A Minor Thesis in Agricultural Education

For the

DEGREE OF MASTER OF SCIENCE

IN

AGRICULTURAL ENGINEERING

[Farm engineering in agricultural high schools]

Submitted by

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THESIS PROBLEM

A study of the content of farm engineering instruction; methods employed; and means of determining instruction needed in the vocational agricultural programs of Virginia High Schools.

OBJECTS OF THE STUDY

First to determine those problems in the field of farm engineering and mechanics, which should be taught; how much time should be devoted to each and how they should be included in the four year program for Vocational Agricultural courses in Virginia.

Secondly to formulate an objective test to be used by the several agricultural departments in determining the course content, the instruction needed and in measuring the efficiency of such instruction as has been given by them.

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REASONS FOR THE STUDY

Numerous requests have been recieved in the past, by the Department of Agricultural Education of the Virginia Polytechnic Institute, from the instructors of Vocational Agriculture in Virginia for suggestions relative to instruction in farm engineering.

These requests are due to the great need for further improvement in economic production, the growing use of farm machinery and the need of farm conveniences.

The maintenance and improvement of soil fertility through drainage and terracing is more evident. Land values have increased. Most of Virginia's acres suitable for cultivation are already in use. This makes necessary the better utilization of that land which is being tilled. It cannot produce if the best of the soil is allowed to wash down our streams. Few crops grown in Virginia can perform profitably in poorly drained soil. Agricultural students should be equipped with that training which will insure that this problem is more efficiently met in the future.

Many farm conveniences, particularly of a labor saving nature, may be had with little effort and expense. The interest of the farm boy, in farming, depends to a large measure on these conveniences. The time and energy wasted in performing such jobs as opening gates, cultivating crops and feeding and watering animals is enormous and unnecessary. The farmer's son knows the hardships of farm life. He has seen his father carry water in buckets for his stock. He has seen him take a day to haul two cords of wood to the station. He has helped him feed by lantern light and milk ten cows.

The efficiency of farm operations remain low. Farm engineering instruction can lessen this wasted human energy. The daughter has seen her mother cook over a hot stove. She does the washing and churning by hand.

What type of young people would not wonder whether a farm life was worth living? Farm engineering will help this situation by harnessing the old stream at a small cost. A small motor will furnish water and light for both home and barn. The washing and churning can be done from the same power. How different would life be by the use of a little practical knowledge?

Many conveniences such as water or heating systems are not practicable for the farmer unless he is able to install the system himself. The outlay or investment required for the farmer is considerable greater than for his city brother. What, for instance, is necessary for a farm water system? The cost of a system for a country home would be greater than for a city home due to a well, gasoline engine, pressure tank and sewage disposal system. The same is true for electrical systems and other home conveniences.

The cost of upkeep is usually greater, particularly if the farmer himself does not know how to use and repair the system. In the one case the farmer must invest a considerable sum whereas in the city even the skilled laborer enjoys the use of improved water systems without investment. Thus it is that more attention must be paid to farm engineering instruction if farm homes are to have modern equipment.

This is the second argument for greater attention to farm engineering instruction in vocational agriculture.

There are a number of Smith-Hughes schools in Virginia teaching farm engineering. The extent to which this subject is taught is determined largely by the preferences of the individual instructor, and not necessarily by the needs of the community. Some teach practically no thing while others with no more demand emphasize farm engineering training. Who is right? How far should the instruction be carried? Who can answer this for the instructor?

A number of states have been teaching unit farm engineering courses for several years. Some states have modified their farm shop courses to include engineering problems and in some states they are now teaching unit courses in only a few departments, as trials. Few states had anything very definite to offer to the author and some only apologized for what they considered a weakness in their programs.

The agriculture of Virginia varies greatly as to the section and locality. Each section and even the community in which vocational agriculture is being taught has its individual needs. Orange County is in a sun-cured tobacco section. It is nearly surrounded by a livestock and a dairying section. Not only may there be a community here and there with a different type of farming, but the community itself may be made up of different types of farming. Many communities are made up of specialized fruit farms and diversified or general farms. The same is true for communities where tobacco and peanuts are specialized

in. There are farms in these communities that need tractors and others that do not. Still other farms may need drainage and another may need terracing. Each community has its own engineering problems.

This being true of the state it is evident that the program for farm engineering instruction to vocational agricultural students cannot be standardized. The instructor is faced with many problems in assuming the responsibility for instruction in farm engineering. These are some of them:-

1. What shall be taught?
   a. What are the needs?
   b. How shall the needs be determined?
   c. How to determine the important needs which can be efficiently taught?
2. How much time shall be given to each problem?
   a. What are the needs?
   b. How shall the needs be determined?
   c. How to determine the important needs which can be efficiently taught?
3. How shall this time be determined?
   a. How much time will it take to teach each problem?
   b. Can this or that problem be efficiently taught?
   c. Is this problem of sufficient importance to justify the time required to teach it?
      (1) Agricultural surveying is a good illustration of a problem that has not the importance to justify the time required to teach it.
4. How shall it be taught?
   a. When actual problems arise on the farm, only?
   b. In supervised practise? If so, as formal enterprises or as supplementary practise?
   c. In the farm shop?
   d. As a field course?
   e. As an informational course?
   f. As an informational course combined with field work?

It is very evident that the program needs to be a very much more definite one than as it now exists in Virginia. It was hoped something might be secured from this study which would be of material assistance toward strengthening the program for farm engineering instruction to vocational agricultural students.

ORIGINAL PLAN OF STUDY

The following procedure was formulated for this study:-

1. A request was sent to each state asking for the state plan providing for farm engineering instruction. Twenty-six states answered this request.

2. The farm engineering problems and jobs taught in other states were tabulated according to the method of teaching the time given to each job and those data studied.

3. Farm engineering problems taught in Virginia were tabulated likewise.

4. A study of farm engineering problems in text books was made.

5. With the above information as a guide the seminar group of students selected a probable list of engineering problems and determined the time to be spent, based on Virginia agriculture, as a whole.

6. A proposed course made in the form of a questionnaire was sent to every agricultural department in the state for revising and criticism, with their respective localities as a basis.

7. The method of tabulating the returned questionnaires is given below:

A. Virginia was divided into six agricultural groups of counties and the questionnaires tabulated in the following groups:

Group 1. Livestock and general farming.

Group 2. Fruit and livestock.

Group 3. Dairying.

Group 4. Tobacco.

Group 5. Sun-cured, dark and bright tobacco.

Group 6. Truck.

S U P P L E M E N T A R Y P L A N

The proceeding procedure was changed as explained under number one:

1. As the tabulation of the groups showed a great similarity in the requirements of several of the groups, this made it evident that there was no need of six standard engineering courses for the state.

2. New geographical sections were formed by combining groups with like requirements, namely:

Western Virginia Section

1. Appalachia
2. Valley
3. Higher Piedmont

Coastal Plain Section

1. Lower Piedmont
2. Coastal Plain.

Tidewater Section

1. Tidewater
2. Eastern Shore

3. The data secured from the agricultural instructors were again summarized for these three sections and for the state as a whole.

4. The data were then carefully studied and final recommendations set up.

5. An objective test was prepared to be used by the instructors to diagnose just what information is needed by their students.

Part II

R E S U L T S O F T H E S T U D Y

The Results to the Letter to Each State:-

The expression of the State Supervisors for agricultural education in answering these requests, seemed unanimous that there was a growing need of farm engineering training for high school agricultural students. Some of the state departments expressed the need of giving this training as occasion arose during the instruction of crops and livestock enterprises. Others suggested the farm management course or along with the managerial problems of the farm. Still others favored the farm shop instruction as a carrier. Some were already studying the problems of how to give better and more adequate instruction in farm engineering.

Only twenty-seven percent reporting taught standard farm engineering courses. Some of these courses were made out in minute detail giving the jobs being taught, while others included only the farm engineering problems. Where distinct courses were being given the results seemed satisfactory. Some reported that these courses would be much more efficient after certain revisions were made.

Over one-third of the states had no standard course in farm engineering. Farm engineering courses were taught in various schools in these states. Some of the letters from the State Supervisors indicated that standardized courses would be taught in the future.

In thirty-eight percent of the twenty-six states reporting farm engineering was being taught through farm shop instruction. The disadvantage of this type of instruction was outlined as follows:

1. Unable to secure sufficient equipment for some of the farm

engineering problems.

2. Time wasted with a large class.

3. Some jobs require study and not practice alone.

4. Insufficient time to teach a field course.

5. The instruction secured did not justify the time required to teach various problems.

Some of the departments in every state reporting, offered farm engineering training. In this case the method of teaching was left to the high school agricultural instructor.

It is interesting to notice that gas engines was the outstanding problem taught. Instruction in gas engines was a part of farm engineering instruction and more time was devoted to it than for any other single problem, in these states. Home conveniences seem to be more largely taught as a group than farm machinery or any other group. A high percentage taught farm structures, farm machinery and concrete. Only one-fourth included surveying in their farm engineering courses. Several years ago nearly all agricultural departments offered surveying. This is encouraging. In the first place few farmers, even good ones, ever do their own surveying. It demands expensive equipment and equipment which is seldom used. It demands a high degree of skill, acquired only through much training and practise. Scarcely enough time can be justified in the high school courses to furnish the necessary skill and practise. The time can be more profitably spent in other ways.

F A R M E N G I N E E R I N G P R O B L E M S

Taught in various States.

Farm Engineering Problems	States in which taught
Agricultural drawing	30.7 %
Estimating materials	11.5 %
Home Lighting	38.4 %
Home heating	34.6 %
Electric wiring	26.8 %
Sanitary equipment and sewage disposal	23.1 %
Water systems and plumbing	23.1 %
Concrete	26.8 %
Farm Structures	38.4 %
Farm machinery	34.6 %
Agricultural surveying	26.8 %
Land drainage	23.1 %
Roads	15.3 %
Irrigation	11.5 %
Terracing	11.5 %
Leveling	7.7 %
Gas Engines	42.2 %
Principles of mechanics	15.3 %
Engineering problems	15.3%
Fencing	7.7%

The state of Virginia offers no standard farm engineering course. A study of the farm engineering problems taught in the state

was made to determine what engineering problems and jobs were being taught. From the following tabulation one may see that nearly all of the important farm problems taught in other states were also taught in Virginia. Very few of the departments teaching farm engineering taught over one-third of the farm engineering problems listed as being taught in Virginia.

