A FOUR YEAR PLAN FOR TEACHING FARM MECHANICS TO YOUNG FARMERS IN THE FORT LARAMIE, WYOMING, VOCATIONAL AGRICULTURE DEPARTMENT

By

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PREFACE

The ability to operate a mechanized farm is essential to success in farming. The responsibility of the maintenance of farm machinery and buildings belongs to the individual farmer.

This study had as its purpose the developing of a four year educational program for the teaching of farm mechanics to young farmers based on their needs and desires.

Indebtedness is acknowledged to Dr. Roy W. Dugger who served as report adviser, and to Professors Robert R. Price, George E. Cook, and other faculty members of the Department of Agricultural Education for their helpful criticisms, advice, and interest given me in preparing this study. Indebtedness is acknowledged to Mrs. Norma Jean Cook and Alton P. Juhlin.

The cooperation of Evertt Laberteau and the ten young farmers who furnished data for this study is greatly appreciated.

Acknowledgement would be incomplete without mention of the encouragement and assistance offered by my wife, Wilma, and my parents, Thomas C. and Myrtle Faye Morgan.

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CHAPTER I

INTRODUCTION

Since the re-establishment of the Department of Vocational Agriculture in the Fort Laramie High School in 1954, little has been done toward organizing a young farmer education program in farm mechanics. Due to inadequate facilities prior to 1956, most of the instruction was limited to the teaching of theory with a small amount of time devoted to the teaching of woodworking skills.

In 1956 a new $20,000 Vocational Agriculture Plant was completed. The 44 foot by 90 foot building included a class room, washroom, locker room, tool room, office, and a 44 foot by 60 foot shop. A 20 foot by 30 foot concrete slab work area was located adjoining the building. All areas were well equipped with the tools needed for teaching farm mechanics.

Realizing the importance of mechanization in the farming operations of today, the writer feels that a well rounded program of farm mechanics should be taught. The Board of Education planned these facilities for farm mechanics because they recognized the need for this program in the community.

The information gathered from the young farmers enrolled in the young farmer class in 1956-1957 formed the basis for

developing a farm mechanics educational program designed to meet the needs of these young farmers. The farm mechanics areas considered as a part of this research report were (1) farm power and machinery, (2) farm buildings and conveniences, (3) farm electrification, (4) soil and water management, and (5) farm shop skills.

Problem Statement

Since the ability to operate a mechanized farm is essential to success in farming, a question which should be answered is, "What should constitute a four year plan for teaching farm mechanics to young farmers in the Fort Laramie Wyoming, Vocational Agriculture Department?" The development of a four year plan for teaching farm mechanics to young farmers enrolled in the Fort Laramie, Wyoming, Vocational Agriculture Department is the problem of this research report.

Definition of Terms

> The farm mechanics program includes all the unspecialized mechanical activities that a progressive farmer should perform on his home farm with the kinds of tools and equipment he will have accessible. The latest recommendations on what should be included in the farm mechanics program were made by the sub-committee on Agricultural Teacher Training of the American Society of Agricultural Engineers in collaboration with an advisory group of vocational agriculture specialists. This sub-committee which met in Chicago on June 22, 1944, recommended five areas of instruction, namely:[1]
>
> 1. Farm shop work.
> 2. Farm power and machinery.

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[1]G. C. Cook, A Handbook on Teaching Vocational Agriculture (Danville, 1947), p. 411.

3. Farm buildings and conveniences.
4. Soil and water management.
5. Rural electrification.

Purposes of Study

To formulate a tentative four year plan for teaching farm mechanics to young farmers based on their needs and desires, and to develop teaching guides for teaching farm mechanics to young farmers for 1957-1958.

Need for the Study

The ability to select and maintain farm machinery and equipment is essential for success in modern farming.

Mack M. Jones stated that,

> With the increased mechanization of farms, it has become necessary for the successful farmer to be proficient in the use, repair, and the maintenance of mechanical equipment of various kinds.[2]

Lloyd J. Phipps reported that,

> Most of the work of a farmer involves some type of mechanical activity. With the increasing mechanization of farming, a farmer cannot be a success unless he possesses considerable mechanical knowledge and skill. Agricultural engineers estimate that approximately 85 per cent of the machinery in operation on farms is more or less out of adjustment. In addition to the adjustment of farm machinery, there are many mechanical jobs on a farm that a farmer should and can do after receiving training in farm mechanics, such as repairing farm machinery, constructing buildings, remodeling buildings, maintaining electrical equipment, repairing and maintaining home conveniences . . .[3]

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[2]Mack M. Jones, Shopwork on the Farm (New York, 1955), p. 1.

[3]Lloyd J. Phipps et al., Farm Mechanics Text and Handbook (Danville, 1954), p. 14.

Procedure

To develop a solution to this research problem and to achieve the purposes previously stated, the procedure followed included:

1. The writer reviewed selected available literature to prepare a questionnaire for use in ascertaining the needs of young farmers for instruction in farm mechanics.

2. The population selected to provide information concerning the needs of young farmers for instruction in farm mechanics included each of the ten currently enrolled members of the young farmer class taught by the vocational agriculture teacher at Fort Laramie, Wyoming.

3. The questionnaire, which is shown in Appendix A, was prepared in two parts.

   a. Part one of the questionnaire was designed to obtain an inventory of the farm equipment and the facilities for maintaining this equipment possessed by each selected young farmer.

   b. Part two of the questionnaire was designed to ascertain which farm mechanic jobs about which the young farmers desired information. This part of the questionnaire was prepared on the basis of certain findings by Roy W. Dugger.

4. Each of the selected young farmers was asked to furnish certain information in accordance with the prepared questionnaire.

5. The results of the survey were compiled and analyzed.

6. A tentative four year plan was developed for teaching farm mechanics to the Fort Laramie young farmer class.

7. Teaching guides were prepared for the first year of instruction.

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[4]Roy Wesley Dugger, "Mechanical Competencies Needed by Vocational Agriculture Teachers in Oklahoma" (unpub. Ph.D. Dissertation, Oklahoma Agricultural and Mechanical College, 1956).

CHAPTER II

REVIEW OF SELECTED LITERATURE

A review of selected literature was made to obtain information useful in the preparation of a questionnaire. This review of selected literature was also made to determine what research had previously been reported concerning the development of educational programs in farm mechanics. In reviewing previously reported research, no record was found concerning the teaching of farm mechanics to young farmers. However, some research has been reported concerning the teaching of farm mechanics to all-day classes of vocational agriculture and to adult farmer education classes. A review of the findings of a selected number of these studies which are representative of the research which has been completed in this field is presented in this chapter.

In 1938, Chris White[1] compiled a thesis entitled "Farm Mechanics as a Part of the Instruction in Vocational Agriculture in Oklahoma High Schools."

The objective of this study was to assemble information that would be helpful in planning the farm mechanics phase

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[1]Chris White, "Farm Mechanics as a Part of the Instruction in Vocational Agriculture in Oklahoma High Schools" (unpub. M.S. thesis, Oklahoma Agricultural and Mechanical College, 1938).

of vocational agriculture.

Data in this study were secured by the use of a questionnaire. One teacher questionnaire and ten student questionnaires were sent to each school in the state that had a vocational agriculture department.

White concluded that the type of farm mechanics program differed because of several factors:

1. The farm families are more stable in some areas than other areas.
2. The type of farming carried on in an area dictated the type of farm mechanics program.
3. Distances of farms from town increased the necessity for more training in farm mechanics.
4. More farm machinery and home conveniences were found in those areas associated with a higher standard of living.

White also concluded that a primary difficulty faced by teachers was the failure of the boys to bring in materials and machinery on which to work.

In 1948, James Elliott[2] compiled a thesis study entitled "Planning a Course in Farm Mechanics in Oklahoma." This study was made for the purpose of providing the teachers of vocational agriculture and school administrators in Oklahoma with material that would assist them in planning the course in farm mechanics.

Elliott concluded that the subject areas of farm mechanics taught and the amount of time spent teaching each subject

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[2]James D. Elliott, "Planning a Course in Farm Mechanics in Oklahoma" (unpub. M.S. thesis, Oklahoma Agricultural and Mechanical College, 1948).

area should vary from community to community. The course of farm mechanics should be developed from information gathered through a comprehensive community survey. After the important areas and the time spent teaching these areas are determined, the instructor should then develop a series of teaching guides that may be used in teaching the course.

Elliott concluded that the personal interests of the instructor and special abilities possessed by the instructor often affected the type of farm mechanics course that was offered, rather than the community needs.

> It is recommended that the shopwork subjects in a course in farm mechanics be chosen to meet the needs of the community and that these subjects be chosen after a comprehensive community survey has been made.[3]

In 1953 William E. James, Jr.,[4] conducted a non-thesis study, "The Teaching of Farm Mechanics to Adult Classes in the Hoehne, Colorado, Vocational Agriculture Department." The following objectives were kept in mind throughout the study:

1. To determine the farm mechanics jobs that farmers do on their farms.
2. To determine the farm mechanics jobs that the farmers would have done if they had known how, assuming that they had the equipment.
3. To determine what jobs the farmer would like to learn how to do or to learn more about doing.

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[3]Ibid, p. 101.

[4]William E. James, Jr., "The Teaching of Farm Mechanics To Adult Classes in the Hoehne, Colorado, Vocational Agriculture Department" (unpub. M.S. report, Oklahoma Agricultural and Mechanical College, 1953).

4. To formulate a teaching plan for a course of study in farm mechanics in adult education.

5. To conduct an adult class in farm mechanics based upon the results of the study and to evaluate its effectiveness.

Data were obtained by personal interview of thirty farmers in the area served by the Hoehne High School.

