER AND POLICIES AND PROGRAMS IN THE
DAIRY INDUSTRY (M. C. Conner - Agricultural Economics)

The objective of this project is to identify the changes in market organization now taking place in the dairy industry and to determine the effect of these changes on the market relationships of dairymen, milk processors and food retailers. A better understanding of these relationships should provide a basis for the development of more effective public policies and programs.

Future Plans: Using a regional model for the South, continue efforts to determine the effects of various changes in organization on the costs and returns to different groups in the industry. Also, identify some of the critical issues confronting each group in the face of these changes. Increasing attention will be given to analyzing the existing and alternative pricing systems for the dairy industry.

1973-74

SMY -----	
Support Personnel -----	
Total Expenditures -----	\$1,894

Market Efficiency

6261330, MARKET ORGANIZATION, POWER AND POLICIES AND PROGRAMS IN THE
DAIRY INDUSTRY (M. C. Conner - Agricultural Economics)

The objective of this project is to identify the changes in market organization now taking place in the dairy industry and to determine the effect of these changes on the market relationships of dairymen, milk processors and food retailers. A better understanding of these relationships should provide a basis for the development of more effective public policies and programs.

Future Plans: Using a regional model for the South, continue efforts to determine the effects of various changes in organization on the costs and returns to different groups in the industry. Also, identify some of the critical issues confronting each group in the face of these changes. Increasing attention will be given to analyzing the existing and alternative pricing systems for the dairy industry.

	<u>1973-74</u>
SMY -----	0.1
Support Personnel -----	0.1
Total Expenditures -----	\$2,795

POULTRY

Virginia's poultry industry includes turkeys, broilers and laying hens. The characteristics of these enterprises have changed rapidly and dramatically within the last 20 years. Rapid application of research technology has provided consumers with high quality products at very reasonable prices. The economic returns per bird are, however, presently, at very low levels. This in turn has forced producers to increase the size of their flocks and has made the poultry industry one of the highest risk enterprises in agriculture. Among the most important research problems are those related to disease and parasite control, housing, efficient feeding and waste disposal.

Summary of 1973-74 Programs

	<u>SMY</u>	<u>Support Personnel</u>	<u>Expenditures</u>
Insect Control	0.2	0.7	\$ 11,742
Disease Control	3.6	8.2	150,741
Basic Biology	1.1	4.9	74,268
Biological Efficiency	3.4	19.9	290,457
Mechanization and Labor Efficiency	0.3	1.5	22,509
New and Improved Products	0.3	0.5	11,020
Chemical and Physical Properties	0.7	1.2	22,041
Maintaining Quality During Marketing	0.3	0.6	11,021
Administration	-	-	82,742
Total	9.9	37.5	\$ 676,541

Insect Control

616144, BIONOMICS AND POPULATION MANAGEMENT OF MAJOR PESTS OF MAN AND DOMESTIC ANIMALS (E. C. Turner, Jr. - Entomology)

The objectives of this project are to investigate the regulatory effect of most species of manure-breeding pest flies on dairy cattle and other flies located around dairy barns; to initiate field experiments on control of house flies in poultry laying houses; to evaluate several insecticide formulations and methods of application for control of pests of horses; and to continue ecological studies both in the field and the laboratory of Virginia species of Culicoides biting midges.

Future Plans: These will include a continuation of the evaluation of certain chemical and non-chemical methods for the management and control of external pests of cattle, horses and poultry. Of special interest will be the investigation of the practical effectiveness of juvenile hormones as a biological method for pest regulation of dipterous insects. Laboratory nutritional studies of Culicoides guttipennis will also be expanded.

	<u>1973-74</u>
SMY -----	0.2
Support Personnel -----	0.7
Total Expenditures -----	\$11,742

Disease Control

616004-0, CONTROL OF RESPIRATORY DISEASES OF POULTRY (R. T. DuBose,
W. B. Gross and C. H. Domermuth - Veterinary Science)

Purpose: To determine the interacting factors, including social stress, in respiratory infections and to devise methods of reducing respiratory diseases of poultry.

Future Work: A method for prevention of a highly fatal adenovirus infection in recreational birds by management systems will be studied under commercial conditions. The economic feasibility and safety of retaining high-value breeders that were previously infected with viral arthritis virus will be determined. Investigation of the effect of stress on resistance against parasitic diseases and on ability to respond to vaccines will continue.

	<u>1973-74</u>
SMY -----	1.4
Support Personnel -----	3.3
Total Expenditures -----	\$62,742

616085-0, ENTERIC INFECTIONS OF POULTRY (C. H. Domermuth, W. B. Gross
and R. T. DuBose - Veterinary Science)

Purpose: To determine causes, mechanisms of infection and methods of diagnosis and control of enteric diseases of poultry.

Future Plans: We will continue to work on enteric infections of economic significance and determine if and how the apparently non-pathogenic viruses referred to above can be used as vaccine strains of virus.

	<u>1973-74</u>
SMY -----	1.7
Support Personnel -----	3.5
Total Expenditures -----	\$67,309

616188, PHYSIOLOGY OF STRESS AS RELATED TO HEALTH AND DISEASE (G.
Colmano - Veterinary Science)

Objective: A profile on seven parameters (corticosterone, Fe-ascorbic acid, Cu-ceruloplasmin, oxidative potential, tetraporphorin

chromophore, protein and peptide chromophore) extrapolated from the comparison of the absorption spectra from 700 to 185 nm of 0.075 ml of oxidized versus reduced blood plasma, screened animals predisposed to disease acquisition by separating unstressed from stressed and healthy from diseased animals.

Future Plans: Application of this new method to different animal species (birds, pigs, ruminants, horses and laboratory animals) including humans is in progress, with collection of basic data differentiating different conditions of stress, health and disease.

	<u>1973-74</u>
SMY -----	0.5
Support Personnel -----	1.4
Total Expenditures -----	\$20,690

Basic Biology

200138, GENETICS AND ONTOGENY OF BEHAVIOR IN CHICKENS AND QUAIL (P. B. Siegel - Poultry Science)

This project was designed to study the inheritance and ontogeny of behaviors in gallinaceous birds. Emphasis is given to behavior-genetic analyses of mating behavior, aggressive behavior and learning in the fowl and quail. Investigations also include the physiological mechanisms involved with these traits.

Future Plans: Efforts will be directed to elucidating the effect of selection for male mating behavior on correlated responses of females. Comparison will be made of the mode of inheritance of behaviors in chickens and quail.

	<u>1973-74</u>
SMY -----	0.4
Support Personnel -----	4.0
Total Expenditures -----	\$43,403

616021, AVIAN ENVIRONMENTAL BIOLOGY: GENETIC PHYSIOLOGICAL INTERRELATIONSHIPS (W. L. Beane - Poultry Science)

The utilization of new and used wood shavings as a litter in conjunction with nutritional factors for broiler production is being evaluated.

Effect of high environmental temperature on egg production of coturnix quail is being evaluated and a selection experiment based on these criteria is underway.

Future Plans: Broiler studies in which litter management will be incorporated with nutritional variables are planned.

Emphasis will be placed on the selection study with the coturnix quail.

	<u>1973-74</u>
SMY -----	0.7
Support Personnel -----	0.9
Total Expenditures -----	\$30,865

Biological Efficiency

200319, DETECTION ISOLATION AND IDENTIFICATION OF UNIDENTIFIED GROWTH FACTORS IN FEED INGREDIENTS USED IN TURKEY RATIONS (L. M. Potter - Poultry Science)

In previous studies of this project, fish meal, dried whey and corn fermentation solubles were found to contain an unidentified growth factor in diets of young turkeys. From additional experiments conducted this year, the relative potency of the factor in fish meal and corn fermentation solubles was determined. Several fractions have been made from fish meal and each has been fed to turkeys from one day to four weeks of age. As a result, some progress has been made to concentrate the growth factor in fish meal.

Future Plans: Additional studies are planned in future experiments with the various fractions of fish meal to further concentrate and hopefully isolate the growth-promoting factor in this ingredient.

	<u>1973-74</u>
SMY -----	0.4
Support Personnel -----	3.6
Total Expenditures -----	\$30,946

200145, FIELD EVALUATION OF POULTRY POPULATIONS (A. T. Leighton, Jr., L. M. Potter and H. P. Van Krey - Poultry Science)

The objectives of this project are to confirm research results obtained at VPI&SU through supervised field trials under commercial conditions, to help the producer see the application of turkey research results within his own facility and to coordinate research and extension efforts for maximum service to the turkey industry.

Future Plans: Additional field trials will be initiated to determine whether recommended light management programs are effective under commercial production conditions.

	<u>1973-74</u>
SMY -----	0.1
Support Personnel -----	0.3
Total Expenditures -----	\$5,807

200146, GROWTH AND REPRODUCTION OF TURKEYS UNDER CONDITIONS OF CONTROLLED ENVIRONMENT HOUSING (A. T. Leighton, Jr. - Poultry Science; J. P. Mason - Agricultural Engineering)

The objectives of this project are to determine the combinations of light environment, temperature and relative humidity required for optimum growth of turkeys, to develop methods for effective odor and dust control and to develop environmental systems that will maintain the environmental conditions necessary to most efficient growth performance of turkeys.