The farm problem was used as a guide in determining what farm problems are of importance in Virginia. This tabulation was used as a guide for setting up a tentative course for the seminar group.

Table III

Time Devoted and the Methods Employed in Teaching Certain Farm Engineering Problems as reported by 13 Agricultural Instructors of Virginia.

Farm Engineering Problems	Average No. Days Devoted to Problems	Method of Teaching: Class Room only % Schools	Field or Lab. only % Schools	Class and Field Instruction % Schools
Concrete	4.5	40	40	20
Leveling	1.	0	50	50
Terracing	4.	0	50	50
Drainage	6.5	33	0	67
Water systems	6.1	28	19	43
Sewage disposal	5.	33	33	33
Surveying	4.6	16	50	33
Gas Engines	5.5	30	20	50
Farm machinery	20.4	0	32	67
Drawing	10.	100	0	0
Farm structures	4.	75	0	25

Table III - Continued

Farm Engineering Problems	Average No. Days Devoted to Problems	Method of teaching: Class Room Only % Schools	Field or Lab. only % Schools	Class and Field Instruction % Schools
Lighting	3.6	40	20	40
Home heating	4.	50	50	0
Mechanics	0	0	0	0
Eng. problems	0	0	0	0
Roads	1.	100	0	0
Land Clearing	2.	100	0	0
Fencing	6.	100	0	0

THE TENTATIVE COURSE IN FARM ENGINEERING FOR VIRGINIA HIGH SCHOOLS

A tentative course in farm engineering was presented to the seminar group of which the author was a number. After careful study it was revised. Such a problem as irrigation was included in the courses of the states. Irrigation may be of importance in several trucking communities near the larger cities. There were no agricultural departments in such areas in Virginia. The need of this problem was so small that this problem was not included in the tentative course of study. Other problems were eliminated for the same reason.

THE RESULT OF THE STUDY OF FARM ENGINEERING PROBLEMS MADE BY THE SEMINAR GROUP

The opinion of the Seminar class was that there is a very immanent need of a course of farm engineering in Virginia. From the tentative course presented to them which included all the important problems taught in other states and important jobs worked up for these problems the group selected the following problems.

The recommendations made by the class were based on past experience and the farming in the community from which they came.

Table IV

FARM ENGINEERING PROBLEMS OF IMPORTANCE IN VIRGINIA AND TIME REQUIRED TO TEACH THEM AS DETERMINED BY SEMINAR GROUP 1924 - 25.

Farm Engineering Problems	Jobs	Days
1. Concrete	3	5
2. Leveling	4	6
3. Terracing	3	5
4. Drainage	10	8
5. Water systems	6	6
6. Sewage disposal	3	2
7. Surveying	4	10
8. Gas engines or tractors	7	13
9. Farm machinery	8	7
10. Agricultural drawing	4	5
11. Farm structures	8	11
12. Home lighting	2	4
13. Home heating	4	8
14. The principles of mechanics	0	0
15. Engineering problems	0	0

After the problems were selected certain operations and skills were determined as necessary, for the solving or completion of each problem. This was necessary to more intelligently determine the time required for instruction.

The opinion of the Seminar group, as to the method of teaching, was that certain operations require study and could be more successfully

taught by class room instruction. For example such an operation as determining the heating system to use. To be able to come to a correct solution, a study of the types of heating systems, with their advantages and disadvantages must be made. Certain skills must be performed to learn the skills and to impress the theory. For example the skill or job of mixing concrete must be performed to acquire the skill. By mixing a sloppy mix and a stiff mix the theory that a stiff mix of concrete is much stronger than a sloppy one will be impressed.

The reasons given for this method of teaching are outlined below:

1. Certain operations require study.
2. Insufficient equipment to teach very many operations.
3. A field course requires too much time for the principals learned.
4. The purpose of the course is to teach practical principals or reasons why certain things must be done as well as how they should be done.
5. By the field application of a few jobs under each problem the theory is impressed.
6. More ground may be thoroughly covered by a combination of these two methods of teaching.

Table II

THE POPULARITY OF CERTAIN FARM ENGINEERING PROBLEMS AS REPORTED BY THIRTEEN AGRICULTURAL INSTRUCTORS IN VIRGINIA

Problems	Number Schools Teaching The Problem
Concrete	5
Leveling	2
Terracing	3
Drainage	6
Water systems	6
Sewage Disposal	3
Surveying	6
Gas Engines	10
Farm Machinery	7
Agricultural Drawing	1
Farm Structures	4
Home Lighting	5
Roads	1
Clearing Land	1
Fencing	1

Part III

A SURVEY OF THE EXPERIENCE OF VOCATIONAL AGRICULTURAL INSTRUCTORS OF VIRGINIA IN TEACHING FARM ENGINEERING.

The original plan explains how the state was divided into six agricultural groups and why these groups were combined, to form sections A, B and C. Then a carefully outlined questionnaire was to be prepared and sent to the instructors of the state and the returns tabulated by sections as set-up here. These sections are composed of the following counties:-

Table V

COUNTIES IN GROUPS AND SECTIONS

A - Western Section		B - Coastal Plain	
Valley Higher Piedmont Appalachia		Lower Peidmont Coastal Plain	
Group 1. Livestock & General Farming			
1.	Shenandoah	24.	Hanover
2.	Rockingham	25.	Caroline
3.	Augusta	26.	Chesterfield
4.	Rockbridge	27.	Powhatan
5.	Roanoke	28.	Buckingham
6.	Montgomery	29.	Appomattox
7.	Giles	30.	Campbell
8.	Pulaski	31.	Cumberland
9.	Wythe	32.	Nottoway
10.	Tazewell	33.	Dinwiddie
11.	Russell	34.	Prince George
12.	Wise	35.	Lunenburg

Table V - Continued.

A - Western Section		B - Coastal Plain	
	Group 1. Livestock and General farming.		
13.	Lee	36.	Charlotte
	Group 2. Fruit and Livestock farming.	37.	Henrico
14.	Carroll	38.	Sussex
15.	Floyd	39.	Mecklenburg
16.	Patrick	40.	Pittsylvania
17.	Culpepper	C - Tidewater	
18.	Clarke		Tidewater Eastern Shore
	Group 3. Dairying		
19.	Fairfax	41.	Westmoreland
20.	Loudon	42.	Northumberland
21.	Prince William	43.	Middlesex
	Group 4. Tobacco	44.	James City
22.	Henry	45.	York
23.	Bedford	46.	Surry
		47.	Northampton
(?)	Unidentified Group	48.	Accomac
51.	A	49.	Nansemond
52.	B	50.	Norfolk
53.	C		
54.	D		
55.	E		

(?) Some of the questionnaires were returned unsigned. These five could never be identified with certainty.

RAND McNALLY

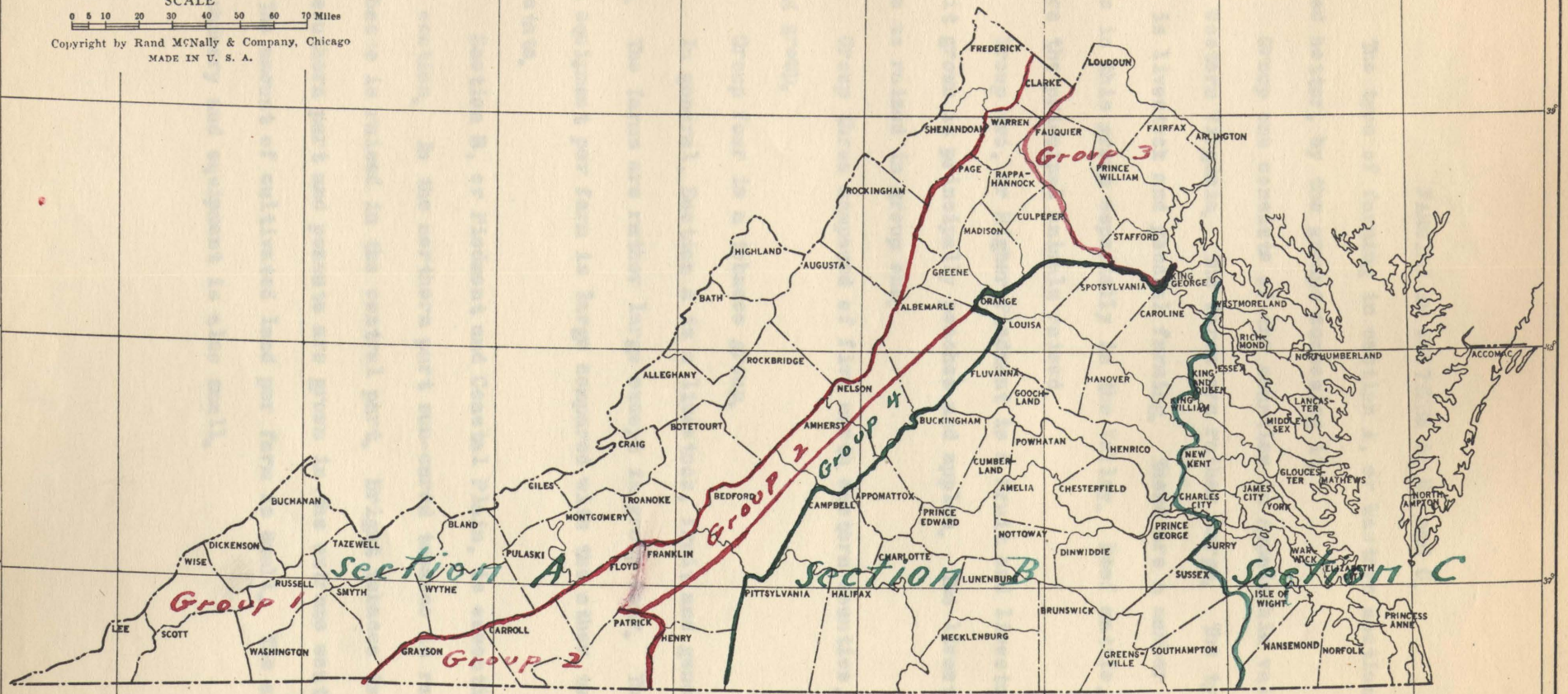
LETTER SIZE OUTLINE MAP

VIRGINIA

SCALE

0 5 10 20 30 40 50 60 70 Miles

MAP SHOWING THE THREE SECTIONS VIRGINIA WAS DIVIDED INTO AND THE GROUPS OF COUNTIES COMPOSING SECTION A.