James found the following results from his study:

1. Farmers are interested in farm mechanics instruction if they can benefit from it.

2. Farmers prefer that this type of instruction be given from October 15 to February 1.

3. Farmers prefer learning new jobs rather than learning more about those things that they have done.

4. Farmers farther from town are more interested in learning farm mechanics than those nearer town and nearer repair shops.

5. Those farmers who have done considerable farm mechanics work are more interested than those who have not.

6. Jobs and problems in which farmers indicated most interest were:

   a. Arc welding
   b. Oxyacetylene welding
   c. Soldering
   d. Blacksmithing
   e. Fitting bearings
   f. Wiring circuits
   g. Repair transmission
   h. Repair differential
   i. Planning sewage disposal system
   j. Planning water system
   k. Timing the engine
   l. Cutting rafters
   m. Planning a wiring system

7. Jobs of moderate interest were:

   a. Glazing
   b. Drawing and blueprints
   c. Servicing electric motors
   d. Grinding and adjusting valves
   e. Pipe fitting

f. Concrete work
g. Adjusting and repairing clutches
h. Repair of ignition systems
i. Ropework
j. Servicing carburetors
k. Painting, refinishing
l. Tool fitting

8. Jobs of very little interest were:

a. Using belts and pulleys
b. Principles of gas engines
c. Locating engine troubles
d. Repair lighting systems
e. General metal work
f. Repair of electrical wiring
g. Selecting building materials
h. Using common hand tools
i. Handle fitting

9. Farmers will become disinterested if not kept busy in adult classes.

In 1954, Walter Pruitt[5] wrote a thesis entitled, "A Four-Year Farm Mechanics Program in Vocational Agriculture for the Marshall High School Based Upon a Community Survey."

Pruitt found that the members of his study believed students should be taught farm machinery maintenance and repair in their vocational agriculture shop as an important phase of their farm training.

Operation, upkeep, and minor repair of tractors were rated as the highest of desirable skills for students to acquire. This high rating would indicate that these skills should be given major emphasis in the training program for vocational agriculture students.

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[5]Walter Pruitt, "A Four-Year Farm Mechanics Program in Vocational Agriculture for the Marshall High School Based Upon a Community Survey" (unpub. M.S. thesis, Oklahoma Agricultural and Mechanical College, 1954).

Pruitt's study revealed that four most common tools used by those farmers were claw hammer, screw driver, pliers, and 10 inch to 12 inch pipe wrench.

The investigator concluded that fields of farm shop which need to be given attention in the farm mechanics program are as follows:

1. Machinery maintenance and repair
2. Purchase of equipment and tools
3. Farm carpentry
4. Fence construction and repair
5. Using the electric drill
6. Rope work
7. Plumbing
8. Electricity

While other research has been conducted in the field of teaching farm mechanics to high school students and adult farmers, those studies which have been cited in this chapter were considered to be representative of this research.

CHAPTER III

PRESENTATION AND ANALYSIS OF DATA

Data presented in this chapter were obtained by class survey of the ten members currently enrolled in the Fort Laramie Young Farmer Class. Each member completed the questionnaire shown in Appendix A. Table I shows the type of farming operations, size of farm, number of years of farming experience, age, number of years of vocational agriculture, and distance from school of each of the selected young farmers.

Part one of the questionnaire is an inventory of the farm equipment and the facilities for maintaining this equipment possessed by each young farmer.

On part two of the questionnaire are listed specific farm mechanic jobs in the following areas: (1) farm power and machinery, (2) farm buildings and conveniences, (3) farm electrification, (4) soil and water management, (5) and farm shop skills. Each young farmer indicated that he possessed adequate skill or desired further instruction in each of the farm mechanic jobs which were listed.

Tables II through XIII are arranged to show the composite inventory. Tables XIV through XLIX are arranged to show the degree of interest of the ten selected young farmers in further instruction in the various farm mechanic jobs. An

TABLE I

GENERAL INFORMATION CONCERNING THE TEN SELECTED YOUNG FARMERS

Farmer's Code No.	Acres	Years Farming	Age	Voc. Agri.	Distance From School	Type of Farming
1	320	4	18	3	7	Diversified. Irrigated.
2	960	4	18	3	12	Wheat and cattle.
3	440	8	22	4	18	Wheat.
4	1,600	13	27	3	17	Wheat, small grain, and cattle.
5	2,500	8	22	2	3	Cattle. Some irrigated meadows.
6	1,880	11	25	4	18	Cattle. Some irrigated meadows.
7	2,500	12	26	1	6	Cattle.
8	3,000	10	24	0	17	Wheat and cattle.
9	800	14	28	0	10	Wheat and small grain.
10	160	13	27	2	5	Diversified. Irrigated.
Totals	14,160	97		22	101	
Averages	1,416	9.7	23.7	2.2	10.1	

analysis of each table is given.

Farm Mechanics Inventory

Farm equipment and the facilities for maintaining this equipment are considered factors in determining the degree of interest in instruction in various farm mechanic skills.

Tables II through XIII are arranged to show the composite inventory of the farm equipment and facilities of the ten selected young farmers considered in this study.

Farm structures found on farms. Table II shows there was a total of fourteen houses on ten farms, twelve barns on ten farms, fifteen equipment sheds on eight farms, and thirty-

TABLE II

NUMBER AND KINDS OF FARM STRUCTURES FOUND ON FARMS

Items	Number of Farms*	Number of Items
Houses	10	14
Barns	10	12
Equipment sheds	8	15
Corrals	10	35

*Number interviewed: Ten young farmers

five corrals on ten farms. The largest number of corrals found on any one farm was eight.

Sizes of trucks found on farms. Table III shows that there were more half ton trucks on the selected farms than any other size. There were seven half ton trucks while

TABLE III

NUMBER AND SIZES OF TRUCKS FOUND ON FARMS

Items	Number of Farms*	Number of Items
1/2 Ton	6	7
3/4 Ton	4	4
1 Ton	1	1
1 1/2 Ton	3	4
2 Ton	4	4

*Number interviewed: Ten young farmers

there were four three-quarter ton trucks, four ton and a half trucks, and four two ton trucks. There was only one one ton truck in this survey.

Tractors and power units found on farms. In Table IV it is noted that two plow bottom, four plow bottom, and five

TABLE IV

NUMBER OF TRACTORS AND POWER UNITS FOUND ON FARMS

Items	Number of Farms*	Number of Items
1 Plow bottom	1	1
2 Plow bottom	7	7
3 Plow bottom	5	6
4 Plow bottom	6	7
5 Plow bottom	5	7
6 Plow bottom	1	1
Stationary engines	6	6
Portable engines	8	13

*Number interviewed: Ten young farmers

plow bottom tractors were most common on the selected farms;

there were seven of each. There were six three plow bottom tractors but only one one plow bottom tractor and one six plow bottom tractor on the selected farms.

There was a total of six stationary engines on six farms and thirteen portable engines on eight farms.

Kinds of tillage equipment found on farms. Table V shows that eight young farmers had a total of sixteen moldboard plows, seven young farmers had a total of 13 wheatland plows, and four young farmers had a total of five irrigation ditch plows.

TABLE V

NUMBER AND KINDS OF TILLAGE EQUIPMENT FOUND ON FARMS

Items	Number of Farms*	Number of Items
Moldboard plows	8	16
Wheatland plows	7	13
Irrigation ditch plows	4	5
Disks	8	12
Harrows	10	15
Packers	5	7
Subsoilers	6	7
Cultivators	6	12
Rotary hoes	3	3

*Number interviewed: Ten young farmers

The ten selected young farmers had a total of fifteen harrows and twelve disks, but only seven packers. Six of the young farmers had twelve cultivators, six had seven subsoilers, but only three had rotary hoes.

Kinds of planting equipment found on farms. Table VI

TABLE VI

NUMBER AND KINDS OF PLANTING EQUIPMENT FOUND ON FARMS

Items	Number of Farms*	Number of Items
Grain drills	9	14
Planters	6	12
Fertilizer distributers	4	4

*Number interviewed: Ten young farmers

shows that nine of the ten young farmers had grain drills, six had planters, and four had fertilizer distributers.

Kinds of harvesting equipment found on farms. Table VII shows that most of the ten young farmers had adequate harvesting equipment.

TABLE VII

NUMBER AND KINDS OF HARVESTING EQUIPMENT FOUND ON FARMS

Items	Number of Farms*	Number of Items
Corn pickers	1	1
Combines	8	9
Mowers	10	16
Rakes	9	11
Balers	6	7

*Number interviewed: Ten young farmers

Kinds of miscellaneous farm equipment found on farms. Table VIII shows that of the ten selected young farmers, seven had sprayers, seven had grain loaders, three had stalk

TABLE VIII

NUMBER AND KINDS OF MISCELLANEOUS FARM EQUIPMENT FOUND ON FARMS

Items	Number of Farms*	Number of Items
Sprayers	7	7
Grain loaders	7	8
Stalk shredders	3	3
Farmhands (Power loaders)	7	7
Hammer mills	3	3
Land levelers	2	2
Trailers	8	10

*Number interviewed: Ten young farmers

shredders, seven had farmhands, three had hammer mills, two had land levelers, and eight had trailers. Of this group, there was only one of each item on any one farm except grain loaders and trailers. One young farmer had two grain loaders and each of two farmers had two trailers.

Power tools for metal working found in shops on farms. Nine of the ten selected young farmers had shops on their farms. Table IX seems to imply that these young farmers believed the repairing of farm machinery on the farm was very important. Most of the selected young farmers had an assortment of power tools for metalworking.