Future Plans: Emphasis is being placed on developing methods for determining moisture production of turkeys at different ages and the influence of intermittent vs. continuous light and wavelength of light on growth performance of turkeys.

	<u>1973-74</u>
SMY -----	0.4
Support Personnel -----	1.5
Total Expenditures -----	\$22,509

200147, A STUDY OF THE INFERTILITY SYNDROME (REFRACTORY FEMALE INFERTILITY) AND LATE SEASONAL DECLINES IN FERTILITY (A. T. Leighton, Jr. and H. P. Van Krey - Poultry Science)

The objectives of this project are to determine the influence of oviduct environment and the intervaginal sperm host glands on the expression of fertility.

Future Plans: Studies will be initiated to determine the influence of semen contaminants on fertility and the possibility of the production of substances at the site of insemination that may affect the survival rate of spermatozoa as the breeding season progresses.

	<u>1973-74</u>
SMY -----	0.4
Support Personnel -----	2.1
Total Expenditures -----	\$29,068

200318, EVALUATION AND EFFICIENT UTILIZATION OF GRAINS AND PROTEIN
SUPPLEMENTS IN DIETS OF TURKEYS (L. M. Potter - Poultry
Science)

Several experiments have been conducted to determine the methionine or the sulfur amino acid requirements at various four-week intervals during the growing period of market turkeys. Diets with graded levels of protein were used in these experiments. Results tentatively indicate that lower levels of protein may be used in commercial turkey diets if properly fortified with more methionine than that currently used.

Future Plans: Further research is planned with lysine and methionine as variables in future experiments.

	<u>1973-74</u>
SMY -----	0.3
Support Personnel -----	3.4
Total Expenditures -----	\$46,418

626216, EXPRESSION OF QUALITATIVE GENES OF POULTRY IN INTERNAL AND
EXTERNAL ENVIRONMENTS (P. B. Siegel - Poultry Science)

This project contributes to the S-93 Regional Project of the same title. Our role in this cooperative research involves an investigation of the action of major genes in different genetic backgrounds.

Future Plans: Concentration of efforts will be devoted to the influence of these loci on growth, reproductive and behavior parameters.

	<u>1973-74</u>
SMY -----	0.2
Support Personnel -----	1.0
Total Expenditures -----	\$25,662

616140, REPRODUCTIVE RESPONSES ASSOCIATED WITH SELECTION FOR BODY
WEIGHT IN THE DOMESTIC FOWL (H. P. Van Krey - Poultry Science)

The associated correlated reproductive responses in weight-selected lines of chickens are being investigated. As they are uncovered, the physiological bases for these differences are being interpreted.

Future Plans: Future research will encompass continued delineation

of the correlated reproductive responses. As these differences are determined and correlated with existing industry problems, the most desirable management practices will be suggested. Efforts to uncover correlated responses of economical significance will also be emphasized.

	<u>1973-74</u>
SMY -----	0.7
Support Personnel -----	1.5
Total Expenditures -----	\$29,602

616128, QUANTITATIVE INHERITANCE OF GROWTH IN CHICKENS (P. B. Siegel - Poultry Science)

This is a long-term project designed to study the genetics of growth in populations of chickens divergently selected for high and low juvenile body weight. Emphasis is given to changes of the selected trait and of correlated responses in lines undergoing selection and in lines where selection has been relaxed.

Future Plans: Emphasis will be given to genetic analyses of long-term selection for high and low body weight and changes in components of fitness.

	<u>1973-74</u>
SMY -----	0.5
Support Personnel -----	2.9
Total Expenditures -----	\$38,305

616049, GENETIC, PHOTOPERIODIC AND ENVIRONMENTAL FACTORS CONCERNED WITH REPRODUCTION IN THE TURKEY (A. T. Leighton, Jr. - Poultry Science)

The objectives of this project are to determine the influence of selection for high reproductive efficiency of turkeys subjected to different combinations of optimum and sub-optimum photoperiodic environments. The interactions of environmental temperature, ahemeral light environments, wavelength and light intensity on reproduction are also being investigated.

Future Plans: Studies will continue to evaluate ahemeral light patterns, light intensity, wavelength of light and their relationships to the expression of reproductive potential.

	<u>1937-74</u>
SMY -----	0.4
Support Personnel -----	3.6
Total Expenditures -----	\$62,140

Mechanization and Labor Efficiency

200146, GROWTH AND REPRODUCTION OF TURKEYS UNDER CONDITIONS OF CONTROLLED ENVIRONMENT HOUSING (A. T. Leighton, Jr. - Poultry Science; J. P. Mason - Agricultural Engineering)

The objectives of this project are to determine the combinations of light environment, temperature and relative humidity required for optimum growth of turkeys, to develop methods for effective odor and dust control and to develop environmental systems that will maintain the environmental conditions necessary to most efficient growth performance of turkeys.

Future Plans: Emphasis is being placed on developing methods for determining moisture production of turkeys at different ages and the influence of intermittent vs. continuous light and wavelength of light on growth performance of turkeys.

	<u>1973-74</u>
SMY -----	0.3
Support Personnel -----	1.5
Total Expenditures -----	\$22,509

New and Improved Products

616079, UTILIZATION OF POULTRY PRODUCTS (E. O. Essary - Food Science and Technology)

Objectives of this project include the determination of the effect of processing and handling upon the quality characteristics and composition of poultry products.

Future Plans: The relation between different cooking temperatures, cooking times and cooking yields of turkey pan roasts will be determined. The factors that may be responsible for the short shelf life of mechanically deboned poultry meat will be studied. The effects of feed ingredients upon pigmentation, tenderness and flavor of broilers is continuing.

	<u>1973-74</u>
SMY -----	0.3
Support Personnel -----	0.5
Total Expenditures -----	\$11,020

Chemical and Physical Properties

616079, UTILIZATION OF POULTRY PRODUCTS (E. O. Essary - Food Science and Technology)

Objectives of this project include the determination of the effect of processing and handling upon the quality characteristics and composition of poultry products.

Future Plans: The relation between different cooking temperatures, cooking times and cooking yields of turkey pan roasts will be determined. The factors that may be responsible for the short shelf life of mechanically deboned poultry meat will be studied. The effects of feed ingredients upon pigmentation, tenderness and flavor of broilers is continuing.

	<u>1973-74</u>
SMY -----	0.7
Support Personnel -----	1.2
Total Expenditures -----	\$22,041

Maintaining Quality During Marketing

616079, UTILIZATION OF POULTRY PRODUCTS (E. O. Essary - Food Science and Technology)

Objectives of this project include the determination of the effect of processing and handling upon the quality characteristics and composition of poultry products.

Future Plans: The relation between different cooking temperatures, cooking times and cooking yields of turkey pan roasts will be determined. The factors that may be responsible for the short shelf life of mechanically deboned poultry meat will be studied. The effects of feed ingredients upon pigmentation, tenderness and flavor of broilers is continuing.

	<u>1973-74</u>
SMY -----	0.3
Support Personnel -----	0.6
Total Expenditures -----	\$11,021

SWINE

Virginia's swine industry, like that of other states, is becoming an intensive operation. Confinement rearing increases the number of animals that can be cared for by one man, but the practice creates new problems in environmental control, disease and parasite control, feeding practices and waste disposal. The consumers are demanding more lean meat and less fat which means that both breeding and feeding practices must be changed.

Summary of 1973-74 Programs

	<u>SMY</u>	<u>Support Personnel</u>	<u>Expenditures</u>
Disease and Parasite Control	2.3	6.2	\$ 105,750
Biological Efficiency	1.7	8.3	177,145
Physical and Chemical Properties	0.1	-	4,042
Maintenance of Quality During Marketing	0.6	1.4	24,740
Mechanization and Improvement of Physical Efficiency	0.4	1.7	40,583
Management to Maximize Income	-	-	4,179
Administration	-	-	50,273
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Total	5.1	17.6	\$ 406,712

Disease and Parasite Control

200327-0, DISEASE AS A DETERRENT TO INCREASED AND MORE EFFICIENT ANIMAL PRODUCTION (D. F. Watson - Veterinary Science)

Objectives of this research are (1) to investigate the disease process as it affects increased and more efficient production of animal origin food and fiber, (2) to continue our investigation of gastric and intestinal ulcers as they occur in animals and birds, (3) to continue our efforts to find a diagnostic method for liver diseases in animals, and (4) to investigate better methods for parasite control based on cultivation of parasites in vitro and in vivo.

Work on the Pink Eye vaccine evaluation will be continued as well as an evaluation of ultra violet radiation in the ceiling as a control of environmental bacteria in a confinement swine facility.

	<u>1973-74</u>
SMY -----	0.2
Support Personnel -----	0.5
Total Expenditures -----	\$11,075

616188, PHYSIOLOGY OF STRESS AS RELATED TO HEALTH AND DISEASE (G. Colmano - Veterinary Science)

Objective: A profile on seven parameters (corticosterone, Fe-ascorbic acid, Cu-ceruloplasmin, oxidative potential, tetraporphorin chromophore, protein and peptide chromophore) extrapolated from the comparison of the absorption spectra from 700 to 185 nm of 0.075 ml of oxidized versus reduced blood plasma, screened animals predisposed to disease acquisition by separating unstressed from stressed and healthy from diseased animals.