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Virginia

FARMING IN SECTIONS A, B, and C.

The type of farming in section A, or Western section, may be explained better, by the groups composing it.

Group one consists of the counties in Appalachia valley and extreme western Virginia. The farms are rather large. The type of farming is livestock and general farming. There are a number of apple orchards in this group especially in the Valley. Beef cattle, hogs and sheep are the principal animals raised.

Group two, or Higher Piedmont is a fruit and livestock section. The fruit grown is principally peaches and apples. The livestock is about the same as raised in group one.

Group three composed of five north eastern counties, is a dairying group.

Group four is a tobacco group.

In general, Section A is a livestock, fruit and general farming section. The farms are rather large except in group four. The amount of farm equipment per farm is large compared with the other two sections of the state.

Section B, or Piedmont and Coastal Plain, is essentially a tobacco section. In the northern part sun-cured tobacco is raised. Dark tobacco is raised in the central part. Bright tobacco is raised in the southern part and peanuts are grown in the extreme southeastern part. The amount of cultivated land per farm is small. The amount of farm machinery and equipment is also small.

Section C, or Tidewater and Eastern Shore, is a trucking section. In the western part tobacco and peanuts are grown. In the central and eastern part, including the Eastern shore, the farming is mainly truck farming. The farms are small and the average amount of equipment is from small to medium.

THE QUESTIONNAIRE.

The questionnaire used was prepared with the help of the Seminar class and members of Teacher-Training Department. (See the questionnaire attached to the rear of this study). The object of this questionnaire was to secure answers to these questions:-

1. What farm engineering problems would the instructors teach?
2. How much time is necessary or justified for their teaching?
3. How should they be taught.

Important problems and jobs were given to secure some uniformity in the thought of the instructors. The questionnaire did not ask for what had been done, but asked what they taught in their respective communities. The questionnaire suggests the time that is required to teach each job. This was done to be used as a guide for the instructors that have made little study of farm engineering problems, and to get some uniformity in the reports made.

The method of teaching is not asked. The method of teaching each operation, whether by practice or class room instruction is implied by the statement of the operation. An operation stated such as, "Studying the types of water systems", would imply class room instruction. On the other hand a job like, "Installing a small water system", would naturally mean practice in the skills of measuring, cutting, threading and laying pipe.

At this point there is a probable weakness in this study. This weakness is due the questionnaire having suggested to the instructor

reporting, the time necessary to teach each farm engineering topic and the operations necessary. The instructors probably tried to approach this time in reporting. The average for a section brought this out too prominently as the average figure was very close to the proposed figure. This in reality was not true. There is no doubt but that some of the instructors tried to follow the suggested time in all problems they taught, if they thought the problems should be taught in their communities. The individual reports and the average reports for the small groups did not closely follow the suggested outline. This shows that the majority of the instructors only used the time proposed as a guide.

WHERE SHALL FARM ENGINEERING BE TAUGHT IN THE FOUR YEARS OF VOCATIONAL AGRICULTURE?

Table number VI shows the place in the course certain farm engineering problems will be taught. This table also shows the percent of the instructors that would teach various problems in their communities. The outstanding features of this table are here outlined:

1. Nearly one hundred percent of the instructors think concrete should be taught in a farm engineering course. About half of the instructors think it wise to include a shop course in addition to this course.

2. The above situation was found to be the same for water systems.

3. Over seventy-five percent of the instructors in each section would teach the following farm problems:-

Concrete	Water systems
Home lighting	Drainage
Sewage disposal	Gas engines

Drainage seems to be a local problem rather than a sectional one. The others are in no ways sectional.

4. Land terracing would be taught only in section B. This is the area of the state where soil erosion has been a serious problem for the farmers.

5. Surveying would be taught only in section C. This is likely explained by drainage being more commonly a local problem. Some idea of levels assists in plowing and handling land to promote drainage as well as more formal drainage systems.

6. Farm machinery would not be taught as a separate farm engineering problem. It would be combined with courses in farm management and farm crops.

7. Agricultural drawing would be taught as opportunity offered during teaching of crop and livestock enterprises. It could be included in the farm shop, particularly blue print reading. Or again, opportunity offers itself in teaching the laying out of the farm and in home ground improvement.

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Table VI

THE ORGANIZATION IN THE HIGH SCHOOL AGRICULTURAL COURSES TO PROVIDE FOR FARM ENGINEERING INSTRUCTION.

A Summary of the experience of sixty-two Agricultural Instructors in Virginia.

Problems	Place in Course to be Taught. Percent of Instructors preferring	Section A Western Section (Groups) No.1	No.2	No.3	No.4	Total	Coastal Plain	Tide-water	Unidentified	State Average
Concrete	Shop	50	80	100	50	62	45	73	40	59
	Engineering course	100	100	100	100	92	100	80	80	95
Water systems	Shop	31	60	100	50	46	30	80	0	47
	Engineering course	100	60	100	100	92	100	100	80	92
Leveling	Engineering course	75	80	100	50	80	70	54	40	70
Terracing	Engineering course	47	10	33	100	42	50	0	40	37
Home lighting	Engineering course	87	100	100	100	92	85	91	80	89
Farm structures	%would combine course	81	80	100	100	85	50	83	80	73
	Engineering course	37	10	0	0	23	65	18	20	35
Home heating	Engineering course	60	40	100	100	64	40	83	40	57
Drainage Course I	Engineering course	12	0	0	0	8	30	59	40	27
Drainage " II	Engineering course	62	80	62	100	69	50	27	40	53
Surveying " I	Engineering course	33	60	33	50	36	30	27	20	34
Surveying " II	Engineering course	33	10	33	0	28	30	27	20	28
Sewage Disposal	Engineering Course	87	40	100	100	81	80	81	80	81
Roads	Engineering course	68	40	33	100	62	75	54	100	68
Farm Machinery	Engineering course	12	0	0	50	11	45	27	60	29
Gas Engines	Engineering course	68	80	100	100	73	100	81	80	85
Agricultural Drawing	" course	13	0	0	0	8	5	0	0	6
Average No. schools reporting		16	5	3	2	26	20	11	5	62

The time that the instructors in the three sections of the state have allotted to the several engineering problems is shown in table VII and graphs. This time was given by operations. The time required to teach these operations was gathered from the experience of these instructors in teaching of a similar nature. When added together the jobs total represents a fairly safe guide as to the amount of time necessary to insure instruction for each topic or farm problem. Experience shows however, more time is required than that which an instructor plans on. Very few are able to teach all that is planned in any course. The outstanding features of this table are here outlined:-

1. There is a very marked uniformity in the time proposed for any one problem in all the sections. It seems that a certain amount of time is necessary to insure efficient instruction for any one farm engineering topic or problem. This time is necessary whether the problem is very important or not in that locality.

2. Some sections did not think terracing, road construction, farm machinery or drawing should be taught. The days they proposed for a course was practically the same as for the sections teaching these problems.

3. No time was given by instructors on farm machinery.

4. A large amount of time was allotted to gas engines and farm conveniences.

5. Only a comparatively short time was given for surveying. This was confined to simple methods of determing areas, relocating fence lines and to simple principles of leveling necessary to terracing and simple forms of drainage.

Table VII

TIME TO BE DEVOTED TO THE SEVERAL FARM ENGINEERING PROBLEMS
Summary of experience of 62 Agricultural instructors of Virginia