Power tools and accessories found in shops on farms. As shown in Table X, seven young farmers had a total of eight drill presses. The majority of the young farmers had some kind of electric drill. Nine of the ten class members had electric soldering coppers. Six of the young farmers had a total of seven air compressors. Only one had a metal lathe.

TABLE IX

ITEMS OF POWER TOOLS FOR METALWORKING FOUND IN SHOPS ON FARMS

Items	Number of Farms*	Number of Items
Arc welders	8	8
Oxyacetylene welders	4	4
Oxyacetylene cutting torches	4	4
Grinders	10	13
Buffers	10	10
Power hacksaws	6	6
Anvils	10	10
Vises	10	10
Forges	8	8

*Number interviewed: Ten young farmers

TABLE X

ITEMS OF POWER TOOLS AND ACCESSORIES FOUND IN SHOPS ON FARMS

Items	Number of Farms*	Number of Items
Electric soldering coppers	9	10
Air compressors	6	7
Metal lathes	1	1
Drill presses	7	8
Electric drills		
1/4 inch	4	5
1/2 inch	7	7
3/4 inch	1	1

*Number interviewed: Ten young farmers

Power tools for woodworking found in shops on farms. Table XI shows that the table saw was the power woodworking tool most commonly found on the selected farms. Five young farmers reported having table saws. The planer was next

TABLE XI

ITEMS OF POWER TOOLS FOR WOODWORKING FOUND IN SHOPS ON FARMS

Items	Number of Farms*	Number of Items
Table saws	5	5
Planers	3	3
Wood lathes	1	1
Skill saws	1	1
Sanders	1	1

*Number interviewed: Ten young farmers

with three on a total of three farms. One young farmer reported having a wood lathe, skill saw, and sander.

TABLE XII

ITEMS OF HAND TOOLS FOR METALWORKING FOUND IN SHOPS ON FARMS

Items	Number of Farms*	Per Cent of Farms
Cold chisels	10	100.00
Punches	10	100.00
Pipe wrenches	10	100.00
End wrenches	10	100.00
Socket wrenches	10	100.00
Files	10	100.00
Tin snips	9	90.00
Solder coppers	9	90.00
Hacksaws	9	90.00
Metal bits	9	90.00
Two lb. sledge hammers	7	70.00
Eight lb. sledge hammers	7	70.00
Pipe threaders	7	70.00
Engineer's hammers	6	60.00
Pipe cutters	5	50.00

*Number interviewed: Ten young farmers

Hand tools for metalworking found in shops on farms. Table XII shows that 100 per cent of the young farmers had cold chisels, punches, pipe wrenches, end wrenches, socket wrenches, and files in their shops. Ninety per cent of the young farmers had tin snips, solder copper, hacksaws, and metal bits in their shops. Only 70 per cent had sledge hammers and pipe threaders. Sixty per cent of the selected young farmers had engineer's hammers and 50 per cent had pipe cutters.

Hand tools for woodworking found in shops on farms. Seventy per cent of the selected young farmers had all of the tools listed in Table XIII. Most of the tools listed

TABLE XIII

ITEMS OF HAND TOOLS FOR WOODWORKING FOUND IN SHOPS ON FARMS

Items	Number of Farms*	Per Cent of Farms
Claw hammers	10	100.00
Ball peen hammers	10	100.00
Wrecking bars	10	100.00
Framing squares	10	100.00
Wood braces	10	100.00
Wood bits	10	100.00
Screw drivers	10	100.00
Hand saws		
Cross-cut saws	10	100.00
Ripsaws	9	90.00
Levels	9	90.00
Wood rasps	9	90.00
Wood chisels	8	80.00
Planes	8	80.00
Tri-squares	7	70.00

*Number interviewed: Ten young farmers

were owned by all ten young farmers. The tri-square was the only tool listed in Table XIII which was found in less than 80 per cent of the selected farm shops; it was found in 70 per cent of the shops.

Farm Power and Machinery

Farm power and machinery is a very important phase of modern agriculture. Each of the ten selected young farmers had an assortment of farm machinery and equipment for their individual farming needs.

Tables XIV through XVII are arranged to show the degree of interest of the selected young farmers in further instruction in certain skills relating to farm power and machinery.

Selecting trucks, tractors, machinery, and stationary engines. Table XIV indicates that 70 per cent of the selected young farmers felt capable of selecting each of the items shown in this table. Thirty per cent desired further instruction.

TABLE XIV

DEGREE OF INTEREST OF TEN YOUNG FARMERS IN SELECTING TRUCKS, TRACTORS, MACHINERY, AND PORTABLE ENGINES

Job	Young farmers indicating: Skill is Adequate		Need for Instruction		Does Not Apply	
	No.	Pct.	No.	Pct.	No.	Pct.
Selecting farm trucks	7	70.00	3	30.00	0	00.00
Selecting farm tractors	7	70.00	3	30.00	0	00.00
Selecting farm machinery	7	70.00	3	30.00	0	00.00
Selecting stationary engines	7	70.00	3	30.00	0	00.00

Servicing engine systems. As shown in Table XV, 60 per cent of the selected young farmers expressed a desire for further instruction in servicing engine ignition systems. Sixty per cent of the young farmers felt they had adequate ability to preform skills in servicing engine fuel systems and servicing engine cooling systems; the remaining 40 per cent desired further instruction.

TABLE XV

DEGREE OF INTEREST OF TEN YOUNG FARMERS IN SERVICING ENGINE SYSTEMS

Job	Young farmers indicating: Skill is Adequate No.	Pct.	Need for Instruction No.	Pct.	Does Not Apply No.	Pct.
Servicing engine ignition systems	3	30.00	6	60.00	1	10.00
Servicing engine fuel systems	6	60.00	4	40.00	0	0.00
Servicing engine cooling systems	6	60.00	4	40.00	0	0.00

Adjusting and replacing valves, clutches, and brakes. It is noted in Table XVI that 60 per cent of the young farmers expressed an interest in further instruction in adjusting engine valves and 50 per cent in replacing and adjusting clutches. Only 40 per cent showed an interest in learning more about adjusting and repairing brakes; 60 per cent felt they had adequate skill for adjusting and repairing brakes.

Servicing and maintaining farm machinery. Table XVII shows that 70 per cent of the class members felt they had

TABLE XVI

DEGREE OF INTEREST OF TEN YOUNG FARMERS IN ADJUSTING AND REPLACING VALVES, CLUTCHES, AND BRAKES

Job	Young farmers indicating: Skill is Adequate No.	Pct.	Need for Instruction No.	Pct.	Does Not Apply No.	Pct.
Adjusting engine valves	3	30.00	6	60.00	1	10.00
Replacing and adjusting clutches	5	50.00	5	50.00	0	0.00
Adjusting and repairing brakes	6	60.00	4	40.00	0	0.00

adequate skill in labricating engines and farm machinery while 30 per cent desired further instruction. Sixty per cent of the class members felt they had adequate skill in

TABLE XVII

DEGREE OF INTEREST OF TEN YOUNG FARMERS IN SERVICING AND MAINTAINING FARM MACHINERY

Job	Young farmers indicating: Skill is Adequate No.	Pct.	Need for Instruction No.	Pct.	Does Not Apply No.	Pct.
Servicing and repairing farm machinery	6	60.00	4	40.00	0	0.00
Servicing transmissions	6	60.00	4	40.00	0	0.00
Lubricating engines and farm machinery	7	70.00	3	30.00	0	0.00

servicing transmissions and servicing and repairing farm machinery while the remaining 40 per cent desired further instruction.

Farm Buildings and Conveniences

All ten of the selected young farmers had various farm buildings which made their farming operations more efficient. All ten had running water and sanitary plumbing facilities in their homes.

Tables XVIII through XXII are arranged to show the degree of interest of the selected young farmers in further instruction in certain skills related to farm buildings and conveniences.

Building with various types of materials. In Table XVIII it is observed that 60 per cent of the selected young farmers were interested in learning more about building with prefabricated materials. Fifty per cent had a desire to learn

TABLE XVIII

DEGREE OF INTEREST OF TEN YOUNG FARMERS IN BUILDING WITH VARIOUS TYPES OF MATERIALS

Job	Young farmers indicating: Skill is Adequate		Need for Instruction		Does Not Apply	
	No.	Pct.	No.	Pct.	No.	Pct.
Building with prefabricated materials	2	20.00	6	60.00	2	20.00
Building with metal	4	40.00	5	50.00	1	10.00
Estimating building costs	3	30.00	5	50.00	2	20.00
Building with lumber	5	50.00	4	40.00	1	10.00
Building with concrete	5	50.00	4	40.00	1	10.00

more about building with metal and estimating building costs. Only 40 per cent felt they needed further instruction in building with lumber and concrete.

Planning and building livestock and poultry equipment. Table XIX shows that 50 per cent of the selected young farmers were interested in further instruction in planning livestock equipment, while 70 per cent felt they had adequate

TABLE XIX

DEGREE OF INTEREST OF TEN YOUNG FARMERS IN PLANNING AND BUILDING LIVESTOCK AND POULTRY EQUIPMENT

Job	Young farmers indicating: Skill is Adequate No.	Pct.	Need for Instruction No.	Pct.	Does Not Apply No.	Pct.
Planning livestock equipment	5	50.00	5	50.00	0	0.00
Building livestock equipment	7	70.00	3	30.00	0	0.00
Planning poultry equipment	2	20.00	3	30.00	5	50.00
Building poultry equipment	2	20.00	3	30.00	5	50.00
Planning fence arrangement	7	70.00	3	30.00	0	0.00
Building fences	8	80.00	2	20.00	0	0.00
Repairing fences	8	80.00	2	20.00	0	0.00

skill in building livestock equipment and planning fence arrangements. A majority of these young farmers reported that they had sufficient skill in building and repairing fences.