Future Plans: Application of this new method to different animal species (birds, pigs, ruminants, horses and laboratory animals) including humans is in progress, with collection of basic data differentiating different conditions of stress, health and disease.

	<u>1973-74</u>
SMY -----	0.5
Support Personnel -----	1.4
Total Expenditures -----	\$20,690

616041-0, CAUSES AND CONTROL OF PRENATAL, NEONATAL AND POSTNATAL DEATH
IN PIGS (J. W. Davis, K. G. Libke and G. Colmano - Veterinary
Science)

The objectives are: (1) Study treatment and control of swine
dysentery in weanling pigs. (2) Study the effect of environmental
stresses, especially the effect of movement on weanling pigs reared in
an intensive farrowing system and/or closed confinement environment.

Future Plans: The project has been rewritten and continued but
will deal with stressors in prenatal, neonatal and postnatal swine.

	<u>1973-74</u>
SMY -----	1.6
Support Personnel -----	4.3
Total Expenditures -----	\$73,985

Biological Efficiency

200227, EFFECT OF ENVIRONMENTAL, ENDOCRINE AND NUTRITION FACTORS ON
REPRODUCTION IN FARM ANIMALS (T. N. Meacham - Animal Science)

The objectives of this project are (1) to study the reproductive performance of exotic beef breed crosses under four winter management systems (2) to evaluate the reproductive efficiency of Angus vs. Angus x Holstein cows wintered on two levels of energy intake (80 vs. 100% N.R.C. requirements) (3) to study the effects of physical (concrete vs. dirt lots) and social (individual rearing vs. group rearing with and without presence of females) environments on the reproductive development of boars and (4) to develop extenders for ram spermatozoa that will maintain fertility through the freeze - thaw process.

Future Plans: The project will be carried on with continued work under objectives one, two and three. A new area of work involving methods of evaluating the breeding potential of young beef bulls is being developed.

	<u>1973-74</u>
SMY -----	0.3
Support Personnel -----	1.3
Total Expenditures -----	\$14,810

616072, SOW AND PIG MANAGEMENT AND NUTRITION (E. T. Kornegay - Animal
Science; H. R. Thomas - Tidewater Research and Continuing
Education Center)

The objectives are: (1) To determine the nutritional requirements and management systems necessary for sows housed in total confinement; (2) To develop the techniques and nutritional requirements of baby pigs weaned at one day of age; (3) To determine mineral availabilities and interactions; (4) To evaluate new feed ingredients, by-products and additives for swine diets and (5) To develop the management and nutrition for optimum boar performance.

Future Plans: Continue according to objectives.

	<u>1973-74</u>
SMY -----	1.4
Support Personnel -----	7.0
Total Expenditures -----	\$162,335

Physical and Chemical Properties

616071, CARCASS TISSUE CHARACTERISTICS, COMPOSITION AND APPRAISAL OF
MEAT ANIMALS (R. F. Kelly - Food Science and Technology)

A major objective of this project is to develop procedures for
evaluation of beef, pork and lamb carcasses by new techniques.

Future Plans: Include the use of neutron activation analysis (NAA)
for trace elements in meat and a study of bone characteristics of the
present meat animal population.

	<u>1973-74</u>
SMY -----	0.1
Support Personnel -----	
Total Expenditures -----	\$4,042

Maintaining Quality During Marketing

616173, MICROBIOLOGICAL AND ENVIRONMENTAL FACTORS AFFECTING QUALITY OF
MEAT PRODUCTS (Paul P. Graham - Food Science and Technology)

Objectives of this project are to investigate the interrelationships of bacteria, chemical properties and shelf-life characteristics of meat products.

Future Plans: To relate kinds of microorganisms present to processing conditions and to chemical properties of the product. Study the individual and associative effects of these final process flora on shelf-life characteristics to thus provide specific information for the establishment of workable guidelines concerning allowable bacteria in the various meat products.

	<u>1973-74</u>
SMY -----	0.6
Support Personnel -----	1.4
Total Expenditures -----	\$24,740

Mechanization and Improvement of Physical Efficiency

616072, SOW AND PIG MANAGEMENT AND NUTRITION (E. T. Kornegay - Animal Science; H. R. Thomas - Tidewater Research and Continuing Education Center)

The objectives are: (1) To determine the nutritional requirements and management systems necessary for sows housed in total confinement; (2) To develop the techniques and nutritional requirements of baby pigs weaned at one day of age; (3) To determine mineral availabilities and interactions; (4) To evaluate new feed ingredients, by-products and additives for swine diets and (5) To develop the management and nutrition for optimum boar performance.

Future Plans: Continue according to objectives.

	<u>1973-74</u>
SMY -----	0.4
Support Personnel -----	1.7
Total Expenditures -----	\$40,583

Management to Maximize Income

6162210, ALTERNATIVE MARKETING AND HEDGING STRATEGIES FOR VIRGINIA
GRAIN AND LIVESTOCK PRODUCERS (David Kenyon - Agricultural
Economics)

In this project the economic potential of alternative marketing strategies using the futures market for grain and livestock producers and handlers in Virginia will be evaluated. The project will involve developing a data bank on prices and basis to be placed on the Computerized Management Network (CMN), price prediction equations, evaluation of alternative hedging strategies, and presentation of workshops on how to effectively use the futures market as a marketing tool.

Future Plans: Present workshops on futures trading and continue analysis on alternative hedging strategies.

1973-74

SMY -----	
Support Personnel -----	
Total Expenditures -----	\$4,179

SHEEP AND WOOL

Sheep continue to be an important source of income on many farms in Southwestern Virginia. Important problems limiting income from sheep in Virginia include: (1) disease and parasite control, (2) nutrition of ewes, (3) management systems for rearing lambs, and (4) consumer acceptability.

Summary of 1973-74 Programs

	<u>SMY</u>	<u>Support Personnel</u>	<u>Expenditures</u>
Disease and Parasite Control	0.4	1.2	\$ 22,958
Biological Efficiency	1.1	6.4	70,699
Chemical and Physical Properties	-	-	1,348
Management to Maximize Income	0.3	1.9	15,469
Marketing Efficiency	0.1	0.5	11,421
Administration	-	-	36,304
Total	<u>1.9</u>	<u>10.0</u>	<u>\$ 158,199</u>

Disease and Parasite Control

200327-0, DISEASE AS A DETERRENT TO INCREASED AND MORE EFFICIENT ANIMAL PRODUCTION (D. F. Watson - Veterinary Science)

Objectives of this research are (1) to investigate the disease process as it affects increased and more efficient production of animal origin food and fiber, (2) to continue our investigation of gastric and intestinal ulcers as they occur in animals and birds, (3) to continue our efforts to find a diagnostic method for liver diseases in animals, and (4) to investigate better methods for parasite control based on cultivation of parasites in vitro and in vivo.

Work on the Pink Eye vaccine evaluation will be continued as well as an evaluation of ultra violet radiation in the ceiling as a control of environmental bacteria in a confinement swine facility.

	<u>1973-74</u>
SMY -----	0.2
Support Personnel -----	0.5
Total Expenditures -----	\$11,075

616014, INFECTIOUS DISEASES AFFECTING REPRODUCTION IN CATTLE AND SHEEP (J. Clark Osborne, T. L. Bibb and D. F. Watson - Veterinary Science)

The objectives of this project are to determine the nutritional and diagnostic characteristics of Vibrio fetus, Vibrio bubulus, Vibrio coli and related organisms; to investigate the chemical composition of the cell wall of V. fetus, V. bubulus and related organisms as well as the ratio of guanine and cytosine to all purine and pyrimidine bases in their nucleic acids; to determine the mechanism and role of endotoxins from gram-negative bacteria (V. fetus) in abortion of cattle and sheep; to isolate and identify anaerobic bacteria and Streptococcus spp. from aborted cattle and sheep fetuses. Isolated organisms will be studied and tested for their ability to cause abortion. The end result of these investigations should lead to a fuller understanding of the infectious agents involved in reproductive failures and point to needed control measures.

Future Plans: This project was terminated 6-30-74 and replaced by a project dealing specifically with reproductive diseases of cattle.

	<u>1973-74</u>
SMY -----	0.2
Support Personnel -----	0.7
Total Expenditures -----	\$11,883

Biological Efficiency

616012, METHODS OF INTENSIVE LAMB PRODUCTION (J. S. Copenhaver -
Animal Science)

The objective of this project is to evaluate the use of Finnish Landrace blood in the commercial production of market lambs in Virginia.

In addition to the breeding phase of the project, various management systems such as methods of grazing and supplemental feeding are being compared using lambs produced in the breeding project.

Future Plans: The project will be continued for approximately three additional lamb crops in order to evaluate ewes of the different fractions of Landrace breeding at young and older ages.