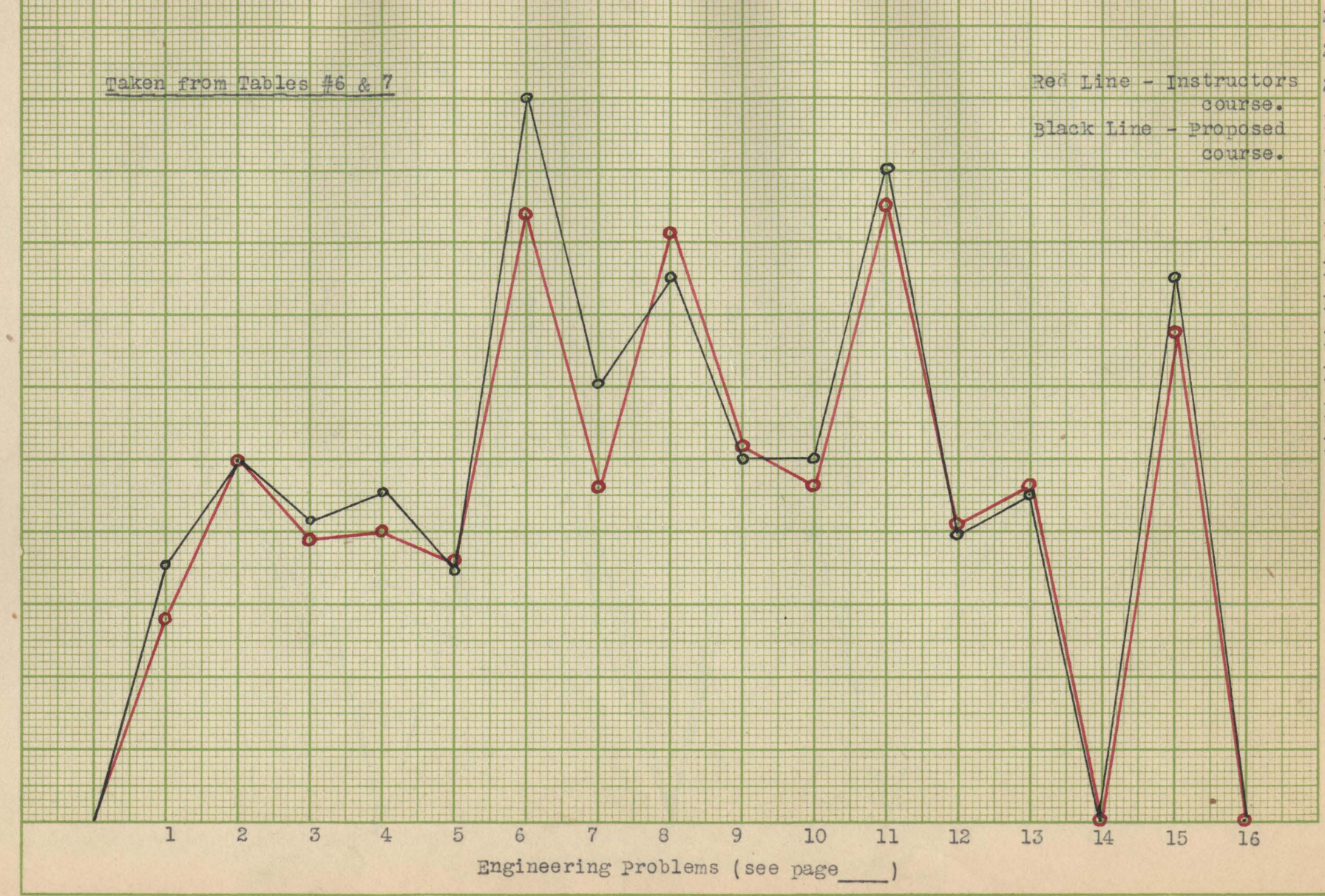
Problems	Days proposed	Section A Western section (Groups) No.1	No.2	No.3	No.4	Total	Sec. B Coastal Plain	Sec.C: Tide-water	Uni-dentified	State Average
Concrete	" "	5.5	6.	6.	5	6	6.5	6.5	4	5.6
Water system	" "	10	9	9	9	10	9	11	9	10
Leveling	" "	5.5	8	6	5	7	7	5	7	6.8
Terracing	" "	6.5	0	8	6	7.5	7	0	7	7.1
Home Lighting	" "	6	6	6	5	6	5.5	7	6	6.2
Farm structures	" "	17	15	20	14	16	18	17	18	16.8
Home Heating	" "	10.5	5.5	9	7.5	10	6	6	12.5	9.1
Drainage Course I	" "	12	0	0	0	12	15	16	16.5	16.2
Drainage " II	" "	9	10	9	8	9	9	10	7	9.4
Aver.No.Days given drainage		10	10	9	8	9	11.5	13.5	12	11.3
Surveying Course I	Days proposed	10.3	12.5	6	8	10/1	9.5	9.5	10	9.2
Surveying " II	" "	15.6	15.	18	0	16	18	17	18	17
Aver.No.Days given surveying		12.5	17	8	8	12	14	12.5	14	14
Sewage Disposal	Days proposed	8	7	8	6/5	8	8	8	8	8
Roads	" "	8.5	9	6	9	8	8	9.5	9	9.3
Farm Machinery	" "	No days, Course given in farm management								
Gas Engines	" "	14	11	14	12.5	13	14	13	13	13.5
Drawing	" "	No days, combined with other courses								
Aver.No.Schools reporting		16	5	3	2	26	20	11	5	62

GRAPHS COMPARING THE PROPOSED COURSE AND THE COURSE GIVEN BY VIRGINIA AGRICULTURAL INSTRUCTORS

Taken from Tables #6 & 7

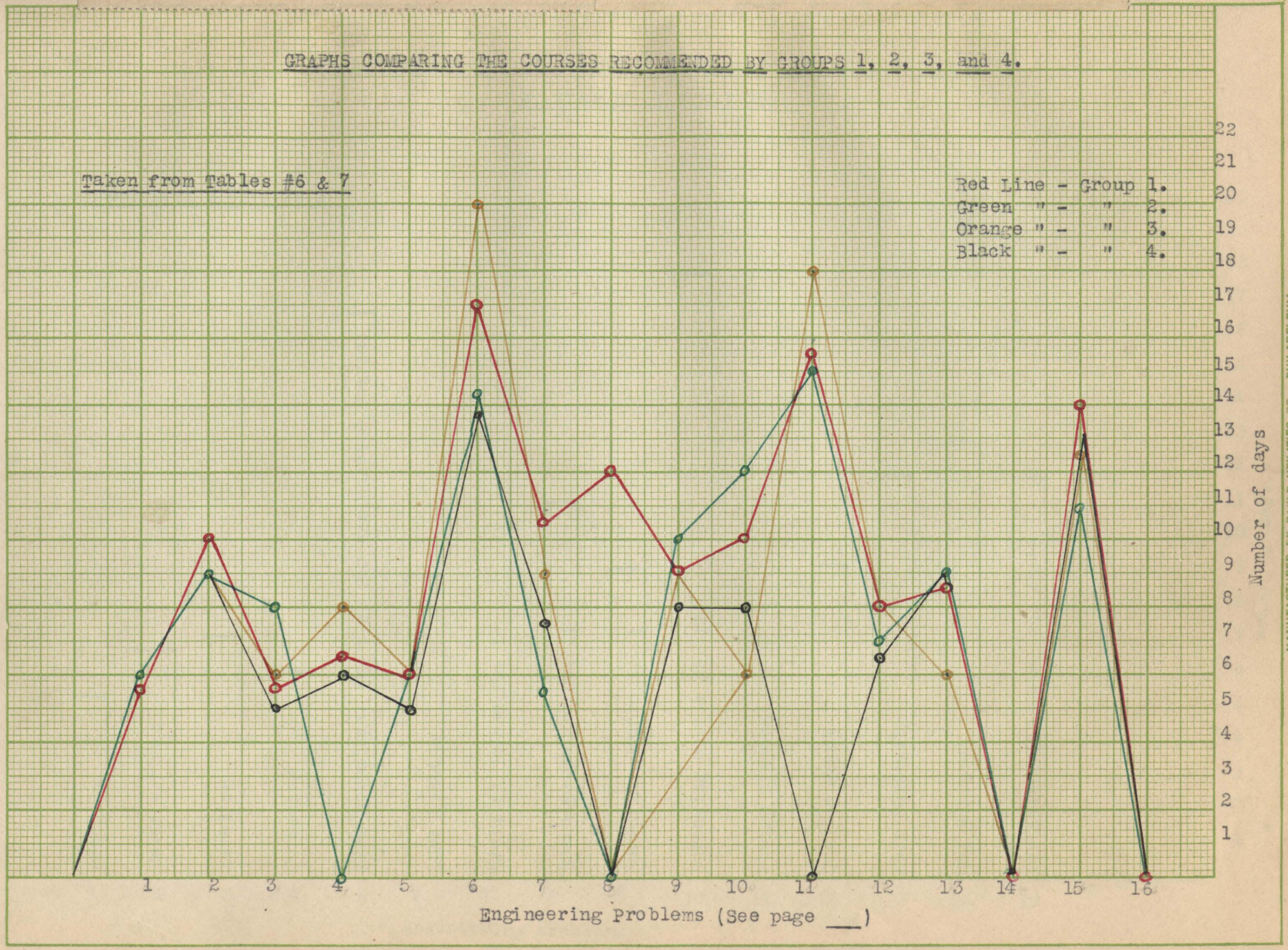
Red Line - Instructors course.

Black Line - Proposed course.



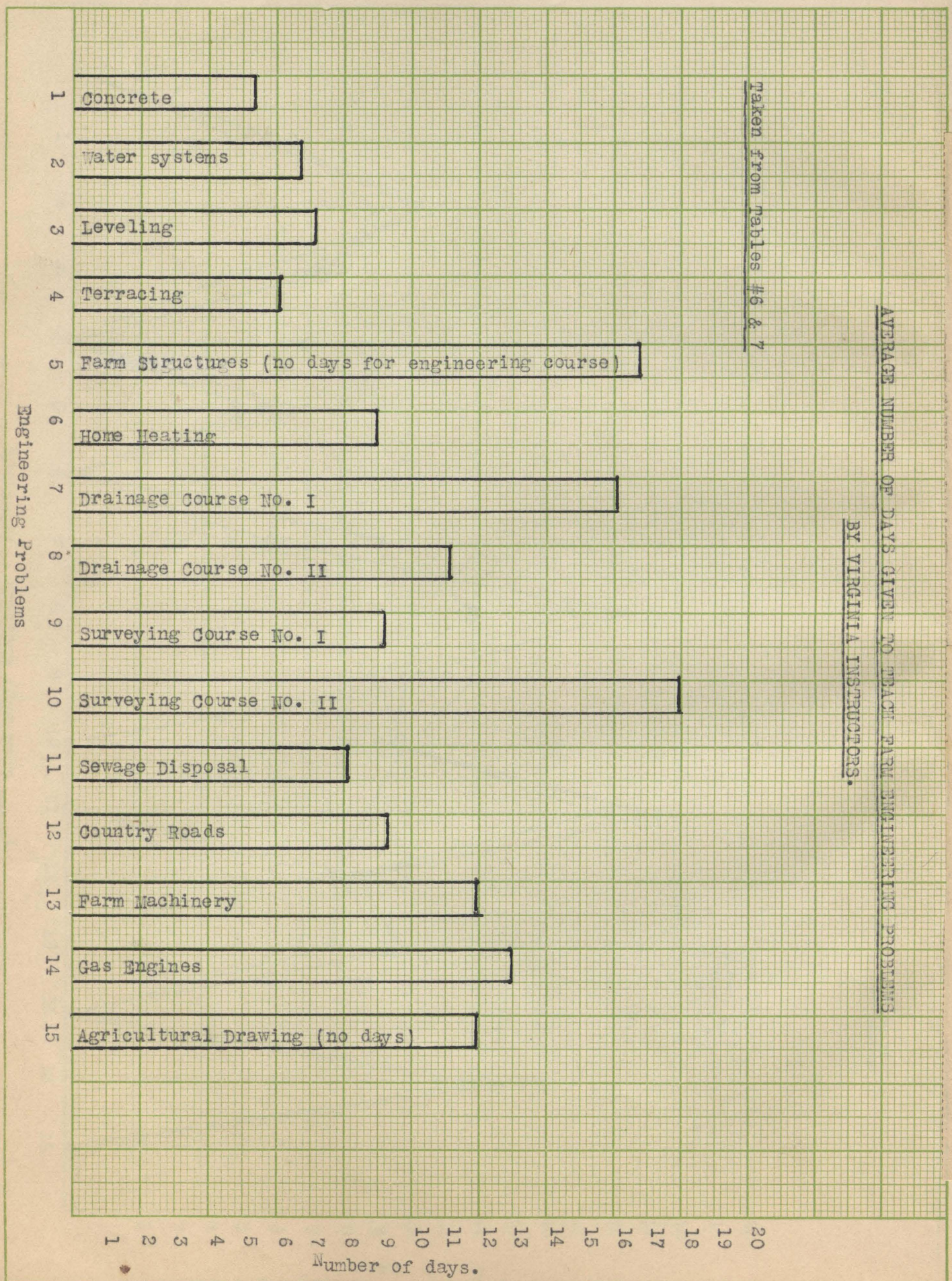
GRAPHS COMPARING THE COURSES RECOMMENDED BY GROUPS 1, 2, 3, and 4.