Fifty per cent reported that planning and building poultry equipment did not apply to their situation. This would indicate that poultry was not an important enterprise on those five farms.

Building construction and repair. Observation of Table

XX shows that 80 per cent of the selected young farmers felt they had adequate ability in repairing farm buildings. Fifty per cent felt that they had adequate skill in planning farm buildings and making sketches to scale. More interest was

TABLE XX

DEGREE OF INTEREST OF TEN YOUNG FARMERS IN BUILDING CONSTRUCTION AND REPAIR

Job	Young farmers indicating: Skill is Adequate		Need for Instruction		Does Not Apply	
	No.	Pct.	No.	Pct.	No.	Pct.
Estimating building costs	3	30.00	5	50.00	2	20.00
Planning farm buildings	5	50.00	3	30.00	2	20.00
Making sketches to scale	5	50.00	3	30.00	2	20.00
Repairing farm buildings	8	80.00	2	20.00	0	0.00

indicated in estimating building costs than in any other job listed in this table. Fifty per cent of the selected young farmers expressed their desire for further instruction in estimating building costs.

Farm sewage disposal system. Table XXI shows that 60 per cent of the selected young farmers felt they had adequate skill in planning and installing sewage disposal systems while 50 per cent felt they had adequate skill in servicing sewage disposal systems.

One farmer reported that the farm sewage disposal system did not apply in his situation. This young farmer owned his home in town.

Farm water system. A study of Table XXII indicates that

TABLE XXI

DEGREE OF INTEREST OF TEN YOUNG FARMERS IN THE FARM SEWAGE DISPOSAL SYSTEM

Job	Young farmers indicating: Skill is Adequate		Need for Instruction		Does Not Apply	
	No.	Pct.	No.	Pct.	No.	Pct.
Servicing sewage disposal systems	5	50.00	4	40.00	1	10.00
Planning sewage disposal systems	6	60.00	3	30.00	1	10.00
Installing sewage disposal systems	6	60.00	3	30.00	1	10.00

TABLE XXII

DEGREE OF INTEREST OF TEN YOUNG FARMERS IN THE FARM WATER SYSTEM

Job	Young farmers indicating: Skill is Adequate		Need for Instruction		Does Not Apply	
	No.	Pct.	No.	Pct.	No.	Pct.
Filtering and treating water	2	20.00	7	70.00	1	10.00
Selecting water pump, motor, and pressure tank	4	40.00	5	50.00	1	10.00
Installing water pump, motor, and pressure tank	4	40.00	5	50.00	1	10.00
Servicing water pump, motor, and pressure tank	4	40.00	5	50.00	1	10.00
Servicing and repairing water system	6	60.00	4	40.00	0	0.00
Installing farm water system plumbing	6	60.00	3	30.00	1	10.00
Planning farm water system	6	60.00	3	30.00	1	10.00

70 per cent of the selected young farmers were interested in further instruction in filtering and treating water. Sixty per cent of the members of the young farmer class indicated they had adequate skill in planning, installing, servicing, and repairing the farm water system plumbing. Fifty per cent of the young farmers felt they needed further instruction in selecting, installing, and servicing water pumps, motors, and pressure tanks.

Farm Electrification

All ten of the selected young farmers had electricity on their farms and electrical appliances in their homes.

Tables XXIII through XXX are arranged to show the degree of interest of the selected young farmers in further instruction in certain skills related to farm electrification.

Servicing and repairing heating equipment. Table XXIII

TABLE XXIII

DEGREE OF INTEREST OF TEN YOUNG FARMERS IN SERVICING AND REPAIRING HEATING EQUIPMENT

Degree of Interest	Young farmers indicating: Number	Per Cent
Interested in instruction	3	30.00
Adequate skill	6	60.00
Does not apply	1	10.00
Totals	10	100.00

shows that 60 per cent of the selected young farmers had adequate skill in servicing and repairing heating equipment.

Thirty per cent of these young farmers indicated interest in further instruction.

Farm electric system. Table XXIV seems to indicate that this young farmer group had a high degree of interest in further instruction in farm electrification. Sixty per cent desired further instruction in repairing electric wiring.

TABLE XXIV

DEGREE OF INTEREST OF TEN YOUNG FARMERS IN THE FARM ELECTRIC SYSTEM

Job	Young farmers indicating: Skill is Adequate		Need for Instruction		Does Not Apply	
	No.	Pct.	No.	Pct.	No.	Pct.
Planning electric wiring systems	2	20.00	7	70.00	1	10.00
Estimating cost of electric wiring	2	20.00	7	70.00	1	10.00
Installing electric wiring	3	30.00	7	70.00	0	0.00
Repairing electric wiring	4	40.00	6	60.00	0	0.00

Seventy per cent of the selected young farmers were interested in planning, installing, and estimating cost of electric wiring systems.

Estimating electric power demand and cost. Table XXV shows that 70 per cent of the selected young farmers were interested in further instruction in estimating electric power demand and electric power cost.

Servicing and selecting electric appliances. Table XXVI indicates a high degree of interest in electric appliances.

TABLE XXV

DEGREE OF INTEREST OF TEN YOUNG FARMERS IN ESTIMATING ELECTRIC POWER DEMAND AND COST

Job	Young farmers indicating: Skill is Adequate No.	Pct.	Need for Instruction No.	Pct.	Does Not Apply No.	Pct.
Estimating electric power demand	2	20.00	7	70.00	1	10.00
Estimating electric power cost	2	20.00	7	70.00	1	10.00

TABLE XXVI

DEGREE OF INTEREST OF TEN YOUNG FARMERS IN SERVICING AND SELECTING ELECTRIC APPLIANCES

Job	Young farmers indicating: Skill is Adequate No.	Pct.	Need for Instruction No.	Pct.	Does Not Apply No.	Pct.
Servicing electric appliances	2	20.00	7	70.00	1	10.00
Selecting electric appliances	3	30.00	6	60.00	1	10.00

Seventy per cent of the selected young farmers were interested in further instruction in servicing electric appliances; 60 per cent were interested in further instruction in selecting electric appliances.

Servicing, selecting, and repairing lighting equipment. It was reported in Table XXVII that 60 per cent of the selected young farmers were interested in further instruction in servicing and repairing lighting equipment. Fifty per cent were interested in additional instruction in selecting

TABLE XXVII

DEGREE OF INTEREST OF TEN YOUNG FARMERS IN SERVICING, SELECTING, AND REPAIRING LIGHTING EQUIPMENT

Job	Young farmers indicating: Skill is Adequate No.	Pct.	Need for Instruction No.	Pct.	Does Not Apply No.	Pct.
Servicing and repairing lighting equipment	3	30.00	6	60.00	1	10.00
Selecting electric lighting equipment	4	40.00	5	50.00	1	10.00

electric lighting equipment.

Selecting, servicing, and repairing electric heating equipment. Table XXVIII shows that 80 per cent of the selected young farmers desired additional instruction in selecting, servicing, and repairing electric heating equipment.

TABLE XXVIII

DEGREE OF INTEREST OF TEN YOUNG FARMERS IN SELECTING, SERVICING, AND REPAIRING ELECTRIC HEATING EQUIPMENT

Job	Young farmers indicating: Skill is Adequate No.	Pct.	Need for Instruction No.	Pct.	Does Not Apply No.	Pct.
Selecting electric heating equipment	1	10.00	8	80.00	1	10.00
Servicing and repairing electric heating equipment	1	10.00	8	80.00	1	10.00

Servicing electric motors. Table XXIX shows that 50 per cent of the selected young farmers felt they had adequate skill in servicing electric motors. Forty per cent were in-

TABLE XXIX

DEGREE OF INTEREST OF TEN YOUNG FARMERS IN SERVICING ELECTRIC MOTORS

Degree of Interest	Young farmers indicating: Number	Per Cent
Interested in instruction	4	40.00
Adequate skill	5	50.00
Does not apply	1	10.00
Totals	10	100.00

terested in additional instruction.

Servicing electric overload protectors. Table XXX shows that 80 per cent of the class members felt they should have further instruction in servicing electric overload protectors.

TABLE XXX

DEGREE OF INTEREST OF TEN YOUNG FARMERS IN SERVICING ELECTRIC OVERLOAD PROTECTORS

Degree of Interest	Young farmers indicating: Number	Per Cent
Interested in instruction	8	80.00
Adequate skill	1	10.00
Does not apply	1	10.00
Totals	10	100.00

Soil and Water Management

Management of soil and water is an important phase of any field of agriculture.

Tables XXXI through XXXV are arranged to show the de-

gree of interest of the selected young farmers in further instruction in certain skills relating to soil and water management.

Planning, building, and estimating cost of irrigation systems. Table XXXI shows that 60 per cent of the selected young farmers indicated they had adequate skill in planning, building, and maintaining irrigation ditch systems. Forty

TABLE XXXI

DEGREE OF INTEREST OF TEN YOUNG FARMERS IN PLANNING, BUILDING, AND ESTIMATING COST OF IRRIGATION SYSTEMS

Job	Young farmers indicating: Skill is Adequate		Need for Instruction		Does Not Apply	
	No.	Pct.	No.	Pct.	No.	Pct.
Planning irrigation ditch systems	6	60.00	2	20.00	2	20.00
Building and maintaining irrigation ditches	6	60.00	2	20.00	2	20.00
Estimating irrigation cost	4	40.00	2	20.00	4	40.00
Planning flood irrigation systems	3	30.00	4	40.00	3	30.00
Building and maintaining flood irrigation systems	2	20.00	4	40.00	4	40.00

per cent of the young farmers were interested in further instruction in planning, building, and maintaining flood irrigation systems. It was also observed that 40 per cent indicated that building and maintaining flood irrigation systems and estimating irrigation cost did not apply to their farming operations. These four young farmers operated dry land

farms.