1973-74

SMY -----	0.3
Support Personnel -----	1.9
Total Expenditures -----	\$15,469

200199, IMPROVEMENT OF GROWTH RATE IN SHEEP THROUGH RECURRENT SELECTION
FOR COMBINING ABILITY (R. C. Carter - Animal Science)

The objective of this project is to evaluate selection for growth rate in Hampshire sheep based on progeny tests of potential herd sires. Each year, 15 ram lambs from the recurrent selection flock and 5 from the unselected control flock are progeny tested by breeding them to samples of grade ewes at the Steeles Tavern Station.

Future Plans: The progeny phase of the project was terminated with the 1974 lamb crop. Data for several years will be analysed and published.

1973-74

SMY -----	0.5
Support Personnel -----	3.3
Total Expenditures -----	\$39,717

200069, THE USE OF PURIFIED AND SEMI-PURIFIED RATIONS TO DETERMINE
NUTRIENT FUNCTIONS, METABOLISM, REQUIREMENTS AND INTERRELA-
TIONS IN RUMINANTS (K. E. Webb, Jr. - Animal Science)

The broad objective of this project is to determine, specifically, nutrient requirements, functions, metabolism and interrelationships in ruminants, with and without rumen fermentation, for maximum performance and normal health. Included in this objective is the development of cellulose-containing purified rations for studying the nutrient requirements and functions for maximum cellulose digestibility and nitrogen utilization and maximum rate and efficiency of gain as compared to commonly-fed natural rations.

Future Plans: This project is being replaced by a new project which will focus specifically on protein and nonprotein nitrogen utilization by ruminants.

	<u>1973-74</u>
SMY -----	0.1
Support Personnel -----	0.4
Total Expenditures -----	\$4,903

200066, HIGH SILAGE RATIONS FOR BEEF CATTLE AND SHEEP (J. P. Fontenot -
Animal Science)

Research has been directed toward optimizing supplementation to silage for beef cattle and sheep. Present studies include different sources and forms of non-protein nitrogen supplements and levels of non-absorbable antibiotics.

Future Plans: Research will be conducted on various systems of fattening cattle with maximum use of forage. Value of grain preservatives and of administering growth stimulants will be investigated. Emphasis will be placed on evaluating new non-protein nitrogen sources.

	<u>1973-74</u>
SMY -----	0.2
Support Personnel -----	0.8
Total Expenditures -----	\$10,610

Chemical and Physical Properties

616071, CARCASS TISSUE CHARACTERISTICS, COMPOSITION AND APPRAISAL OF
MEAT ANIMALS (R. F. Kelly - Food Science and Technology)

A major objective of this project is to develop procedures for
evaluation of beef, pork and lamb carcasses by new techniques.

Future Plans: Include the use of neutron activation analysis (NAA)
for trace elements in meat and a study of bone characteristics of the
present meat animal population.

1973-74

SMY -----	
Support Personnel -----	
Total Expenditures -----	\$1,348

Management to Maximize Income

616012, METHODS OF INTENSIVE LAMB PRODUCTION (J. S. Copenhaver -
Animal Science)

The objective of this project is to evaluate the use of Finnish Landrace blood in the commercial production of market lambs in Virginia.

In addition to the breeding phase of the project, various management systems such as methods of grazing and supplemental feeding are being compared using lambs produced in the breeding project.

Future Plans: The project will be continued for approximately three additional lamb crops in order to evaluate ewes of the different fractions of Landrace breeding at young and older ages.

1973-74

SMY -----	0.3
Support Personnel -----	1.9
Total Expenditures -----	\$15,469

Marketing Efficiency

6162220, ECONOMIC ANALYSIS OF SHEEP PRODUCTION AND SLAUGHTERING OPPORTUNITIES IN VIRGINIA (David Kenyon - Agricultural Economics)

The overall objective of this project is to determine the feasibility of expanding sheep and lamb production in Virginia and the feasibility of operating a sheep and lamb slaughtering facility in the state.

Future Plans: Complete analysis on this project during 1974-75.

	<u>1973-74</u>
SMY -----	0.1
Support Personnel -----	0.5
Total Expenditures -----	\$11,421

OTHER ANIMALS

The research program on special test animals is relatively small and will continue to be a minor portion of the total program. Mice and rats are used as test animals in a considerable portion of the basic research in the Division of Basic Sciences and Animal and Veterinary Sciences. Most of this research is classified under other sections of this report.

Summary of 1973-74 Programs

	<u>SMY</u>	<u>Support Personnel</u>	<u>Expenditures</u>
Disease Control	0.3	1.1	\$ 21,421
Basic Biology	0.6	1.6	60,239
Administration	-	-	11,319
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Total	0.9	2.7	\$ 92,979

Disease Control

616188, PHYSIOLOGY OF STRESS AS RELATED TO HEALTH AND DISEASE (G. Colmano - Veterinary Science)

Objective: A profile on seven parameters (corticosterone, Fe-ascorbic acid, Cu-ceruloplasmin, oxidative potential, tetraporphorin chromophore, protein and peptide chromophore) extrapolated from the comparison of the absorption spectra from 700 to 185 nm of 0.075 ml of oxidized versus reduced blood plasma, screened animals predisposed to disease acquisition by separating unstressed from stressed and healthy from diseased animals.

Future Plans: Application of this new method to different animal species (birds, pigs, ruminants, horses and laboratory animals) including humans is in progress, with collection of basic data differentiating different conditions of stress, health and disease.

	<u>1973-74</u>
SMY -----	0.2
Support Personnel -----	0.6
Total Expenditures -----	\$10,346

200327-0, DISEASE AS A DETERRENT TO INCREASED AND MORE EFFICIENT ANIMAL PRODUCTION (D. F. Watson - Veterinary Science)

Objectives of this research are (1) to investigate the disease process as it affects increased and more efficient production of animal origin food and fiber, (2) to continue our investigation of gastric and intestinal ulcers as they occur in animals and birds, (3) to continue our efforts to find a diagnostic method for liver diseases in animals, and (4) to investigate better methods for parasite control based on cultivation of parasites in vitro and in vivo.

Work on the Pink Eye vaccine evaluation will be continued as well as an evaluation of ultra violet radiation in the ceiling as a control of environmental bacteria in a confinement swine facility.

	<u>1973-74</u>
SMY -----	0.1
Support Personnel -----	0.5
Total Expenditures -----	\$11,075

Basic Biology

363041, MAGNESIUM NUTRITURE AND PATHOLOGICAL CALCIFICATION (G. E. Bunce - Biochemistry and Nutrition)

The aim of this research is to explain in biochemical terms the mechanism whereby a dietary insufficiency of magnesium causes calcification in the kidney and arteries. The project is expected to yield a clearer understanding of the role of dietary magnesium in renal and cardiovascular health.

	<u>1973-74</u>
SMY -----	0.2
Support Personnel -----	0.3
Total Expenditures -----	\$10,696

616099, DIRECT AND CORRELATED RESPONSES TO SELECTION FOR GROWTH AND MATERNAL PERFORMANCE IN THE LABORATORY MOUSE (J. M. White - Dairy Science)

The objectives of this project are to characterize some of the basic genetic mechanisms involved in determining the response to direct selection for improvement in a single quantitative trait in mammals and to determine the relative degree of genetic change that may take place in other physiological traits as selection is practiced for the primary characteristics.

Future Plans: This project was revised last year. It will be continued next year with two Masters and one Ph.D. candidate completing theses on various aspects of this project.

	<u>1973-74</u>
SMY -----	0.4
Support Personnel -----	1.3
Total Expenditures -----	\$49,543

PEOPLE AS INDIVIDUALS

People are the ultimate beneficiaries of all research. People have needs other than food, clothing and shelter. These include protection from noxious or dangerous insects, knowledge on how to adjust to social and technological change and on how to achieve a sense of well-being.

Summary of 1973-74 Programs

	<u>SMY</u>	<u>Support Personnel</u>	<u>Expenditures</u>
Insect Control	0.3	0.7	\$ 11,742
Nutritional Values	1.5	2.2	70,692
Administration	-	-	11,432
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Total	1.8	2.9	\$ 93,866

Insect Control

616144, BIONOMICS AND POPULATION MANAGEMENT OF MAJOR PESTS OF MAN AND DOMESTIC ANIMALS (E. C. Turner, Jr. - Entomology)

The objectives of this project are to investigate the regulatory effect of most species of manure-breeding pest flies on dairy cattle and other flies located around dairy barns; to initiate field experiments on control of house flies in poultry laying houses; to evaluate several insecticide formulations and methods of application for control of pests of horses; and to continue ecological studies both in the field and the laboratory of Virginia species of Culicoides biting midges.

Future Plans: These will include a continuation of the evaluation of certain chemical and non-chemical methods for the management and control of external pests of cattle, horses and poultry. Of special interest will be the investigation of the practical effectiveness of juvenile hormones as a biological method for pest regulation of dipterous insects. Laboratory nutritional studies of Culicoides guttipennis will also be expanded.