Taken from Tables #6 & 7



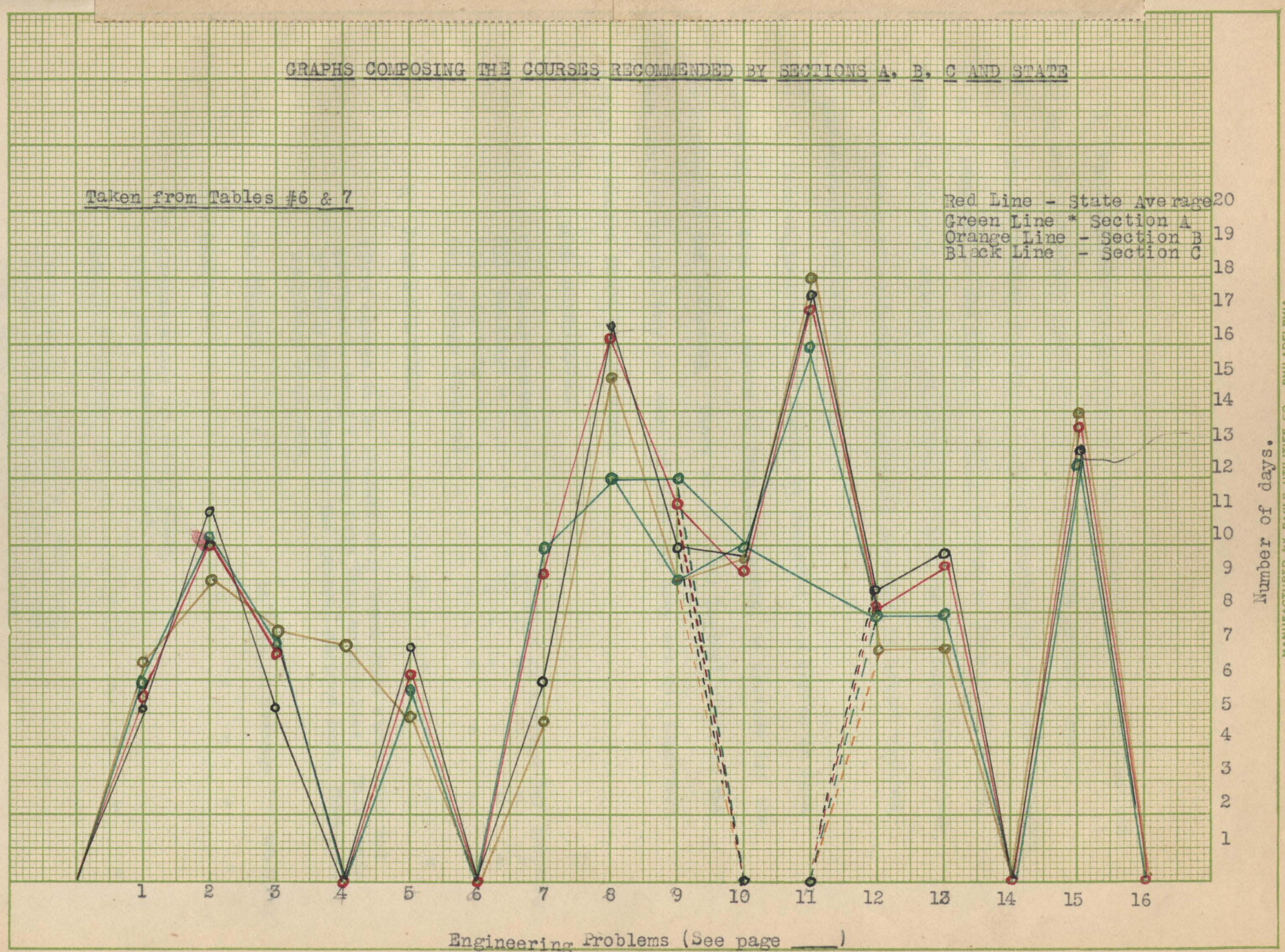
AVERAGE NUMBER OF DAYS GIVEN TO TEACH FARM ENGINEERING PROBLEMS BY VIRGINIA INSTRUCTORS.

Taken from Tables #6 & 7



GRAPHS COMPOSING THE COURSES RECOMMENDED BY SECTIONS A, B, C AND STATE

Taken from Tables #6 & 7



C O N C L U S I O N S

1. Farm engineering training for agricultural high school students must be more definitely provided for because of the growing demand.

2. The best place to teach a farm engineering job is when attention to it is demanded in the study of some farm crop or form of livestock. Motivation already exists. Its proper relation to the farm enterprises, home conditions of students and supervised practice is better assured. It therefore is the natural place.

3. Farm engineering jobs should be included in a course in farm engineering or else in a course in farm management, to provide for the instruction in the following. There is no other logical place in the four years of agriculture for many of them and they are all important enough to demand there being taught.

A. HOME CONVENIENCES

(1) Water systems - - - - - - - 10 days an average for teaching
(2) Heating- - - - - - - - - - 10 " " " " "
(3) Lighting- - - - - - - - - - 6 " " " " "
(4) Sewage disposal - - - - - 8 " " " " "

B. FARM STRUCTURES - - - - - - - - - 17 " " " " "

(This course is to include only those farm structures not previously taught along with farm enterprises) This topic probably would include the general purpose barn, farm house, machinery shed, etc.

C. GAS ENGINES - - - - - - - - - - - 14 days an average for teaching

D. CONCRETE- - - - - - - - - - - - - 6 " " " " "

(Concrete may be taught along with some farm enterprise)

E. PROFILE LEVELING- - - - - - - - 7 " " " " "

(Preparatory to drainage, terracing, water systems, sewage disposal and water power developments, and may be taught with same)

F. DRAINAGE (SIMPLE FORM) - - - - - 10 days an average for teaching

If drainage problem is complex, 16 days an average for teaching (Drainage is a local problem and should be taught in sections where needed)

G. TERRACING - - - - - - - - - - - - 7 days an average for teaching

(should be taught only in sections where soil erosion is a problem)

H. ROADS - - - - - - - - - - - - - - 9 days an average for teaching

I. AGRICULTURAL SURVEYING (SIMPLE) 9 days an average for teaching

(Methods of determining areas, in reorganizing field layouts and in home ground improvement. Formal agricultural surveying by the use of surveying instruments, is too advanced for high school instruction).

J. FARM MACHINERY - - - - - - - - Time too varying to state.

(This topic would include only implements not used for any *particular farm enterprise, such as tractors, wood saws,* feed grinders, etc.).

4. The following farm engineering problems can best be included with regular farm crops and livestock instruction:

A. FARM MACHINERY

B. FARM STRUCTURES

(This topic includes those farm buildings demanded when certain enterprises are being studied, such as a corn crib, poultry house or hog feeder).

C. DRAINAGE (Taught here if occasion arises).

D. TERRACING (Taught here if occasion arises).

E. AGRICULTURAL DRAWING (Simple sketches and blue print reading as demanded by the study and consideration of farm structures, feeding devices, etc., for crop and livestock enterprises and in home ground improvement).

5. Farm engineering jobs can be well taught in farm shop for the following. Farm shop exists for formal application of class room instruction.

A. FARM STRUCTURES

(Simple operations offering as application from the class room, such as hog houses and brood coops).

B. GAS ENGINES

(Only as application arises for the repair of gas engines).

C. CONCRETE

(Simple practice when occasion arises).

D. WATER SYSTEMS

(Application in the skills of cutting, threading and measuring pipe, etc.).

E. AGRICULTURAL DRAWING

(Confined largely to blue print reading and simple sketches demanded for every construction problem, undertaken before being begun).

6. The author started with the idea that a farm engineering unit course for agricultural high schools of Virginia was a necessity. In concluding this study he is somewhat doubtful of its feasibility, as a unit course. Farm management raises all the problems of farm engineering. They are again raised naturally. They must come up in farm management even if taught previously. Motivation for teaching a job often exists in the study of reorganizing the home farm in the farm management class. It has been proven that the job is a necessary one. There is a water system demanded as necessary. The student must decide on that system to use which is best adapted. It is then sometimes possible to assist, or at

least observe the instalation of some such water system. The skills required for such an operation may be taught in the farm shop.

A distinct course was favored by many state supervisors. However it is thought that this was due to there unanimous feeling of the need for more real farm engineering instruction. It is felt that if taught in farm management and specifically provided for both by the program and method of instruction (which includes the step of application if not of testing out) that their desire is met.

7. The most satisfactory method of teaching listed was by the combination of class room with field or shop instruction.

THE FARM ENGINEERING QUESTIONNAIRE SENT TO THE VIRGINIA AGRICULTURAL INSTRUCTORS

Topic No. 1 - CONCRETE

The new standard shop course for Virginia recommends certain suggested jobs, in order to give proficiency in the following skills:

Standard Shop Course

Jobs (Suggested):	Skills:
a. Making a concrete watering trough.	1. Building forms.
	2. Mixing conrete.
	3. Pouring and tamping concrete.
b. Making a concrete walk.	4. Floating and troweling concrete.
	5. Removing and cleaning forms.