Planning contour farming. Table XXXII shows that 50 per cent of the selected young farmers desired further instruction in making contour maps and planning contour strip systems. In some cases contour farming did not apply. This was due to severe wind erosion during certain periods of the year.

TABLE XXXII

DEGREE OF INTEREST OF TEN YOUNG FARMERS IN PLANNING CONTOUR FARMING

Job	Young farmers indicating: Skill is Adequate		Need for Instruction		Does Not Apply	
	No.	Pct.	No.	Pct.	No.	Pct.
Making contour maps	3	30.00	5	50.00	2	20.00
Planning contour strip systems	2	20.00	5	50.00	3	30.00

Measuring and calculating acreage. Fifty per cent of the selected young farmers were interested in further instruction in measuring and calculating land, as shown in Table XXXIII. The remaining 50 per cent of the young farmers felt they had adequate ability in preforming this skill.

Learning how to obtain water rights. As shown in Table XXXIV, 60 per cent of the selected young farmers were interested in further instruction in obtaining water rights. Thirty per cent felt they had adequate skill, whereas ten per cent felt that obtaining water rights did not apply.

Smoothing or grading land. Table XXXV shows that 50

TABLE XXXIII

DEGREE OF INTEREST OF TEN YOUNG FARMERS IN MEASURING AND CALCULATING ACREAGE

Degree of Interest	Young farmers indicating: Number	Per Cent
Interested in instruction	5	50.00
Adequate skill	5	50.00
Does not apply	0	0.00
Totals	10	100.00

TABLE XXXIV

DEGREE OF INTEREST OF TEN YOUNG FARMERS IN LEARNING HOW TO OBTAIN WATER RIGHTS

Degree of Interest	Young farmers indicating: Number	Per Cent
Interested in instruction	6	60.00
Adequate skill	3	30.00
Does not apply	1	10.00
Totals	10	100.00

TABLE XXXV

DEGREE OF INTEREST OF TEN YOUNG FARMERS IN SMOOTHING OR GRADING LAND

Degree of Interest	Young farmers indicating: Number	Per Cent
Interested in instruction	4	40.00
Adequate skill	5	50.00
Does not apply	1	10.00
Totals	10	100.00

per cent of selected young farmers felt they had adequate skill in smoothing or grading land while 40 per cent desired further instruction.

Farm Shop Skills

Nine of the ten selected young farmers possessed farm shops. The other young farmer owned a good assortment of hand tools.

Tables XXXVI through XLIX are arranged to show the degree of interest of the selected young farmers in further instruction in certain farm shop skills.

Selecting and using power tools. Table XXXVI shows that the majority of the selected young farmers felt they had adequate skill in selecting and using power tools. Only 40 per cent desired instruction in selecting power tools and only 30 per cent desired instruction in using power tools.

TABLE XXXVI

DEGREE OF INTEREST OF TEN YOUNG FARMERS IN SELECTING AND USING POWER TOOLS

Job	Young farmers indicating: Skill is Adequate		Need for Instruction		Does Not Apply	
	No.	Pct.	No.	Pct.	No.	Pct.
Selecting power tools	6	60.00	4	40.00	0	0.00
Using power tools	7	70.00	3	30.00	0	0.00

Selecting and using hand tools. A study of Table XXXVII shows that a majority of the selected young farmers felt they had adequate skill in selecting and using hand tools. Sixty

per cent stated that they had adequate skill in using hand tools while 70 per cent stated they had adequate skill in selecting hand tools.

TABLE XXXVII

DEGREE OF INTEREST OF TEN YOUNG FARMERS IN SELECTING AND USING HAND TOOLS

Job	Young farmers indicating: Skill is Adequate		Need for Instruction		Does Not Apply	
	No.	Pct.	No.	Pct.	No.	Pct.
Selecting hand tools	7	70.00	3	30.00	0	0.00
Using hand tools	6	60.00	4	40.00	0	0.00

Conditioning tools. Table XXXVIII shows that 60 per cent of the selected young farmers were interested in further instruction in conditioning tools. It was previously

TABLE XXXVIII

DEGREE OF INTEREST OF TEN YOUNG FARMERS IN CONDITIONING TOOLS

Degree of Interest	Young farmers indicating: Number	Per Cent
Interested in instruction	6	60.00
Adequate skill	4	40.00
Does not apply	0	0.00
Totals	10	100.00

pointed out in Tables XXXVI and XXXVII that a majority of these young farmers had adequate skill in selecting and using power tools and hand tools.

Using nails and screws. In Table XXXIX it is noted that only 30 per cent were interested in further instruction in using nails and screws. The other selected young farmers felt they had adequate ability to use nails and screws.

TABLE XXXIX

DEGREE OF INTEREST OF TEN YOUNG FARMERS IN USING NAILS AND SCREWS

Degree of Interest	Young farmers indicating: Number	Per Cent
Interested in instruction	3	30.00
Adequate skill	7	70.00
Does not apply	0	0.00
Totals	10	100.00

Using bolts, keys, and pins. A study of Table XL indicates that the selected young farmers felt they had ade-

TABLE XL

DEGREE OF INTEREST OF TEN YOUNG FARMERS IN USING BOLTS, KEYS, AND PINS

Degree of Interest	Young farmers indicating: Number	Per Cent
Interested in instruction	3	30.00
Adequate skill	7	70.00
Does not apply	0	0.00
Totals	10	100.00

quate skill in using bolts, keys, and pins; only 30 per cent were interested in further instruction.

Selecting power transmission belts. Table XLI indicates that half of the class members felt they had adequate skill in selecting power transmission belts while half desired further instruction.

TABLE XLI

DEGREE OF INTEREST OF TEN YOUNG FARMERS IN SELECTING POWER TRANSMISSION BELTS

Degree of Interest	Young farmers indicating: Number	Per Cent
Interested in instruction	5	50.00
Adequate skill	5	50.00
Does not apply	0	0.00
Totals	10	100.00

Painting. Table XLII indicates that a majority of the selected young farmers had adequate skill in painting. All of the buildings on these selected farms had been painted in recent years.

TABLE XLII

DEGREE OF INTEREST OF TEN YOUNG FARMERS IN PAINTING

Degree of Interest	Young farmers indicating: Number	Per Cent
Interested in instruction	3	30.00
Adequate skill	6	60.00
Does not apply	1	10.00
Totals	10	100.00

Using a framing square. Table XLIII shows that 70 per cent of the selected young farmers expressed the opinion that they had adequate skill in using a framing square.

TABLE XLIII

DEGREE OF INTEREST OF TEN YOUNG FARMERS IN USING A FRAMING SQUARE

Degree of Interest	Young farmers indicating: Number	Per Cent
Interested in instruction	3	30.00
Adequate skill	7	70.00
Does not apply	0	0.00
Totals	10	100.00

Planning farm shop facilities. Table XLIV shows that the number of selected young farmers who wanted further instruction in planning farm shop facilities was equal to the number who had adequate skill in planning farm shop facilities.

TABLE XLIV

DEGREE OF INTEREST OF TEN YOUNG FARMERS IN PLANNING FARM SHOP FACILITIES

Degree of Interest	Young farmers indicating: Number	Per Cent
Interested in instruction	5	50.00
Adequate skill	5	50.00
Does not apply	0	0.00
Totals	10	100.00

Annealing and tempering metal. Table XLV shows that 60 per cent of the selected young farmers were interested in additional instruction in annealing and tempering metal.

TABLE XLV

DEGREE OF INTEREST OF TEN YOUNG FARMERS IN ANNEALING AND TEMPERING METAL

Degree of Interest	Young farmers indicating: Number	Per Cent
Interested in instruction	6	60.00
Adequate skill	4	40.00
Does not apply	0	0.00
Totals	10	100.00

Using electric arc and oxyacetylene equipment. Table XLVI implies that the use of the electric arc and oxyacetylene welding equipment was considered to be of great im-

TABLE XLVI

DEGREE OF INTEREST OF TEN YOUNG FARMERS IN USING ELECTRIC ARC AND OXYACETYLENE EQUIPMENT

Job	Young farmers indicating: Skill is Adequate No.	Pct.	Need for Instruction No.	Pct.	Does Not Apply No.	Pct.
Using electric arc equipment	4	40.00	6	60.00	0	0.00
Using oxyacetylene equipment	4	40.00	6	60.00	0	0.00

portance in the farming operations of the selected young farmers. Sixty per cent of the selected young farmers were

interested in further instruction. As stated in Table IX, eighty per cent of these selected young farmers had arc welders and forty per cent had oxyacetylene welders.

Cutting and threading pipe and bolts. Table XLVII indicates 60 per cent of the selected young farmers had adequate skill in cutting and threading pipe and bolts. Table XI shows that most of these young farmers had facilities for cutting and threading pipe.

TABLE XLVII

DEGREE OF INTEREST OF TEN YOUNG FARMERS IN CUTTING AND THREADING PIPE AND BOLTS

Job	Young farmers indicating: Skill is Adequate		Need for Instruction		Does Not Apply	
	No.	Pct.	No.	Pct.	No.	Pct.
Cutting and threading pipe	6	60.00	4	40.00	0	0.00
Cutting and threading bolts	6	60.00	4	40.00	0	0.00

Splicing rope and tying knots. A higher percentage of the class was interested in further instruction in splicing rope and tying knots than in any other skill reported in this survey. Table XLVIII shows that only one farmer reported having adequate skill in splicing rope and tying knots; the remaining 90 per cent desired further instruction.