	<u>1973-74</u>
SMY -----	0.3
Support Personnel -----	0.7
Total Expenditures -----	\$11,742

Nutritional Values

616208, RESPONSE OF NICOTINAMIDE ADENINE DINUCLEOTIDE TO THYROID HORMONE
(C. J. Ackerman - Biochemistry and Nutrition)

It is the purpose of this investigation to determine how thyroid hormones control metabolism. These hormones have a profound effect on the utilization of food, temperature control of the body, and on the general well-being of an individual. Their mechanism of action is not clear. Low doses of hormone stimulate the synthesis of ribonucleic acid within 3 hours after the administration of the hormone but how the hormone effects this stimulation is not clear. Evidence in this laboratory suggests that the hormones stimulate the synthesis of the purine nucleotides which are precursors of ribonucleic acid. In addition, the hormone stimulates the synthesis of NAD (Nicotinamide adenine dinucleotide) which plays a central role in biological oxidation. Experiments are in progress to determine the role thyroid hormones play in the incorporation of glycine-¹⁴C into the adenine and ribose moieties of NAD.

	<u>1973-74</u>
SMY -----	0.7
Support Personnel -----	0.5
Total Expenditures -----	\$22,485

616209, MINERAL NUTRITION FOR OPTIMAL HEALTH (G. E. Bunce - Biochemistry and Nutrition)

The objective of this project is the determination of the sub-cellular role of the minerals magnesium and calcium, particularly in the kidney as a means of better understanding the daily nutritional requirement. The project combines both biochemical and microscopic approaches.

	<u>1973-74</u>
SMY -----	0.5
Support Personnel -----	0.7
Total Expenditures -----	\$18,135

363265, CATARACT FROM A VEGETABLE PROTEIN-BASED DIET (George E. Bunce
and John L. Hess - Biochemistry and Nutrition)

A model diet, low in tryptophan and vitamin E, has been found to produce cataract in the offspring of female rats maintained on the diet through pregnancy and lactation. The role of each nutrient in the normal lens development and the biochemical changes within opaque lens are being investigated. The project should yield basic information concerning nutrition and lens health.

	<u>1973-74</u>
SMY -----	0.3
Support Personnel -----	1.0
Total Expenditures -----	\$30,072

FOOD

Agriculture is responsible for producing and marketing foods that the public can buy with confidence. Food must be wholesome and free from harmful pesticide residues, disease agents or toxic substances. While an efficient agriculture has provided this nation with the world's best food-quantity and quality--additional improvements are needed to increase microbiological safety and to maintain the food supply free from toxic residues.

Summary of 1973-74 Programs

	<u>SMY</u>	<u>Support Personnel</u>	<u>Expenditures</u>
Insect Control	0.1	0.2	\$ 3,368
Protection from Toxins	2.6	7.8	164,568
Metabolism and Utilization	0.2	0.2	6,045
Maintenance of Quality During Marketing	0.3	1.4	14,630
Analysis of Supply, Demand and Price	1.0	0.5	12,785
Total	<u>4.2</u>	<u>10.1</u>	<u>\$ 229,467</u>

Insect Control

2002290, MICROBIAL AND ENVIRONMENTAL CONTROL OF PIOPHILA CASEI IN CURED HAMS (Paul P. Graham and R. F. Kelly - Food Science and Technology)

Objectives of this project are to investigate the interrelationships existing among the microbial flora, the environmental conditions during aging of hams, and the compound responsible for the attraction of Piophila casei. In addition, the identification and use of products of microbial metabolism or related compounds as attractants for this insect pest are being studied.

Future Plans: This project will be replaced by one which will test the effectiveness of compounds as attractants to be used in trapping devices in the dry-cured ham industry. In addition, environmental conditions to control process flora or actual changes in process flora will be studied as a means of controlling Piophila casei.

	<u>1973-74</u>
SMY -----	0.1
Support Personnel -----	0.2
Total Expenditures -----	\$3,368

Protection from Toxins

616087, INTERACTION BETWEEN AFLATOXIN AND PROTEIN NUTRITION (T. Colin Campbell - Biochemistry and Nutrition)

The objective of this research is to determine the mechanism by which dietary protein deficiency modifies the ability of the animal to metabolize aflatoxin and other foreign compounds. The principal finding to date demonstrates that protein deprivation in the growing animal reduces the rate at which the live cells proliferate, thereby reducing the total quantity of liver microsomal enzymes which metabolize such compounds. Second, phospholipid functionality is altered and thereby triggering a further reduction in the specific enzyme activity of the liver microsomes. The depression of liver cell proliferation by dietary protein deficiency in the growing animal can be reversed by refeeding adequate protein. Current experiments are in progress to determine the fundamental enzyme mechanism which is altered during protein deficiency--such information is expected to show how dietary variation relates to such diverse responses as predisposition to cancer, adverse side effects from drugs and human health tolerance to environmental chemicals.

	<u>1973-74</u>
SMY -----	0.6
Support Personnel -----	2.8
Total Expenditures -----	\$91,230

616177, HEAT INJURY TO CLOSTRIDIUM PERFRINGENS (M. D. Pierson - Food Science and Technology)

Objectives of this research are (1) to demonstrate heat injury to Clostridium perfringens, (2) to relate heat injury to commonly used assay procedures for Clostridium perfringens, and (3) to investigate the requirements for recovery of heat injured Clostridium perfringens.

Future Plans: The effect of various selective media used for the enumeration of Vibrio parahaemolyticus will be tested with heat stressed cells. The current project will be rewritten to include other studies dealing with the effect of environmental factors on anaerobic bacteria in foods.

	<u>1973-74</u>
SMY -----	0.3
Support Personnel -----	1.4
Total Expenditures -----	\$14,630

626141, PESTICIDE RESIDUES IN AGRICULTURAL COMMODITIES AND ENVIRONMENTS
(R. W. Young - Biochemistry; E. L. Wisman - Poultry Science)

The objectives of this project are to devise new or improved methods for sampling, extraction, clean-up and analytical techniques for carbamates, organophosphates, herbicides, pesticides, PCB's and other residues found in agriculturally-related areas, including the processing of food products and water used in these areas for production and human use, to determine the fate and rate of dissipation in animals and food products.

Future research will involve investigation of the level of residues and unknown chemicals found in water and consumer food products. Studies will be made on the recycling of food contaminants as related to residues from agriculturally- and industrially-related chemicals including environmental factors and the constant requirement to improve methodology.

	<u>1973-74</u>
SMY -----	1.7
Support Personnel -----	3.6
Total Expenditures -----	\$58,708

Metabolism and Utilization

616209, MINERAL NUTRITION FOR OPTIMAL HEALTH (G. E. Bunce - Biochemistry and Nutrition)

The objective of this project is the determination of the sub-cellular role of the minerals magnesium and calcium, particularly in the kidney as a means of better understanding the daily nutritional requirement. The project combines both biochemical and microscopic approaches.

	<u>1973-74</u>
SMY -----	0.2
Support Personnel -----	0.2
Total Expenditures -----	\$6,045

Maintaining Quality During Marketing

616177, HEAT INJURY TO CLOSTRIDIUM PERFRINGENS (M. D. Pierson - Food Science and Technology)

Objectives of this research are (1) to demonstrate heat injury to Clostridium perfringens, (2) to relate heat injury to commonly used assay procedures for Clostridium perfringens, and (3) to investigate the requirements for recovery of heat injured Clostridium perfringens.

Future Plans: The effect of various selective media used for the enumeration of Vibrio parahaemolyticus will be tested with heat stressed cells. The current project will be rewritten to include other studies dealing with the effect of environmental factors on anaerobic bacteria in foods.

	<u>1973-74</u>
SMY -----	0.3
Support Personnel -----	1.4
Total Expenditures -----	\$14,630

Analysis of Supply, Demand and Price

2003450, VIRGINIA AGRICULTURAL PRODUCTION: 1985 (John T. Buck -
Agricultural Economics)

Trends in the production and market supply of sixteen crops and livestock products of major importance in Virginia and contributing significantly to national output have been analyzed. Based on changes and developments during the past 20 to 25 years, projections of Virginia's share of national output to year 1985 are being made. Projected agricultural output for each of the 22 State Economic Planning Districts is being developed.

Satisfactory and efficient use of agricultural resources requires continued attention to providing the best available information on the general prospects and direction of agricultural production.

Future Plans: The project will be revised or replaced on June 30, 1975.

	<u>1973-74</u>
SMY -----	1.0
Support Personnel -----	0.5
Total Expenditures -----	\$12,785

COMMUNITIES, AREAS AND REGIONS

The social well-being and the economic opportunity of a farm family are determined to a large extent by the infra-structure of the community and by the public programs and policies of the State. Research can provide meaningful guides for the development of these.

Summary of 1973-74 Programs

	<u>SMY</u>	<u>Support Personnel</u>	<u>Expenditures</u>
Description and Inventory	-	0.4	\$ 11,397
Economic Development and Adjustment	3.3	7.2	133,434
Evaluation of Public Programs	0.5	2.1	26,512
Management to Maximize Income	0.3	1.0	13,949
Market Efficiency	0.1	0.3	1,930
Administration	-	-	26,034
	<hr/>	<hr/>	<hr/>
Total	4.2	11.0	\$ 213,256

Description and Inventory

2000350, INDICATORS OF ECONOMIC WELL BEING IN VIRGINIA (L. A. Shabman -
Agricultural Economics)

The objective of this study is to develop measures of the quality of living and assess their relationship to measures of economic well-being for Virginia counties.