Do you think the skills involved in concrete work should be taught in shop course given during the first and second years? (Yes, No)_____

Concrete Course in Farm Engineering

Should this topic be taught in your community? (Yes, No) _____

Columns	1 Proposed: Days	2 Your Days
A. Determining factors controlling the strength of concrete. (Amount of cement, aggregate strength and how graded, amount of organic matter and water).	3	
B. Determining the mixture for certain jobs, (the four standard mixes, the type of work each is used for and the number of cu. ft. of cement, sand and gravel required for one cu. yard of each mix.)	2	
C. Figuring materials. (A barn foundation is to be 36 ft. wide, 60 ft. long, 3 ft. high, and 10 in. thick. What mixture would you use? How many cu. yds. of cement, sand and gravel would it take? What will it cost, figuring cement at $1.00 per cu. ft., sand at $2.00 per cu. yd., rock at $2.00 per cu. yd., and labor @ $2.00 per day). (Better to substitute a local problem for this.)	2	
Total -	7	

1. Do you think boys should receive training in skills, involved in concrete work, in Farm Engineering course, in addition to practise secured in Farm Shop course? (Yes, No) _____

2. Would you teach the suggested Engineering course in case you can find no local problems to hitch up with each job? (Yes, No) _____

3. Do you recommend this course as you have revised it for your community? (Yes, No) _____

Topic No. 2 - FARM WATER SYSTEMS

The new standard shop course for Virginia recommends certain suggested jobs, in order to give proficiency in the following skills:

Standard Shop Course

Jobs (Suggested):	Skills:	
a. Putting in a kitchen sink.	1. Measuring pipe	4. Jointing pipe
	2. Cutting Pipe	5. Threading pipe
b. Installing a pitcher pump	3. Bending pipe.	

Do you think the skills involved in plumbing should be taught in shop course given during the first and second years? (Yes, No) _____

Should this topic be taught in your community? (Yes, No) _____

Columns:	1	2
	Proposed: Days	Your Days
A. Learning terms (Cu. ft.; cu. ft. per min.; friction in pipe)	1	
B. Studying the sources of water supply.	1/2	
C. Determining the quantity of water required.	1/2	
Select a farm and apply the following:		
D. Determine the water system needed. (Gravity; power and reservoir; pneumatic or pressure tank system)	2	
E. Determining the kind of power to be used. (Wind mill; hydraulic ram; gasoline engine; electric motor).	2	
F. Determining the size of pipe required for various distances and quantity of flow.	1	
G. Making out a bill of material. (Where to order)	1/2	
H. Figuring cost of system.	1/2	
I. Practice in installing a system.	2	
Total	10	

Engineering Course (water systems)

1. Do you recommend this course as you revised it for your community? (Yes, No) _____

2. Would you teach the skills involved in the above jobs, in Farm Engineering Course, in addition to practice secured in Farm Shop? (Yes, No) _____

Topic No. 3 - LEVELING

Should this topic be taught in your community? (Yes, No) _____

Columns	1	2
	Proposed: Days	Your: Days
A. Studying profile leveling (by diagrams)	1	
B. Learning to read rod and keep notes.	1	
C. Practise in measuring with a steel tape.	1/2	
D. Practise in adjusting the level.	1/2	
E. Practise in leveling a foundation.	1	
F. Practise in profile leveling.	3	
Total	7	

1. Should this course as outlined above be taught as a separate course in order to save time when using instrument in connection with other jobs, or should it be combined with drainage, water systems, terracing and sewage disposal? (Yes, No) _____

2. Do you recommend this course as you revised it for your community? (Yes, No) _____

Topic No. 4 - TERRACING

Should this topic be taught in your community? (Yes, No) _____

Columns	1 Proposed: Days	2 Your Days
A. Studying Farmers Bulletin #995 on terracing.	3	
a. Causes and forms of erosion.		
b. Method of preventing erosion.		
c. The ridge terrace (width, height, grade)		
B. Locating and staking off a level terrace with drain on local farm.	2	
C. Cost of terracing on above farm.	1	
D. Practice in building terraces.	2	
Total	8	

Do you recommend this course as you revised it for your community? (Yes, No) _____

Topic No. 5 - HOME LIGHTING

Should this topic be taught in your community? (Yes, No) _____

Columns	1 Proposed: Days	2 Your Days
Select a farm home which needs a lighting system and perform the following:		
A. Studying simple methods of lighting (kerosene and gasoline mantle lamps, acetylene lighting)	1	
B. Studying electric lighting systems (kerosene-gasoline unit electric plants, water power plants)	3	
C. Figuring the size of plant needed.	1	
D. Figuring the cost of lighting systems.	1	
Total	6	

1. Would you have boys secure practice in installing a system? (Yes, No) _____

2. Do you recommend this course as you revised it for your community? (Yes, No) _____

Topic No. 6 - FARM STRUCTURES

Would you teach this topic in connection with farm crops, farm management, etc., and not as a separate course? (Yes, No) _____

Columns	1	2
	Proposed: Days	Your: Days
A. Determining the location of farm buildings.	1	
B. Studying farm buildings in the community.	4	
C. Studying the construction of the following buildings with emphasis on lighting, ventilation, sanitation and space required for the various purposes:		
(a) Poultry house	1	
(b) Dairy barn	1	
(c) Horse barn	1	
(d) Barn framing	2	
(e) Farm house	2	
(f) Silo	1	
(g) Corn crib	1	
(h) Implement house and shop	1	
D. Drawing plans for one farm structure to be built.	2	
E. Making out bill of material	2	
F. Studying the advantages of using paint on farm.	1	
Total	20	

Do you recommend this course as you revised it for your community? (Yes, No) _____

Topic No. 7 - HOME HEATING

Should this topic be taught in your community? (Yes, No) _____

Columns	1 Proposed: Days	2 Your: Days
A. Studying pipeless hot air furnaces. (Advantages, size required)	1	
B. Studying hot air furnaces (Adv., size required)	1	
C. Studying steam and vapor furnaces. (Advantages, method of piping, how to figure radiation required)	3	
D. Studying hot water furnaces. (Advantages, method of piping, how to figure radiation required)	3	
E. Determining the system to use in the above case.	1	
F. Practise in installing (Yes, No)	3	
Total -	12	

Do you recommend this course as you revised it for your community? (Yes, No) _____

Topic No. 8 - DRAINAGE

Decide on Course I or II if drainage is necessary in your community.

Course I (Designed especially for low country)

Should this topic be taught in your Community? (Yes, No) _____

Columns	1 Proposed: Days	2 Your: Days
A. Determing the advantages of draining land and a comparison of cost between open ditches and the drainage	2	
B. Studying drainage systems with method of taking notes and making a contour map of field.	1	
C. Taking levels and keeping notes for a contour map.	3	
D. Determining by study the distance apart, size and grade of laterals and mains, for the field mapped above:	1	
E. Plotting drainage system with grade cut calculated for each stake.	3	

Topic No. 8 - DRAINAGE

	Columns	1 Proposed Days	2 Your Days
F.	Staking off system for the use of an overhead line.	1	
G.	Determining the advisability of using a ditching machine.	1	
H.	Figuring (when to purchase tile, etc.) the cost of drainage.	1	
I.	Ditching and laying tile.	2	
	Total -	15	

Course II. (Designed especially for hilly country)

Should this topic be taught in your community? (Yes, No) _____

	Columns	1 Proposed Days	2 Your Days
A.	Determining the advantages of draining land and comparing the cost of open ditch systems with tile systems.	2	
B.	Studying the simplest forms of drainage systems with depth, distances apart, minimum and maximum grade with the size of ordinary drainage tile for these purposes.	2	
C.	Practice in staking off a simple drainage system (A system for a number of wet spots)	3	
D.	Figuring the cost of this drainage system.	1	
E.	Practice in ditching and laying tile.	2	
	Total -	10	

Do you recommend a course in drainage for your community? (Yes, No) _____

Which course with your revision do you recommend? (I or II) _____

Topic No. 9 - AGRICULTURAL SURVEYING

Course I. Should this course be taught in your community? (Yes, No) ____

To be used where maps of home farm are on file at Clerk's office.	Columns 1 Proposed: Days	2 Your Days
A. Measuring; use and care of instruments.	2	
a. How to make a survey with a chain or steel tape (by dividing field into triangles) (1) Chain, tape, marking pins, range poles.		
b. Determining length of pace.		
B. Making chain surveys and keeping notes.	4	
a. How to locate points on a desired line between two points, not visible from each other.		
b. How to measure to an inaccessible point.		
c. How to extend a line beyond an obstacle.		
C. Drawing the tract surveyed, to a suitable scale.	2	
D. Calculating the areas of the tracts surveyed.	2	
Total	10	

Course II. Should this course be taught in your community? (Yes, No)____

To be used when no map of home farm is on file at Clerk's office.	Columns 1 Proposed: Days	2 Your Days
A. General definitions; care and use of instruments.	1	
B. Measuring with a steel tape.	1	
C. Adjusting the compass or transit.	1	
D. Making a survey.		
1. How to keep notes	1	
2. How to measure angles and calculate bearing.	1	
3. How to locate points on a desired line, between two points, not visible from each other.	1	
4. How to measure the distance to an inaccessible point.	1	
5. How to extend a line beyond an obstacle.		
6. How to run a random line.	1	
7. Drawing the tract surveyed to a suitable scale.	2	
8. Extra time to complete survey.	4	
9. Calculating the area of the tract surveyed.	3	
Total -	18	

Do you recommend a course in Farm Surveying for your community?(Yes,No)_____

Which course with your revision do you recommend? (I or II) _____

Topic No. 10 - SEWAGE DISPOSAL

Should this topic be taught in your community? (Yes, No) _____

Columns	1	2
Select a farm home which needs a sewage disposal system and perform the following.	Proposed: Days	Your Days
A. Determining the sewage disposal system needed.	1	
1. Studying the construction of a standard concrete septic tank.	1	
2. Studying the construction of a standard sand or earth filter.	1/2	
3. Studying the action of a septic tank and filter.	1/2	
B. Determining the location of the septic tank and filter: (Distance from buildings and water supply)	1	
C. Determining the size septic tank and filter required for these conditions.	1	
D. Estimating the cost of the septic tank sewage disposal system.	1	
E. Assisting owner in installing system.	2	
Total	8	

Do you recommend this course as you revised it for your community? (Yes, No) _____

Topic No. 11 - COUNTRY ROADS

Should this topic be taught in your community? (Yes, No) _____

Columns	1	2
	Proposed: Days	Your Days
A. Studying the economic value of good roads.	1	
B. Studying the location of roads.	1	
C. Studying surface and sub-drainage of roads.	1	
Using county road machinery perform the following jobs:		
D. Locate, place a culvert and grade road over same.	2	
E. Grade up road to secure good drainage. (Eliminate mud hole)	1	
F. Practice in working road to keep it in good condition. (When to work road; what machinery should be used - scraper, drag or both)	1	
G. Studying the method of making a gravel road. (How to prepare subgrade)	1	
H. Studying the method of making a sand clay road.	1	
Total -	9	

Do you recommend this course as you revised it for your community? (Yes, No) _____

Topic No. 12 - FARM MACHINERY

Due to the very close relation between farm machinery and crops, farm management, standard shop course, etc., do you think a separate course in farm machinery should be included in the course in Farm Engineering? (Yes, No) _____

To determine this give in column provided in what course you think the jobs listed below should be taught.