Soldering. Table XLIX shows that 70 per cent of the selected young farmers felt they had adequate skill in soldering. Thirty per cent desired further instruction in soldering.

TABLE XLVIII

DEGREE OF INTEREST OF TEN YOUNG FARMERS IN SPLICING ROPE AND TYING KNOTS

Degree of Interest	Young farmers indicating: Number	Per Cent
Interested in instruction	9	90.00
Adequate skill	1	10.00
Does not apply	0	0.00
Totals	10	100.00

TABLE XLIX

DEGREE OF INTEREST OF TEN YOUNG FARMERS IN SOLDERING

Degree of Interest	Young farmers indicating: Number	Per Cent
Interested in instruction	3	30.00
Adequate skill	7	70.00
Does not apply	0	0.00
Totals	10	100.00

CHAPTER IV

SUMMARY AND CONCLUSIONS

This chapter presents a summary of this study and conclusions based upon the findings of this study.

Summary

This study was designed to meet the specific needs of the currently enrolled members of the Fort Laramie Young Farmer Class in the field of farm mechanics. Therefore, when the writer refers to the ten selected young farmers used in this study, he is actually referring to the total membership of the young farmer class which he instructs. Information about size of farm, type of farming, number of years of experience, age, number of years of vocational agriculture, and distance from school of each member is shown in Table I.

The writer reviewed selected available literature to prepare the questionnaire which is shown in Appendix A. Part one of this questionnaire was designed to obtain an inventory of the farm equipment and the facilities for maintaining this equipment possessed by each selected young farmer. Part two of the questionnaire was designed to ascertain which farm mechanic jobs the young farmers desired

in the following areas: (1) farm power and machinery, (2) farm buildings and conveniences, (3) farm electrification, (4) soil and water management, (5) and farm shop skills. Part two was prepared on the basis of certain findings by Roy W. Dugger.[1]

Each of the ten selected young farmers completed the questionnaire during one of the regular class meetings.

Farm mechanics inventory. Each of the ten selected young farmers was asked to complete a prepared farm mechanics inventory in order that the writer could better understand their needs and possibilities in the field of farm mechanics.

More of the selected young farmers owned half ton trucks than any other size.

There was an average of 2.9 tractors on each farm. It was noted that the majority of the selected young farmers were well equipped with tillage, planting, and harvesting equipment.

Nine of the ten selected young farmers had farm shops. Most of these shops were well equipped with both power and hand tools for woodworking and metalworking.

Farm power and machinery. The ten selected young farmers were asked to express their desire for further instruction in thirteen mechanical skills relating to farm power

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[1]Roy Wesley Dugger, "Mechanical Competencies Needed by Vocational Agriculture Teachers in Oklahoma" (unpub. Ph.D. dissertation, Oklahoma Agricultural and Mechanical College, 1956).

and machinery. Sixty per cent or more of the selected young farmers expressed a desire for further instruction in the following mechanical skills:

1. Adjusting engine valves.
2. Servicing engine ignition systems.

Forty to fifty per cent inclusive of the selected young farmers expressed a desire for further instruction in the following mechanical skills:

1. Servicing and repairing farm machinery.
2. Servicing engine fuel systems.
3. Servicing engine cooling systems.
4. Replacing and adjusting clutches.
5. Repairing and adjusting brakes.
6. Servicing transmissions.

Thirty per cent or less of the selected young farmers expressed a desire for further instruction in the following mechanical skills:

1. Selecting farm tractors.
2. Lubricating engines and farm machinery.
3. Selecting farm machinery.
4. Selecting farm trucks.
5. Selecting stationary engines.

Farm buildings and conveniences. The ten selected young farmers were asked to express their desire for further instruction in twenty-six mechanical skills relating to farm buildings and conveniences. Sixty per cent or more of the selected young farmers expressed a desire for further instruction in the following mechanical skills:

1. Building with prefabricated materials.
2. Filtering and treating water.

Forty to fifty per cent inclusive of the selected young farmers expressed a desire for further instruction in the following mechanical skills:

1. Building with concrete.
2. Building with lumber.
3. Building with metal.
4. Planning livestock equipment.
5. Estimating building costs.
6. Servicing sewage disposal system.
7. Servicing and repairing water system.
8. Selecting water pump, motor, and pressure tank.
9. Installing water pump, motor, and pressure tank.
10. Servicing water pump, motor, and pressure tank.

Thirty per cent or less of the selected young farmers expressed a desire for further instruction in the following mechanical skills:

1. Repairing farm buildings.
2. Planning poultry equipment.
3. Building poultry equipment.
4. Building livestock equipment.
5. Planning fence arrangements.
6. Repairing fences.
7. Making sketches to scale.
8. Planning farm buildings.
9. Building fences.
10. Planning sewage disposal systems.
11. Installing sewage disposal systems.
12. Planning farm water systems.
13. Installing farm water system plumbing.
14. Servicing and repairing heating equipment.

Farm electrification. The ten selected young farmers were asked to express their desire for further instruction in fourteen mechanical skills relating to farm electrification. Sixty per cent or more of the selected young farmers expressed a desire for further instruction in the following mechanical skills:

1. Planning electric wiring systems.
2. Estimating cost of electric wiring.
3. Installing electric wiring.
4. Repairing electric wiring.
5. Estimating electric power demand.
6. Estimating electric power cost.
7. Servicing electric overload protectors.
8. Selecting electric appliances.
9. Servicing and repairing electric appliances.
10. Servicing and repairing lighting equipment.

11. Selecting electric heating equipment.
12. Servicing and repairing electric heating equipment.

Forty to fifty per cent inclusive of the selected young farmers expressed a desire for further instruction in the following mechanical skills:

1. Servicing electric motors.
2. Selecting electric lighting equipment.

Soil and water management. The ten selected young farmers were asked to express their desire for further instruction in ten mechanical skills relating to soil and water management. Sixty per cent or more of the selected young farmers expressed a desire for further instruction in the following mechanical skill:

1. Obtaining water rights.

Forty to fifty per cent inclusive of the selected young farmers expressed a desire for further instruction in the following mechanical skills:

1. Measuring land and calculating acreage.
2. Smoothing or grading land.
3. Planning flood irrigation systems.
4. Building and maintaining flood irrigation systems.
5. Making contour maps.
6. Planning contour strip systems.

Thirty per cent or less of the selected young farmers expressed a desire for further instruction in the following mechanical skills:

1. Estimating irrigation costs.
2. Planning irrigation ditch systems.
3. Building and maintaining irrigation ditches.

Farm shop skills. The ten selected young farmers were asked to express their desire for further instruction in eighteen mechanical skills relating to farm shop skills.

Sixty per cent or more of the selected young farmers expressed a desire for further instruction in the following mechanical skills:

1. Conditioning tools.
2. Annealing and tempering metal.
3. Using electric arc equipment.
4. Using oxyacetylene equipment.
5. Splicing rope and tying knots.

Forty to fifty per cent inclusive of the selected young farmers expressed a desire for further instruction in the following mechanical skills:

1. Selecting power tools.
2. Using hand tools.
3. Selecting power transmission belts.
4. Planning farm shop facilities.
5. Cutting and threading pipe.
6. Cutting and threading bolts.

Thirty per cent or less of the selected young farmers expressed a desire for further instruction in the following mechanical skills:

1. Using power tools.
2. Selecting hand tools.
3. Using nails and screws.
4. Using bolts, keys, and pins.
5. Painting.
6. Using a framing square.
7. Soldering.

Conclusions

The purposes of this study have been to formulate a tentative four year plan for teaching farm mechanics to young farmers based on their needs and desires, and to develop teaching guides for teaching farm mechanics to young farmers for 1957-1958. In order to effectively achieve these purposes, a class survey was made of the ten currently enrolled

members of the Fort Laramie Young Farmer Class.

The previous summary shows that a low percentage desired further instruction in most of the skills listed. Individual instruction was planned for those skills in which further instruction was desired by thirty per cent or less.

Many of the selected young farmers felt they had adequate skill in many of the jobs listed. Table I shows that the selected young farmers had had an average of 2.2 years of vocational agriculture. This may partly account for their skill in farm mechanics.

More of the selected young farmers desired further instruction in farm electrification than any of the other four areas considered in this study. Therefore, it may be concluded that teachers of vocational agriculture should have sufficient college training in the field of farm electrification.

It was noted that farmers who lacked adequate skill desired further instruction. Each of the selected young farmers desired some instruction in farm mechanics. Therefore, it may be concluded that teachers of vocational agriculture should have more college training in the field of farm mechanics.

The following four year plan for teaching farm mechanics and 1957-1958 calendar of farm mechanic instruction were prepared on the basis of the findings of this study. Then the farm mechanic teaching guides which appear in Appendix B were prepared for class instruction of the Fort Laramie

Young Farmer Class for 1957-1958.