Future Plans: Publication of social indicators for Virginia counties will be forthcoming. Another publication will assess the relationship between measures of income distribution and the economic development of counties in Virginia.

1973-74

SMY -----	
Support Personnel -----	
Total Expenditures -----	\$5,316

626179, PROCESSES OF RURAL ECONOMIC CHANGE IN THE NORTHEAST (Burl F.
Long - Agricultural Economics)

The objectives of this project are: (1) To inventory and classify non-metropolitan areas for changing structure of economic activity, (2) Determine processes by which economic change occurs and assess the viability of areas in terms of their resources, (3) Determine the probable direction of future economic changes, (4) Evaluate the effects of institutional changes and policy activities on rural economic development.

Future Plans: Analysis of the effects of market location, resource base and relative growth rates of different economic sectors on rural economic development is continuing. Wage differentials between counties and between planning districts is being examined to determine factors accounting for differential growth rates.

1973-74

SMY -----	
Support Personnel -----	0.4
Total Expenditures -----	\$5,340

6462260, BALANCED GROWTH POTENTIALS AND RESOURCE REQUIREMENTS IN THE WEST PIEDMONT PLANNING DISTRICT OF VIRGINIA (Dennis Smith, M. C. Conner, Dilip Pendse, Leonard Shabman, Ralph Kline, Sandra Batie and James Pratt - Agricultural Economics)

The objective of this project is an economic analysis of the major components of the economy of the West Piedmont District as a basis for identifying development opportunities and meeting the needs for public services. This study comes under the Rural Development Act of 1972 and is joint between the Research Division and the Extension Division.

Work under this project, initiated early in 1974, is involved with analyzing interindustry relationships using an input-output procedure, determining agricultural and industrial potentials for the area, identifying quality of living factors and the public service needs and estimating impacts of likely changes in economic activity.

Future Plans: Continue to develop the work outlined above.

1973-74

SMY	-----	
Support Personnel	-----	
Total Expenditures	-----	\$741

Economic Development and Adjustment

200308, ADJUSTMENT POSSIBILITIES IN RURAL AREAS (R. G. Kline, S. Batie, B. Long, J. Havlicek, L. Shabman and M. C. Conner - Agricultural Economics)

The objectives of this project are to identify in rural areas present and potential strengths and limitations of the major sectors including farming, industry, education, health, housing and government and to evaluate industries as to their potential for development of a community's resources.

Future Plans: Results of the analyses will be published and made available to those interested in development of rural Virginia. Plans are to identify and analyze other sectors where there are problems relating to the development and use of a community's resources including land use and environmental enhancement.

	<u>1973-74</u>
SMY -----	1.3
Support Personnel -----	2.6
Total Expenditures -----	\$65,239

616154, ECONOMIC CONSEQUENCES OF ECOLOGICAL DECISIONS: A CASE STUDY OF SALTVILLE, VIRGINIA (Burl F. Long - Agricultural Economics)

The objective of this project was to analyze a water pollution control plan in a small community and determine the economic consequences of the program adopted. Specifically, the study sought to identify the sources and magnitude of water pollution damages, to assess consequences of the pollution abatement program on water users in the area, local industry, local government, residents and employees of the community.

An article based on findings of this study appeared in the June 1974 edition of Virginia Agricultural Economics under the title "Economic Implications of Pollution Control in a Small Community." The project was terminated June 30, 1974 and a summary report has been prepared in draft form. Publication of a research report is planned for the near future.

	<u>1973-74</u>
SMY -----	0.3
Support Personnel -----	1.4
Total Expenditures -----	\$14,070

616155, ECONOMIC DEVELOPMENT OF THE EASTERN SHORE OF VIRGINIA (R. L. Chambliss, M. C. Conner, D. E. Kenyon, R. G. Kline and B. F. Long - Agricultural Economics)

The objective of this project is to evaluate the potential for economic development on the Eastern Shore of Virginia taking into account the resources available and industry relationships.

Future Plans: Further analysis of specific aspects of the economy such as transportation and market access problems and the competitiveness of certain industries with other areas.

	<u>1973-74</u>
SMY -----	1.6
Support Personnel -----	2.3
Total Expenditures -----	\$40,775

626179, PROCESSES OF RURAL ECONOMIC CHANGE IN THE NORTHEAST (Burl F. Long - Agricultural Economics)

The objectives of this project are: (1) To inventory and classify non-metropolitan areas for changing structure of economic activity, (2) Determine processes by which economic change occurs and assess the viability of areas in terms of their resources, (3) Determine the probable direction of future economic changes, (4) Evaluate the effects of institutional changes and policy activities on rural economic development.

Future Plans: Analysis of the effects of market location, resource base and relative growth rates of different economic sectors on rural economic development is continuing. Wage differentials between counties and between planning districts is being examined to determine factors accounting for differential growth rates.

	<u>1973-74</u>
SMY -----	0.1
Support Personnel -----	0.9
Total Expenditures -----	\$13,350

Evaluation of Public Programs

616152, THE REAL PROPERTY TAX IN COMMUNITY DEVELOPMENT (R. B. Jensen -
Agricultural Economics)

The general objective of this project is to analyze the overall tax structure of the commonwealth in relation to the magnitude and distribution of the wealth of its people and their need for public services and to appraise the current status of the real property tax in state and local fiscal policy.

Future Plans: Emphasis in the future will be on the analysis of the public provision of water recreation facilities.

	<u>1973-74</u>
SMY -----	0.3
Support Personnel -----	1.3
Total Expenditures -----	\$13,173

6261330, MARKET ORGANIZATION, POWER AND POLICIES AND PROGRAMS IN THE
DAIRY INDUSTRY (M. C. Conner - Agricultural Economics)

The objective of this project is to identify the changes in market organization now taking place in the dairy industry and to determine the effect of these changes on the market relationships of dairymen, milk processors and food retailers. A better understanding of these relationships should provide a basis for the development of more effective public policies and programs.

Future Plans: Using a regional model for the South, continue efforts to determine the effects of various changes in organization on the costs and returns to different groups in the industry. Also, identify some of the critical issues confronting each group in the face of these changes. Increasing attention will be given to analyzing the existing and alternative pricing systems for the dairy industry.

	<u>1973-74</u>
SMY -----	0.1
Support Personnel -----	0.2
Total Expenditures -----	\$4,328

626179, PROCESSES OF RURAL ECONOMIC CHANGE IN THE NORTHEAST (Burl F.
Long - Agricultural Economics)

The objectives of this project are: (1) To inventory and classify non-metropolitan areas for changing structure of economic activity, (2) Determine processes by which economic change occurs and assess the viability of areas in terms of their resources, (3) Determine the probable direction of future economic changes, (4) Evaluate the effects of institutional changes and policy activities on rural economic development.

Future Plans: Analysis of the effects of market location, resource base and relative growth rates of different economic sectors on rural economic development is continuing. Wage differentials between counties and between planning districts is being examined to determine factors accounting for differential growth rates.

	<u>1973-74</u>
SMY -----	0.1
Support Personnel -----	0.6
Total Expenditures -----	\$9,011

Management to Maximize Income

2002840, RELATIONSHIP BETWEEN FARM MACHINERY COSTS AND TYPE OF FARM,
SIZE OF FARM, FARM LABOR COSTS AND FARM PROFITS (R. L.
Chambliss, Jr. - Agricultural Economics)

The broad purpose of this project is to discover factors associated with wide differences in unit costs of owning and operating farm field machinery and their relationships with types of farms, sizes of farms, farm labor costs and farm profits.

Future Plans: Results of the analysis will be reported for suitable publication, although the project was officially terminated June 30, 1974.

	<u>1973-74</u>
SMY -----	0.3
Support Personnel -----	1.0
Total Expenditures -----	\$13,949

Market Efficiency

808447-1, AN ANALYSIS OF THE PHYSICAL DISTRIBUTION SYSTEM SERVING THE VIRGINIA SEAFOOD INDUSTRY (C. W. Coale - Agricultural Economics)

The objective of this research is to determine the effectiveness of and suggest improvements in the transportation and distribution system used for marketing Virginia seafood and seafood products. Work is proceeding under phase three of the basic proposal which focuses on accessing the transportation and distribution system as to its potential for moving these products at competitive cost levels.

Future Plans: A computer model will be developed based on the structure of a vertically integrated firm studied during 1973-74. The purpose of the model will be used for estimating the potential profitability of firms under deficient corporate objectives and deficient resource levels. After development, the model will be applied to the Computer Management Network at VPI and SU.

	<u>1973-74</u>
SMY -----	0.1
Support Personnel -----	0.3
Total Expenditures -----	\$1,930

RESEARCH NOT ORIENTED TO ANY SPECIFIC COMMODITY OR RESOURCE

A considerable portion of V.P.I.'s agricultural research program undergirds all the research on commodities and resources. The basic research in biochemistry, genetics, pathology, physiology, ecology, entomology, economics and marketing and taxonomy of plants and animals falls in this category. Most of this research is supported with grants from Federal Agencies. In addition, there is a considerable amount of applied research that supports all of the commodity-oriented research.