(A common piece of machinery is being used for an example)

Machine: Farm Mower — Indicate: Plant Prod.; Animal Production, Farm Mgt., etc.

	Where taught
A. Determining the advisability of buying a mower.	
B. Determining the type of mower to buy.	
C. Learning the parts of a mower.	
D. Learning how to operate a mower.	
E. Repairing a mower.	
F. Learning how to care for a mower.	

Topic No. 13 - GAS ENGINES

Should this topic be taught in your community? (Yes, No) _____

Columns	1 Proposed: Days	2 Your Days
A. Studying gas engine nomenclature.	1	
B. Studying cooling systems (by using charts and motors)	1	
C. Studying lubricating systems (by using charts & motors)	1	
D. Studying source of power and power transmission.		
a. Class room study	1	
b. Laboratory study	2	
E. Studying ignition systems (Lab.)		
a. Low tension (Hit and miss)	1	
b. High tension (Coil and spark plug)	1	
c. Timing systems.	1	
F. Studying the elements of carburetion.	2	
a. Type of feed (Gravity or force)		
b. Take mixers apart and study.		
c. Take carburetors apart and study.		
G. Overhaul engines.	4	
Total	15	

Gas Engines - Continued

Do you recommend this course as you revised it for your community? (Yes, No) _____

Do you think that the practise boys receive should be with only <u>one cylinder</u> engines? (Yes, No) _____

Do you think that if only one cylinder engines are used in this course the boy can carry out the principles involved in the case of four-cylinder engines? (Yes, No) _____

Do you think it of advantage to use Ford cars as practise work in the course? (Yes, No) _____

If your department has no gas engines have you ever been unable to secure engines to use in class instruction? (Yes, No) _____

Topic No. 14 - AGRICULTURAL DRAWING

Agricultural Drawing is not included in this course as a separate topic. It was included in Farm Structures, Drainage, etc. It consists, for example, of making a drainage map, making sketches of building plans with dimensions, reading drawings and blue prints.

Do you recommend drawing as a separate enterprise? (Yes, No) _____

If so, include your course below.

EXPLANATION OF THE FOLLOWING FARM ENGINEERING TEST.

This test is to be used by the several instructors of the state to diagnose their class needs in Agricultural Engineering.

The accusation is frequently made that teachers waste a great deal of time teaching things that their students know. It is very important that the instructor know what information his students bring with them. Thirty minutes devoted to a comprehensive test affords a logical beginning. Besides enabling the instructor to get a good idea of the vocational information needed by his class, the test is one of the surest and most effective means for creating an interest in the subject.

A tabulation of the results of the test will easily show what information does not need to be taught. A similar tabulation of the test given at the end of the course will show the efficiency of the instruction given.

"A standard educational test is not a course of study, but a random sample of material from what may be conceived to be a perfect and complete course of study, according to the range of information needed for success in the field for which the test be prepared."

The aim in making the test was to make it so easy that anyone may make some sort of score, and so hard that no one can make a perfect score.

Criteria used in making the test:

1. To have the same number of true as false statements.
2. To make statements brief.

3. Not to allow one statement to answer or suggest the answer of another.

4. To avoid complex wording.

5. To have a sufficient number of questions to represent a fair sample of that for which the students are being tested.

6. To include information presented in those text books, bulletins and references which are most applicable to Virginia conditions.

7. For simplicity, to use the true and fale and recall type of objective test.

The average instructor will not test his students on all the farm problems listed in this test. This test has 190 questions in order to allow the selection of at least 130 questions.

The score is found by subtracting the number of questions marked wrong from the number of questions marked right. (for example--110 right - 20 wrong = 90) Then the percent this score is of the total number of questions will be the score of the test. (For example, 90 divided by 130 - total number of questions equals 69 which is the test score).

The number of questions not marked, when there is no time limit, should be subtracted from the total number of questions before the percent is found. Where there is a time limit they should not be included in the grading in any way but left out of consideration.

OBJECTIVE TEST ON FARM ENGINEERING

CONCRETE

A. Mark the true statements (+), the false statements (-).

(-) 1. Cement will be just as strong if allowed to become damp before using.

(+) 2. Concrete is an artificial stone made by a mixture of cement, water sand and stone.

(-) 3. The aggregate for concrete consists of coarse stone or large gravel.

(+) 4. The strength of concrete will be in proportion to the strength of the stone used.

(+) 5. The strength of concrete will be in proportion to the amount of water used.

(-) 6. A mixture of concrete that will pour from a bucket will be much stronger than one that is placed in the forms in a stiff condition.

(-) 7. Organic matter in water does not affect the strength of concrete.

(+) 8. The stone or gravel used in concrete should be clean.

(+) 9. Fine, medium and coarse stones are required for strong concrete.

(+)10. The soil under concrete should be firm and well drained.

(-)11. Concrete will harden into a stronger mass if placed in a dry sunny place.

(-)12. Concrete gets its full strength in four days.

B. Complete the following statements by filling in on the dotted lines.

A good mixture for a concrete walk is:-

Materials		Amount	
	13. _____(cement)	16. _____	(1 part)
	14. _____(sand)	17. _____	(2.5 parts)
	15. _____(stone)	18. _____	(5 parts)

OBJECTIVE TEST ON FARM ENGINEERING

WATER SYSTEMS.

A. Mark the true statements (+), the false statements (-).

(-) 1. There is no great danger of disease germs in surface water.

(+) 2. All wells and cisterns should have water tight tops.

(-) 3. A one inch pipe will cary half as much water as a two inch pipe.

(-) 4. A lift or suction pump will draw water from a depth of forty feet.

(-) 5. A gravity water system is a system by which water is forced up hill by a gasoline engine.

(+) 6. A spring usually becomes contaminated by surface drainage.

(+) 7. By using small pipe and a number of elbows in the pipe line, the amount of power required to pump a certain quantity of water is increased.

(+) 8. The amount of power required to pump water twenty feet high increases in proportion to the length of pipe.

(-) 9. A hydraulic ram pumps water by using electrical power.

(+)10. Deep well pumps are combinations of lift and force pumps.

(+)11. A hydraulic ram pumps water by using the power of the water flowing to it.

(-)12. A pressure tank water system forces water from the tank by compressing the water in the tank.

(+)13. If one were to drill a hole in the top of a charged pressure water tank, air would come out- water would likewise come out of the bottom.

(+)14. With the same slope a larger pipe is required to carry 200 gallons of water per minute 5000 feet than is required to carry the same quantity of water 100 feet.

Water systems - Continued.

(+)15. The level of water in an ordinary well is governed by the amount of rain fall.

(-)16. Water is forced out of artisian wells by deep well pumps.

(-)17. Gas that accumulates in wells is not dangerous.

(-)18. Chlorine is used to soften water.

(+)19. All spring and well water contains minerals in varyingquantities.

(-)20. Water that is colorless and odorless is good for drinking purposes.

B. Complete the following statements by filling in on the dotted lines.

The four main parts of a pneumatic water system are:

Parts: 21. _____(pipe)

22. _____(power)

23. _____(pump)

24. _____(Pressure tank)

Two advantages of a water system are:

25. _____(Sanitation)

26. _____(Saving in labor)(fire protection)

OBJECTIVE TEST ON FARM ENGINEERING

PROFILE LEVELING

A. Mark the true statements (+), the false statements (-)

(+) 1. The object of Profile Leveling is to determine the elevation of various points of the surface of the ground, along a definite line.

(-) 2. To adjust the level you point the level at the north star.

(-) 3. In profile leveling the compass alone is used.

(-) 4. A bench mark is a point of unknown elevation.

(-) 5. The cross hairs in a level are used to point to the north and south.

(+) 6. Adjusting the cross-hairs and the image in such a manner that both may be seen, is called Focusing.

(+) 7. To get the elevation of a point you subtract the rod reading from the height of the instrument.

(-) 8. To get the elevation of a Bench Mark you add the rod reading to the height of instrument.

(-) 9. An example of profile leveling is, determining which corner of a barn foundation is the highest.

(-)10. A turning point is a place where an angle is made in the course leveled.

(+)11. To level the instrument the thumbs move either toward each other or away from each other.

(-)12. A backsight is a reading taken on a point of unknown elevation.

(+)13. A foresight is a reading taken on a new point to determine its elevation.

(+)14. A target is used on a rod for distant reading.

Profile Leveling - Continued.

B. Complete the following statements by filling in on the dotted lines.

Profile leveling is used in solving the following farm problems:

15. _____(Drainage)

16. _____(Terracing)

17. _____(Water systems) or (water power sites)

18. _____(Sewage disposal systems)

OBJECTIVE TEST ON FARM ENGINEERING

LAND TERRACING

A. Mark the true statements (+), the false statements (-).

(-) 1. The operation of laying a pipe on top of the ground to prevent soil washing is called land terracing.

(+) 2. The operation of making earth embankment on the side of hills to prevent washing is called land terracing.

(+) 3. The broad terrace may be cultivated.

(+) 4. A broad terrace is made very much like a road.

(+) 5. A level is used to stake off the course of a terrace.

(-) 6. All terraces must be made level.

(-) 7. All hilly pasture land should be terraced.

(-) 8. Land between terraces must be scraped level.