A Four Year Plan for Teaching Farm Mechanics to Young Farmers in the Fort Laramie, Wyoming, Vocational Agriculture Department

First Year[2]

Farm Power and Machinery
- Servicing and repairing farm machinery
- Adjusting engine valves
- Servicing engine ignition systems
- Replacing and adjusting clutches

Farm Buildings and Conveniences
- Filtering and treating water

Farm Electrification
- Planning electric wiring systems
- Estimating cost of electric wiring
- Installing electric wiring
- Repairing electric wiring
- Estimating electric power demand
- Estimating electric power cost
- Servicing electric overload protectors
- Selecting electric heating equipment
- Servicing and repairing electric heating equipment

Farm Shop Skills
- Conditioning tools
- Planning shop facilities
- Using electric arc equipment
- Using oxyacetylene equipment
- Splicing rope and tying knots

Second Year

Farm Power and Machinery
- Repairing farm machinery
- Servicing engine fuel systems
- Servicing engine cooling systems
- Repairing and adjusting brakes
- Servicing transmissions

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[2]Teaching guides for the first year of instruction are found in Appendix B.

Farm Buildings and Conveniences
- Building with lumber
- Building with metal
- Planning livestock equipment
- Building livestock equipment
- Estimating building cost
- Building with prefabricated materials
- Servicing and repairing water systems
- Selecting water pump, motor, and pressure tank
- Installing water pump, motor, and pressure tank
- Servicing water pump, motor, and pressure tank

Soil and Water Management
- Planning contour strip systems
- Making contour maps

Farm Shop Skills
- Annealing and tempering metal

Third Year

Farm Power and Machinery
- Selecting farm tractors
- Selecting farm machinery
- Selecting farm trucks
- Selecting stationary engines
- Lubricating engines and farm machinery

Farm Buildings and Conveniences
- Servicing sewage disposal systems

Farm Electrification
- Servicing electric motors

Soil and Water Management
- Obtaining water rights
- Planning flood irrigation
- Building and maintaining flood irrigation systems

Farm Shop Skills
- Selecting power tools
- Using power tools
- Selecting hand tools
- Using hand tools
- Cutting and threading pipe
- Cutting and threading bolts

Fourth Year

Farm Buildings and Conveniences
- Building with concrete

Planning poultry equipment
Building poultry equipment
Planning fence arrangements
Making sketches to scale
Planning sewage disposal systems
Installing sewage disposal systems
Planning farm water systems
Installing farm water system plumbing

Farm Electrification
Selecting electric appliances
Servicing and repairing electric appliances
Selecting electric lighting equipment
Servicing and repairing lighting equipment

Soil and Water Management
Measuring land and calculating acreage
Smoothing or grading land

Farm Shop Skills
Selecting power transmission belts
Painting
Soldering

The 1957-1958 Farm Mechanics Class for the Fort Laramie Young Farmer Group will begin in October and continue until the second week in March. The classes are scheduled for 7:30 each Monday night. The length of each meeting will be approximately two hours.

1957-1958 Calendar of Farm Mechanic Instruction
for Young Farmers of Fort Laramie, Wyoming,
Vocational Agriculture Department

	Periods Taught
October	
Selecting and servicing electric heating equipment	2
Power demand and overload protection	1
November	
Conditioning tools	1
Planning farm shop facilities	1
Use of arc welder	2
December	
Use of oxyacetylene welding and cutting equipment	2

	Periods Taught
Christmas party	1
Machinery repair	2
January	
Adjusting valves	1
Servicing ignition systems	1
Adjusting and replacing clutches	2
February	
Splicing rope and tying knots	1
Planning and estimating the cost of electric wiring	1
Installing electric wiring	1
March	
Repairing electric wiring	1
Filtering and treating water	1

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APPENDIXES

General Information

Name of farmer _____
Address _____
Total acres in farm _____ Age _____
Years of farming experience since fourteenth birthday _____
Years of high school vocational agriculture _____

1. List number of the following:

   a. Houses _____

   b. Barns _____

   c. Equipment sheds _____

   d. Corrals _____

2. List number of the following farm equipment:

   a. Trucks

      (1) 1/2 ton _____

      (2) 3/4 ton _____

      (3) 1 ton _____

      (4) 1 1/2 ton _____

      (5) Other sizes (Please give size.) _____

   b. Tractors

      (1) 1 row _____

      (2) 2 row _____

      (3) 3 row _____

      (4) 4 row _____

      (5) Other sizes _____

   c. Planters and cultivators _____

   d. Fertilizer distributers _____

   e. Grain drills _____

   f. Sprayers _____

   g. Disks _____

h. Harrows _____

i. Plows

(1) Moldboard _____

(2) Wheatland _____

(3) Irrigation ditch _____

j. Corn pickers _____

k. Packers _____

l. Sub-soilers _____

m. Farmhands _____

n. Combines _____

o. Rotary hoes _____

p. Grain loaders _____

q. Stationary engines _____

r. Portable engines _____

s. Trailers _____

t. Stalk shredders _____

u. Hammermills _____

v. Land levelers _____

w. Mowers _____

x. Rakes _____

y. Balers _____

z. Please list others _____

3. Do you have a shop on your farm? _____

4. Check the following items which you have in your shop and list additonal items.

a. Power tools

(1) Arc welders _____

(2) Oxyacetylene welders _____

(3) Oxyacetylene cutting torches _____

(4) Table saws _____

(5) Planers _____

(6) Wood lathes _____

(7) Metal lathes _____

(8) Drill presses _____

(9) Grinders: bench _____ floor _____

(10) Electric drills: 1/4 ____ 1/2 ____ 3/4 ____

(11) Soildering irons _____

(12) Skill saws _____

(13) Hack saws _____

(14) Air compressors _____

(15) Sanders _____

(16) Please list others _____

b. Hand tools for woodworking

(1) Claw hammers _____

(2) Ball peen hammers _____

(3) Hand saws: Cross-cut _____ Ripsaw _____

(4) Wood chisels _____

(5) Planes _____

(6) Wrecking bars _____

(7) Levels _____

(8) Framing square _____

(9) Tri-squares _____

(10) Brace _____ and bits _____

(11) Screw drivers _____

(12) Wood rasps _____

(13) Please list others _____

c. Hand tools for metal working

(1) Tin snips _____

(2) Solder irons _____

(3) Hack saws _____

(4) Engineer's hammers _____

(5) Two lb. sledge hammers _____

(6) Eight lb. sledge hammers _____

(7) Cold chisels _____

(8) Punches _____

(9) Metal bits _____

(10) Pipe wrenches _____

(11) Pipe cutters _____

(12) Pipe threaders _____

(13) End wrenches _____

(14) Socket wrenches _____

(15) Files _____

(16) Please list others _____

Farm Mechanics Survey

Name _____ Location _____
Address _____

Check Column 1 if you want to know more about the job or practice.
Check Column 2 if you have adequate skill.
Check Column 3 if it does not apply to your situation.

Job	Column 1	Column 2	Column 3
Farm Power and Machinery			
Selecting farm tractors			
Lubricating engines and farm machinery			
Selecting farm machinery			
Servicing and repairing farm machinery			
Selecting farm trucks			
Selecting stationary engines			
Servicing engine fuel systems			
Adjusting engine valves			
Servicing engine ignition systems			
Servicing engine cooling systems			
Replacing and adjusting clutches			
Repairing and adjusting brakes			
Servicing transmissions			
Farm Buildings and Conveniences			
Building with concrete			
Building with lumber			
Building with metal			
Repairing farm buildings			
Planning livestock equipment			
Planning poultry equipment			
Building livestock equipment			
Building poultry equipment			
Planning fence arrangements			
Repairing fences			
Making sketches to scale			
Planning farm buildings			
Estimating building costs			
Building with prefabricated materials			
Building fences			
Planning sewage disposal systems			
Installing sewage disposal systems			
Servicing sewage disposal systems			
Installing farm water system plumbing			
Servicing and repairing water system			
Planning farm water systems			

Job	Column 1	2	3
Selecting water pump, motor, and pressure tank	___	___	___
Installing water pump, motor, and pressure tank	___	___	___
Servicing water pump, motor, and pressure tank	___	___	___
Filtering and treating water	___	___	___
Servicing and repairing heating equipment	___	___	___
Farm Electrification			
Planning electric wiring systems	___	___	___
Estimating cost of electric wiring	___	___	___
Installing electric wiring	___	___	___
Repairing electric wiring	___	___	___
Estimating electric power demand	___	___	___
Estimating electric power cost	___	___	___
Servicing electric motors	___	___	___
Servicing electric overload protectors	___	___	___
Selecting electric appliances	___	___	___
Servicing and repairing electric appliances	___	___	___
Selecting electric lighting equipment	___	___	___
Servicing and repairing lighting equipment	___	___	___
Selecting electric heating equipment	___	___	___
Servicing and repairing electric heating equipment	___	___	___
Soil and Water Management			
Measuring land and calculating acreage	___	___	___
Estimating irrigation costs	___	___	___
Obtaining water rights	___	___	___
Smoothing or grading land	___	___	___
Planning irrigation ditch systems	___	___	___
Building and maintaining irrigation ditches	___	___	___
Planning flood irrigation systems	___	___	___
Building and maintaining flood irrigation systems	___	___	___
Making contour maps	___	___	___
Planning contour strip systems	___	___	___
Farm Shop Skills			
Selecting power tools	___	___	___
Using power tools	___	___	___
Selecting hand tools	___	___	___
Using hand tools	___	___	___
Conditioning tools	___	___	___
Using nails and screws	___	___	___
Using bolts, keys, and pins	___	___	___

Job	Column 1	2	3
Selecting power transmission belts	____	____	____
Painting	____	____	____
Using a framing square	____	____	____
Planning farm shop facilities	____	____	____
Annealing and tempering metal	____	____	____
Using electric arc equipment	____	____	____
Using oxyacetylene equipment	____	____	____
Cutting and threading pipe	____	____	____
Cutting and threading bolts	____	____	____
Splicing rope and tying knots	____	____	____
Soldering	____	____	____

Problem: Selecting and servicing electric heating equipment.