Summary of 1973-74 Programs

	<u>SMY</u>	<u>Support Personnel</u>	<u>Expenditures</u>
Research Methodology	0.8	1.1	\$ 34,760
Biology of Cell Systems	3.6	9.1	288,313
Biology of Invertebrates	4.1	8.6	189,820
Biology of Microorganisms and Viruses	0.1	0.8	6,464
Biology of Plants	2.9	4.2	131,908
Biology of Animals	0.7	0.5	23,982
Human Nutrition	1.0	-	75,275
Anaerobic Bacteriology	8.0	38.5	730,636
Administration	-	-	206,458
Total	<hr/> 21.2	<hr/> 62.8	<hr/> \$1,687,616

Research Methodology

353724-1, REMOTE SENSING IN AGRICULTURE (D. E. Pettry and N. L. Powell - Agronomy)

The objectives of this project are to cooperate in the development and evaluation of an agricultural remote sensing system for the Chesapeake Bay region of Virginia.

Future Plans: Use remote sensing to detect diseases in peanuts (cylindrocladium black rot and sclerotinia blight), detect nutrient deficiency in soybean and peanuts (especially manganese) and use of satellite data to determine the agricultural production of the southeastern portion of Virginia.

	<u>1973-74</u>
SMY -----	0.8
Support Personnel -----	1.1
Total Expenditures -----	\$34,760

Biology of Cell Systems

323385, MECHANISM OF ENZYME ACTION (Bruce M. Anderson - Biochemistry and Nutrition)

The objectives of this project are to investigate the specific binding processes and catalytic properties of proteins with respect to the functioning of proteins as efficient catalysts of biological processes. Emphasis is being placed on the functioning of dehydrogenases and the selective interactions of pyridine nucleotide coenzymes. Dehydrogenase site-labelling reagents are being synthesized and used to study enzyme functional group involvement and selective active site interactions.

Future Plans: Funds have been received from the National Science Foundation to extend these studies for an additional two-year period.

	<u>1973-74</u>
SMY -----	0.7
Support Personnel -----	1.1
Total Expenditures -----	\$25,165

2003350, MECHANISM OF CATALYSIS (John P. Fox - Biochemistry and Nutrition)

The ability of imidates to serve as substrates for α -chymotrypsin and papain was investigated in order to determine whether a tetrahedral intermediate postulated in the enzymic hydrolysis of amides could be generated by an indirect route. Only slight increases in rates of hydrolysis of imidates were observed in the presence of these enzymes under conditions of optimal activity with respect to normal amide substrates.

The specificity of α -chymotrypsin with respect to the acyl oxygen of amides and esters is being investigated by static and kinetic methods. A primary objective of this work is the quantitative evaluation of the interactions between substrate and enzyme which contribute to the rate enhancement.

	<u>1973-74</u>
SMY -----	0.8
Support Personnel -----	0.8
Total Expenditures -----	\$22,469

616007, UTILIZATION OF CELLULOSE AND RELATED COMPOUNDS AS NUTRIENTS
(Ross D. Brown, Jr. - Biochemistry and Nutrition)

The objectives of this project are to clarify current uncertainties regarding the number of enzymes involved in extracellular degradation of cellulose and the individual functions of these enzymes; conduct comparative studies of the cellulase systems of various organisms in order to arrive at generalizations it is not now possible to formulate; and to assess the technical feasibility of applying this new knowledge to practical problems in food and feed processing, waste disposal, textile processing, and related operations involving cellulosic materials.

Future Plans: Most of the objectives of this project having been achieved, new projects now are being directed in part toward the biological degradation of cellulose by soil organisms and in part toward applications of the cellulase enzymes in cellulose utilization.

	<u>1973-74</u>
SMY -----	0.8
Support Personnel -----	2.2
Total Expenditures -----	\$85,684

323400, CHARACTERIZATION OF MAMMALIAN SEMEN ENZYMES (Bruce M.
Anderson and John R. Vercellotti - Biochemistry and Nutrition)

This project includes studies on the isolation and characterization of enzymes that are of importance in reproductive processes. Enzymes are being purified and studied with respect to kinetic properties and with respect to the involvement of carbohydrate moieties in catalysis and enzyme structure.

Enzymes involved in the metabolism of pyridine nucleotide co-enzymes are being isolated and studied with respect to control processes occurring in seminal fluid.

	<u>1973-74</u>
SMY -----	0.5
Support Personnel -----	1.4
Total Expenditures -----	\$45,520

423669-1, BIOCHEMICAL CONTROL OF EFFICIENCY IN THE HIGHER PLANT
(Robert R. Schmidt and John L. Hess - Biochemistry and Nutrition)

The proposed research has three major objectives: 1) to use synchronous cotton cells in suspension culture to elucidate the biochemical mechanisms regulating gene expression and enzyme levels during the growth and division cycle; 2) to determine if the same regulatory mechanisms operative in cell suspension culture are operative in the cells of differentiated tissues of the intact plant; and 3) to use "chemomanipulation", by addition (to the whole plant or to specific tissues of the developing plant) of synthetic repressors (corepressors) or inducers of gene transcriptional and/or inhibitors or activators of enzyme synthesis and/or stabilizers or labilizers of enzyme activity, to alter intracellular processes for a more efficient utilization of exogenous nutrients, and the programmed composition and regulated growth rate of the entire plant or its organs.

1973-74

SMY -----	
Support Personnel -----	1.2
Total Expenditures -----	\$33,425

616162, REGULATION OF ENZYME SYNTHESIS AND DEGRADATION AND GENE
EXPRESSION DURING THE CELL CYCLE OF PLANT CELLS (Robert R.
Schmidt - Biochemistry and Nutrition)

The research has as its objectives to use synchronous cultures of higher plant cells and of Chlorella, a highly compartmentalized unicellular alga, to study the biochemical mechanisms regulating the timing of expression of structural genes and the synthesis and degradation of their encoded enzymes, involved in (1) assimilation of inorganic nitrogen and carbon dioxide, essential nutrients in plant nutrition, and (2) biosynthesis of nucleotides, prerequisite precursors to cellular replication. In addition, the intracellular location of the structural genes coding for these different organelle and cytoplasmic enzymes will be investigated in relation to the intracellular site (i.e., cytoplasmic or organelle ribosomes) of synthesis of these enzymes. Moreover, the physiological function and intracellular location of isozymes of certain of these enzymes will be ascertained in conjunction with experiments aimed at elucidating the biochemical autonomy exhibited by the chloroplast and other organelles.

1973-74

SMY -----	0.8
Support Personnel -----	2.4
Total Expenditures -----	\$76,050

Biology of Invertebrates

616212, GENETICAL AND INSECTICIDAL RESISTANCE STUDIES ON THE GERMAN
COCKROACH (D. G. Cochran, M. H. Ross and J. M. Grayson -
Entomology)

The objectives of this project are to extend our knowledge of the genetics of the German cockroach and to conduct cytogenetic studies, with the view of finding ways in which genetics can be used in suppression of cockroach populations; to investigate the various aspects of development of resistance to chemical insecticides; and to seek procedures for cockroach control that will be more currently acceptable.

Future Plans: All objectives of this project will be pursued. An attempt will be made to integrate deleterious genetic traits into natural cockroach populations and observe the results in terms of population suppression.

	<u>1973-74</u>
SMY -----	1.9
Support Personnel -----	2.9
Total Expenditures -----	\$69,888

2002730, MORPHOLOGY, CLASSIFICATION AND BIOLOGY OF THE PIT SCALES,
MEALYBUGS AND SOFT SCALES OF VIRGINIA (M. Kosztarab -
Entomology)

The objectives of this project are: to prepare detailed descriptions, illustrations, and keys for the identification of the pit scales, mealybugs and soft scales in Virginia; to study their life histories, host plants and distribution; and to investigate their natural enemies from the standpoint of biological control.

The objectives have been accomplished for 36 species of mealybugs, 52 species of pit scales, and 32 species of soft scales. Manuscripts on this work have been published or are being prepared. An indexed bibliography of the Coccoidea has been completed.

Future Plans: This project has been replaced by project #200358 which involves studies of the armored and asterolecaniid pit scales found in Virginia.

	<u>1973-74</u>
SMY -----	0.6
Support Personnel -----	1.7
Total Expenditures -----	\$39,082

616163, NITROGEN METABOLISM AND EXCRETION IN SELECTED INSECT SPECIES
(D. G. Cochran - Entomology)

The objectives of this project are to study the nitrogenous excretory products of selected insect species as keys to underlying biochemical events, to elucidate these events as pathways, and to evaluate the possible role of gut and especially fat body microorganisms in these processes.

Future Plans: The investigation of nitrogenous excretory products will continue.