B. Complete the following statements by filling in on the dotted lines.

9. Sloping terraces on light soil should have a grade of _____( ) per 100 feet.

10. The distance apart level terraces, around a hill, should be depends on the following factors:

10. _____(area for rainfall)

11. _____(slope of hill)

12. _____(type of soil)

13. _____(hill under cultivation)

14. Drains from level terraces should be made of _____(clay tile, Concrete pipe or wood)

Two disadvantages of a narrow ridge terrace are:

15. _____(cannot be cultivated over)

16. _____(harbor weeds)

OBJECTIVE TEST ON FARM ENGINEERING.

HOME LIGHTING

4. Mark the true statements (+), the false statements (-).

(-) 1. Acetylene gas is given off when the calcium carbide is put under pressure.

(+) 2. An acetylene gas generator is a device which regulates the flow of calcium carbide into water, or the flow of water on the carbide.

(+) 3. Neither the acetylene generator or the pipes should ever be tested for leaks with a flame.

(+) 4. Electric generators are operated from power derived from water power, gasoline, kerosene, crude oil, and steam.

(-) 5. Storage batteries will give out more electrical power than is put in them.

(+) 6. Direct current generators are commonly used for small lighting plants.

(-) 7. When storage batteries are used on alternating current a generator is essential.

(+) 8. Storage batteries are used to store up electrical energy.

(+) 9. The switchboard carried the apparatus which makes it possible to control the current.

(-)10. Fuses are used to speed up the flow of current.

(-)11. An eighty watt bulb takes less current than a 25 watt bulb.

(-)12. A short circuit should not blow out a fuse.

Home Lighting - continued.

B. Complete the following statements by filling in on the dotted lines.

The advantages of an electric lighting system are:

13. _____(less injury to eyes)

14. _____(better fire protection)

15. _____(convenience or labor saving-requires less labor)

16. _____(labor saving equipment)

17. _____(cleanliness)

OBJECTIVE TEST ON FARM ENGINEERING

HOME HEATING

A. Mark the true statements (+), the false statements (-).

(—) 1. Hot air furnaces are very unhealthful and should not be used.

(+) 2. A water evaporator should be used with all hot air furnaces.

(—) 3. Hot air furnaces should not draw in cold outside air to be heated.

(—) 4. A hot air furnace will keep a house more comfortable than any other type of furnace.

(+) 5. A steam furnace will heat a house much quicker than a hot water furnace.

(—) 6. A steam furnace requires more fuel to heat a house than a hot air furnace.

(+) 7. A hot air pipeless furnace will not be satisfactory in all types of houses.

(—) 8. A hot water furnace requires less radiation or fewer radiators than a steam heating plant.

(+) 9. A hot water furnace will keep a house at a more even temperature than any other type of furnace.

(+) 10. A double pipe line to radiators is much more efficient than a single pipe line.

(+) 11. Water in a hot water furnace is caused to circulate by the hot water rising to the radiators where it cools and falls again to the furnace.

(—) 12. Cool water is lighter than hot water.

Home heating - continued.

B. Complete the following statements by filling in on the dotted lines.

13. The seven methods of heating Virginia homes are: _____ _____

_____(open fire place), _____(grates), _____(stoves),

_____ _____ _____(hot air furnace, pipe or pipeless),

_____ _____(steam furnace), _____ _____(vapor furnace),

_____ _____(hot water furnace).

Steam vapor and hot water furnaces have a high efficiency than a hot air furnace due to the four following factors:

14. _____(water and steam are good conductors of heat)

15. _____(hot water and steam are rapidly circulated by continually cooling in the radiators and heating in furnace).

16. _____(radiators allow a large surface for the transmission of heat).

17. _____(the wind will not hinder the circulation in the radiators)

18. In what way does a vapor heating system differ from a steam heating system_____(the steam is circulated under a very low pressure).

OBJECTIVE TEST ON FARM ENGINEERING

DRAINAGE

A. Mark the true statements (+), the false statements (-).

(+) 1. Field crops in Virginia do not thrive on land saturated with water two to six inches below the surface.

(+) 2. Tile drainage is a practical method of eliminating excess moisture.

(+) 3. Plants will have deeper roots on land that is well drained.

(-) 4. Plants will not resist a long drouth as well on drained land as they would have resisted before the land was drained.

(+) 5. Drainage lengthens the growing season.

(-) 6. Open ditch drainage is the best method to use.

(-) 7. Drainage causes the soil to wash.

(-) 8. The drains for sandy soil have to be closer together than for clay soil.

(-) 9. Drain tile should be laid one foot deep.

(+) 10. Drain tile must be laid with a small slope.

(+) 11. Drain tile should not be smaller than 4 inch.

(-) 12. It is not necessary to stake out as small a field as five acres to be drained.

B. Complete the following statements by filling in on the dotted lines.

What are the five main ways in which tile drainage systems are laid or planned out?

13. _____ (natural)

14. _____ (random)

15. _____ (Herring bone)

16. _____ (single line or half gridiron)

17. _____ (gridiron)

Drainage - Continued.

18. The grade of every line of drainage tile must be _____(uniform) throughout its length to prevent clogging.

19. The bottom of a drainage trench is dug parallel to the _____ _____(grade line) which has been previously erected.

20. The outlet of a drainage system should be constructed of _____ (concrete).

OBJECTIVE TEST ON FARM ENGINEERING

SURVEYING

A. Mark the true statements (+), the false statements (-).

(+) 1. The number of acres in a field may be found by dividing by the field into triangles and measuring the sides of the triangles.

(+) 2. The length of the sides of the triangles a field may be divided into may be found by using a tape or chain.

(-) 3. One angle in each triangle must be found.

(-) 4. The area of a triangle is equal to the base times its altitude divided by one angle.

(+) 5. The sum of the areas of all the triangles in a field will be the area of the field.

(-) 6. It is not necessary to make a sketch of a field giving distances and angles for remapping the farm layout of fields.

(-) 7. Notes giving distances should not be kept on a sketch of a field divided into triangles.

(+) 8. It is not necessary to know the correct elevation of one point of a farm in order to survey it.

B. Complete the following statements by filling in on the dotted lines. The equipment needed to reorganize a field layout or make a practical survey of a field is:

9. _____(steel tape or chain)

10. _____(marking pins)

11. _____(range poles)

12. _____(Note book)

13. _____(10) square chains in an acre of land.

14. An acre of land has _____(43,560) square feet.

OBJECTIVE TEST ON FARM ENGINEERING

SEWAGE DISPOSAL

A. Mark the true statements (+), the false statements (-).

(+) 1. Flies carry typhoid and other dangerous diseases.

(+) 2. All privies should be fly proof.

(-) 3. The chemical closet is cheap and very practical.

(-) 4. A cess pool for the disposal of sewage is recommended by health departments.

(+) 5. Raw sewage should not be drained into streams or rivers.

(+) 6. The septic tank is the best means devised for the disposal of sewage.

(-) 7. Septic tanks should not have filter beds.

(-) 8. There is no great danger of drainage from a cess pool that will contaminate a well or spring.

(+) 9. One type of bacteria works on sewage in the septic tank and a different type works on it in a filter bed.

(+)10. The drainage from a septic tank and filter bed is nearly free from disease germs.

(-)11. Concrete should not be used for septic tanks.

(-)12. Aerobic bacteria disintergrates sewerage in the septic tank.

B. Complete the following statements by filling in on the dotted lines.

13. How many sections are there in a standard septic tank _____(2).

14. A filter bed system for sewage disposal may have the same design as a _____ _____(drainage system).

Sewage Disposal - Continued

15. In heavy clay soil the filter tile should be laid on _____ _____ (broken stone).

16. All filter beds should have an _____ __ _____(outlet or drainage)

17. The size of a septic tank or of a filter bed, depends on the _____ __ _____(size of family).

18. The septic tank or the filter bed should be _____(200) feet from the well, cistern or spring.

OBJECTIVE TEST ON FARM ENGINEERING

COUNTRY ROADS

A. Mark the true statements (+), the false statements (-).

(+) 1. Good roads decrease the cost of transportation by allowing larger loads to be hauled or by saving time.

(+) 2. Good roads allow the cultivation of crops not otherwise profitable.

(-) 3. The grade of a road for example is earth, concrete, etc.

(-) 4. The worst enemy of an earth road is traffic.

(-) 5. Roads on level ridges and valleys are easier to maintain than on slightly rolling land.

(+) 6. Roads should not be located through low bottom land when they can be located on the side of a hill.

(+) 7. A road should have a long gradual slop rather than a short steep slope.

(-) 8. When a mud hole is found in an earth road it should be filled with loose stone.

(-) 9. Culverts should cause a small bump in the road to prevent them from filling with earth.

(+)10. The most important requisite of a good road is drainage.

Country Roads - Continued.

B. Complete the following statements by filling in on the dotted lines.

11. The curvature or rounded part of the surface of a road is called the _____(crown).

The size of culvert depends on:

12. _____(area exposed to rainfall)

13._____(type of soil)

14._____(slope of culvert)

OBJECTIVE TEST ON FARM ENGINEERING

GAS ENGINES

A. Mark the true statements (+), the false statements (-).

(+) 1. The explosion of gasoline acts on a piston like powder acts on a bullet when fired in a rifle.

(-) 2. Connecting rods are bolted to the crankcase.

(-) 3. Circulation of water in a Ford radiator is caused by the heat of the engine which causes contraction of the water.

(+) 4. The differential of a car allows one wheel to go faster than the other when making a curve.

(-) 5. The duty of a carburetor is to pour liquid fuel into the cylinder to be exploded.

(-) 6. A Ford has a four cylinder two cycle engine.

(-) 7. Induction coils open and close the carburetor.

(+) 8. The timer allows the current to flow to the spark plug just before the piston comes up on dead center, on the compression stroke.

(+) 9. The clutch connects and disconnects the engine from the power transmission system.

B. Complete the following statements by filling in on the dotted lines.

The four strokes of a one cylinder four cycle engine are:

10. _____(suction)

11. _____(compression)

12. _____(power)

13. _____(exhaust)

14. The order of the above strokes are (1)_____(suction),(2)_____(compression),(3)_____(power), (4)_____(exhaust).