	<u>1973-74</u>
SMY -----	0.2
Support Personnel -----	1.9
Total Expenditures -----	\$42,671

616167, BEHAVIORAL AND PHYSIOLOGICAL INVESTIGATIONS OF THE RESPONSES
OF CERTAIN INSECTS TO RADIANT ENERGY (J. L. Eaton -
Entomology)

The objectives of this project are to study the behavioral and physiological bases for the attraction of insects to sources of radiant energy and to study chemical attractants singly and in combination.

Future Plans: To further study the role of ocelli (simple eyes of insects) in the orientation of insects to sources of radiant energy. Additional studies will be made also of the structure and function of internal ocelli.

	<u>1973-74</u>
SMY -----	0.8
Support Personnel -----	0.7
Total Expenditures -----	\$26,342

643475-1, BIOSYSTEMATICS OF INDIGENOUS ARTHROPODS ATTACKING WEED
SPECIES (L. T. Kok, R. L. Pienkowski, W. H. Robinson and
J. M. Grayson - Entomology)

The objectives of this project are to identify the arthropods attacking selected weed species, determine their effects on the weeds, and evaluate the factors regulating the major arthropod populations. This research will complement and provide a strong background of knowledge for an expanded program of biological control of weeds.

It may also be possible to manipulate certain of the weed-feeding arthropods to increase their effects on the plant.

Future Plans: Continue to survey the arthropods attacking selected weed species, but in a more comprehensive manner and over a broader geographic area. The biology and life cycle of certain arthropods will be studied in detail and their effect on the vigor and competitive ability of their weed plant hosts will be determined.

	<u>1973-74</u>
SMY -----	0.6
Support Personnel -----	1.4
Total Expenditures -----	\$11,837

Biology of Microorganisms and Viruses

616077, THE PATHOGENIC POTENTIAL OF SAPROPHYTIC SOIL MICROFLORA (H.
B. Couch - Plant Pathology and Physiology)

The objective of this project is to assess the specific roles
of groups of saprophytic soil-inhabiting microorganisms in root disease
complexes.

Future Plans: This project will be replaced with a project on
the specific relationships of a limited number of species of sapro-
phytic soil microflora to the severity of root disease.

	<u>1973-74</u>
SMY -----	0.1
Support Personnel -----	0.8
Total Expenditures -----	\$6,464

Biology of Plants

616082, ROLE AND FATE OF SURFACTANTS AND OTHER ADDITIVES IN MODIFYING
HERBICIDAL ACTION AND SELECTIVITY (C. L. Foy - Plant
Pathology and Physiology)

Objectives are (1) to determine patterns of absorption, translocation and fate of herbicides and additives in higher plants; (2) to evaluate herbicide-additive-plant surface interactions influencing uptake, fate and phytotoxicity; and (3) to determine sites and mechanisms of the modifying effects of surfactants and other additives on biological response.

Future Plans: This project was terminated during the 1973-74 fiscal year, and a new project (616229) has been initiated.

	<u>1973-74</u>
SMY -----	0.7
Support Personnel -----	1.9
Total Expenditures -----	\$52,390

616055, RELEASE OF ORGANIC SUBSTANCES FROM ROOTS AND OTHER UNDERGROUND PLANT PARTS (M. G. Hale - Plant Pathology and Physiology)

Objectives: To measure the effects of foliarly applied chemicals and controlled injury on exudation patterns from living roots and to evaluate exudates as chelators of inorganic nutrients.

Future Plans: How are altered exudation patterns related to fungal colonization of roots and fruits of peanut and what is the significance of root exudates as chelators of inorganic nutrients? Is the role of calcium in exudation related to its effect on cell membrane permeability? Answers to these questions contribute to control of diseases and availability of nutrients in crop production.

	<u>1973-74</u>
SMY -----	0.6
Support Personnel -----	0.7
Total Expenditures -----	\$29,869

616062, TRANSLOCATION AND DEGRADATION OF HERBICIDES IN PLANTS (S.
W. Bingham - Plant Pathology and Physiology)

The project objective is to determine effectiveness of various plants for removal and degradation of herbicides in soil and water. Emphasis is being placed on the use of aquatic weeds as potential plants for degrading herbicide residues in water and improving water quality. The effect of herbicides on plant processes and plant structure will receive considerable emphasis during the coming year.

	<u>1973-74</u>
SMY -----	0.7
Support Personnel -----	1.0
Total Expenditures -----	\$26,665

616061, THE ROLE OF CERTAIN EXTRACELLULAR ENZYMES AND CALCIUM IN PLANT
DISEASE DEVELOPMENT (L. D. Moore - Plant Pathology and
Physiology)

Objective: Determine the nature and role of carbohydrate and cell wall degrading enzymes associated with certain plant diseases and evaluate the role of calcium nutrition in disease resistance.

Future Plans: The program is being directed towards studies of the composition of plant cell wall. Detailed analyses have been made for nonstructural carbohydrate, free sugars, starch and pectic substances. The hemicelluloses and cellulose will be analyzed next, so that the importance of certain pectic enzymes, hemicellulase and cellulase in plant disease development can be determined.

	<u>1973-74</u>
SMY -----	0.9
Support Personnel -----	0.6
Total Expenditures -----	\$22,984

Biology of Animals

200273, CHARACTERIZATION OF THE SYNTHESIS AND RELEASE OF ANTERIOR
PITUITARY HORMONES (M. H. Samli - Biochemistry and Nutrition)

Purpose: The long-term goal of this study is to examine the control of the secretion of the anterior pituitary hormones, with a consequent gain in understanding of the roles of these hormones as relates to both the agricultural and medical sciences.

Future Plans: To better understand the secretion of a specific pituitary hormone, work is now being initiated to examine the general metabolic changes that are characteristic of pituitary hormone secretion. For example, when hormone secretion is stimulated, RNA metabolism of the cell will concurrently be examined as well as the metabolism of membrane proteins and membrane phospholipids.

	<u>1973-74</u>
SMY -----	0.7
Support Personnel -----	0.5
Total Expenditures -----	\$23,982

Human Nutrition

303044-6, PHILIPPINE NATIONAL NUTRITION PROGRAM (R. W. Engel, Chief of Party - Manila; T. Colin Campbell, Campus Coordinator - Biochemistry and Nutrition)

The primary objective of the project is to assist the Government of the Philippines in the development of a nationwide nutrition program focuses primarily on the pre-school age child.

These programs, include nutrition centers ('mother-craft centers') for the pre-school age child; the nutrition program which provides a ready-made-to-eat highly, nutritious bun for malnourished pre-schoolers and schoolers; and a targetted maternal child health (TMCH) program which includes disbursement of food commodities for malnourished pre-schoolers and pregnant and lactating mothers.

Plans for the coming year include expansion primarily of the TMCH and Nutrition Programs; as well as providing technical assistance on home food preservation programs.

	<u>1973-74</u>
SMY -----	1.0
Support Personnel -----	
Total Expenditures -----	\$75,275

Anaerobic Bacteriology

2002820, 363431 and 3630957, NATIONAL INSTITUTE OF GENERAL MEDICAL SCIENCES V.P.I. ANAEROBIC BACTERIOLOGY RESEARCH PROGRAM (W. E. C. Moore, L. V. Holdeman, E. P. Cato, C. S. Cummins, J. L. Johnson, R. M. Smibert, L. DS. Smith and T. D. Wilkins - Anaerobe Laboratory)

Purpose: To characterize and catalog the anaerobic flora of man and animals in disease and in health and to measure the steroid metabolism of intestinal organisms associated with these flora. About 1/3 of the work concerns clinical material from hospitals and medical schools, 1/3 normal flora and 1/3 reference strains. Methods for culture, identification, antibiotic susceptibility, infectivity, distribution and occurrence are investigated.

	<u>1973-74</u>
SMY -----	8.0
Support Personnel -----	38.5
Total Expenditures -----	\$730,636

OUTLYING RESEARCH STATIONS do much of the mission-oriented or applied agricultural research administered by Virginia Tech at Blacksburg (largest circle). They are located to meet the needs of the main geographic regions of the Commonwealth:

1. Winchester Research Laboratory—Winchester: Research primarily on apples.
2. Virginia Forage Research Station—Middleburg: Forage, pasture, hay, and ensilage studies—research on beef cattle nutrition.
3. Shenandoah Valley Research Station—Steeles Tavern: Research on beef cattle and sheep—management and breeding. Research on apples and peaches.
4. Piedmont Research Station—Orange: Agronomic research—soils and plant nutrition, small grains, corn, alfalfa and other hay crops.
5. Eastern Virginia Research Station—Warsaw: Agronomic research—small grains and soybeans, etc.

6. Southwest Virginia Research Station—Glade Spring: Research on beef cattle and sheep management; burley tobacco production and management.
7. Reynolds Homestead Research Center—Critz: Forestry and fisheries—wildlife research.
8. Southern Piedmont Research and Continuing Education Center—Blackstone: Consolidated multipurpose station—research on crops (tobacco

and other agronomic crops). Programs involving vegetables, ornamentals, forestry, and animals will be developed as facilities and staffing are obtained.

9. Virginia State College Research Station—Petersburg: Agronomic research.
10. Tidewater Research and Continuing Education Center—Holland: Research on peanuts, soybeans and corn—swine management studies.