References: Rural Electrification, J. P. Schaenzer; Planing the Farm Home Wiring System, G. E. Henderson and G. E. Turner.

Objectives:
1. To familiarize students with things to consider in selecting electric heating equipment.
2. To enable students to service electric heating equipment.

Introduction: The topics of this plan will be brought to the attention of the students by a specialist in the field in order that a better understanding of these topics may be had.

Pivotal Points:

A. Water heaters.

1. 30 to 50 gallons.
2. 1200 to 7000 watts.
3. Average kilowatt hours per month is 250 for farm family of four.
4. Table top models and tank type.
5. Should supply 10 to 15 gallons per person per day.
6. Temperature controlled automatically.
7. Local service.
8. Requires 230 volt circuit.

B. Range.

1. Apartment size, regular, or double oven units.
2. 8500 to 16,460 watts.
3. Average kilowatt hours per month is 100 to 150.
4. Automatic heat control on oven.
5. Local service.
6. 3-wire 115 to 230 volt circuit.

C. Portable heaters.

1. Average size 16 by 13 by 8 inches.
2. 660 to 1620 watts.
3. Average kilowatt hours per hour: 1/2 to 1-1/2.
4. Reflector and circular type available.
5. All types should be equipped with safety guards.
6. Heater should be connected directly into convenience outlets--not on extension cords.
7. Used as a supplemental heater.

D. Electrically controlled oil burners.

1. Average size: 19 by 32 inches.
2. 100 to 300 watts.
3. Average kilowatt hours per month: 25 to 40.
4. Burner should be of standard make.
5. Local service.
6. Burner should be fitted to the needs of the home and must be properly installed.
7. Connect to separate circuit.

E. Electric bed covering.

1. Size: 80 by 86 inches.
2. 100 to 200 watts.
3. Average kilowatt hours per year: 140.
4. Temperature is automatically controlled.
5. Blankets or sheets.
6. Some can be washed.
7. Should not be tucked between mattress and springs.

F. Residential heating.

1. Size: 1500 to 10,000 watts.

2. Average kilowatt hours per month for a five-room house: 1000 to 2500.

3. Not practical unless rate is one cent per kilowatt hour or less.

4. Heat can be automatically controlled.

5. House must be insulated.

G. It is recommended that servicing be done by skilled workmen.

Method: Class discussion.

Problem: Estimating electric power demand and cost.

References: F. F. A. Farm Electrification Manual, Texas Power and Light Co.; Rural Electrification, J. P. Schaenzer; Electric Wiring, A. A. Schuhler.

Objectives:
1. To enable students to understand some basic electrical terms.
2. To develop understanding of the way electricity is sold.

Introduction: The wattmeter measures the amount of electric power is used.

Pivotal Points:

A. Electrical terms.

1. Volts.

a. Units of measurement of electricity.

b. Volume or electrical pressure.

2. Kilovolts.

a. "Kilo" means thousand.

b. One kilovolt is equal to one thousand volts.

3. Amperes or amps.--rate of flow of electricity.

4. Ampere-hour.

a. Flow of electricity at the rate of one ampere for one hour.

b. Used in storage battery work.

5. Watts.

a. Measures the total energy or power flowing into a current.

b. The voltage multiplied by amperes equals the watts.

c. 746 watts equals 1 horsepower.

6. Kilowatts--one kilowatt equals 1,000 watts.

7. Watt-hour.

a. Total amount of electrical energy that is flowing at a given period of time.

b. Measures the total amount of electrical energy consumed.

c. The number of watts multiplied by the number of hours equals the watt-hours.

8. Kilowatt hour.

a. Unit of measure by which electricity is bought and sold.

b. 1000 watts of electricity used by the consumer for a period of one hour.

B. Reading meters.

1. Modern electric meters have a cyclometer dial.

2. Some meters have four dials with numbers from one to ten.

3. The more kilowatt-hours of electricity used, the less the cost per unit.

C. Estimating demand.

Equipment	Rating	Average KWH Used
Blanket	50-150 watts	10 per mo.
Food mixer	200 watts	1 per mo.
Clock	2-10 watts	4 per mo.
Iron, hand	660-1000 watts	6 per mo.
Lighting	5-500	40 per mo.
Radio	45-150	9 per mo.
Range	5000-10,000 watts	125 per mo.
Refrigerator	1/8-1/3 hp.	40 per mo.
Home freezer	1/4-1/2 hp.	6-7 per mo. per cu. ft.
Sewing machine	30-100 watts	1 per mo.
Television	200-315 watts	20 per mo.
Washing machine	1/4 hp.	3 per mo.
Water heater	500-5000 watts	250 per mo.
Water pump, shallow	1/4-1/3 hp.	1 per 1000 gal.
Water pump, deep	1/2 - 1-1/2 hp.	1-2 per 1000 gal.
Feed grinder	1/2 - 7-1/2 hp.	1/10-1 per 100 lbs.
Vacuum cleaner	100-200 watts	1/2 per mo.

Equipment	Rating	Average KWH Used
Arc welder	50-180 amps.	1 per hour of use
Electric drill	1/6-1 hp.	1/2 per hour use
Motors	Fractional hp.	1 ea. 1-5 hrs. oper.
Soldering iron	60-500 watts	1 per 4 hrs. use

D. Methods used in selling electricity.

1. Block energy rate--low-priced blocks which are reached after a few kilowatt-hours are used.

2. Minimum bills (flat rate).

a. Consumer density--rate based on number of consumers per mile of line.

b. Transformer--number of farms per transformer.

3. Cost of electricity per kilowatt-hour--cost decreases per unit as the amount used increases.

E. Estimating cost--cost equals kilowatt-hours used multiplied by the cost per kilowatt-hour. Example: If you use 300 kwh at $0.07 per kwh, the cost would be $21.00.

Method: Class discussion and individual estimation of home farm electric demand and cost.

Problem: Electric overload protectors.

References: Rural Electrification, J. P. Schaenzer; Shopwork on the Farm, M. M. Jones; Farm Electrification, Bul. 558, Texas Education Agency; F. F. A. Farm Electrification Manual, Texas Power and Light Co.

Objectives:
1. To develop understanding of the importance of fuses and circuit breakers in the farm electrical system.
2. To familiarize students with the various types of electrical protection equipment.

Introduction: It is cheaper to use correct overload protection devices than to pay for damage caused by improper overload protection devices.

Pivotal Points:

A. Protection of branch circuits.

1. Branch circuits should have some type of safety device which will break the flow of electricity when the circuit is overloaded or when a short occurs.

2. Types of protective devices.

a. Fuses--a fuse is a strip of soft wire or metal in a container. This strip of metal is designed to carry a certain electrical load. It will melt if the load on the circuit is greater than the rating of the fuse.

(1) Plug fuse.
(2) Cartridge fuse which is seldom used in homes.

b. Fusetrons.

(1) Similar to fuses, but fusetrons have a delayed action "Burnout" element.
(2) Useful for protecting branch circuits on which temporary overloads are created by the operation of motor driven appliances.
(3) More expensive than fuses.

c. Fustats.

(1) Same characteristics as fusetrons.

(2) Have special adapters that fit into fuseholders.
(3) Fustats of different rates are different sizes.
(4) Fustats are smaller than coins; therefore, coins cannot be used in the fusebox.

d. Circuit breakers.

(1) Same time delay characteristics as fusetrons and fustats.
(2) Do not burn out when overloaded. A thermal element trips the switch open.
(3) When thermal element has cooled, the breaker can be reset by pushing switch all the way toward off position and then back to the on position.

e. Protection of small motors on branch circuits.

(1) Light motors can be overloaded easily until burned out unless properly protected.
(2) A 1/2 h.p. motor will draw 5 amps. at full load. Branch circuits are fused to carry less than 15 amps. This is too much load for 1/4 h.p. motor.
(3) A common fuse will not protect the motor.
(4) A delayed action motor starter switch will permit momentary heavy overload of starting.

f. Grounding of equipment.

(1) The ground for equipment provides a pathway for electric current to pass from equipment to the ground.
(2) This protects the person using the equipment if it shorts out.

Method: Class discussion.

Problem: Conditioning tools.

References: Shopwork on the Farm, M. M. Jones; Units in Hand Woodworking, J. H. Douglas.

Objective: To enable students to become familiar with the value of keeping tools in good condition.

Introduction: Good tools make for better workmanship. It is almost impossible to do a satisfactory job with poorly conditioned tools.

Pivotal Points:

A. Fundamentals of tool conditioning.

1. Purpose of tool conditioning.
2. Selecting grinders, stones, and equipment.
3. Care of tool conditioning equipment.
4. Repair tools before sharpening.
5. Operating the grinder safely.

B. Sharpening tools.

1. Sharpening an ax or hatchet.
2. Sharpening a wood chisel.
3. Sharpening a plane iron.
4. Sharpening a cold chisel and punches.
5. Sharpening tin snips.
6. Sharpening a sickle.
7. Sharpening a twist drill.
8. Sharpening knives.
9. Sharpening auger bits.
10. Sharpening screw drivers.

C. Sharpening a saw.

1. Set and file hand crosscut saw.
2. Set and file hand rip saw.

D. Replace broken handles.

E. Oiling shop tools.

F. Cleaning shop tools.

Method: Class discussion and individual responsibility.

APPENDIX B

Problem: Sharpening plane bits and wood chisels.

Reference: Shopwork on the Farm, M. M. Jones.

Objective: To develop ability to keep hand tools in good conditon.

Introduction: Sharp tools produce better workmanship. Time spent sharpening tools results in more time being saved by faster and better work.

Pivotal Points:

A. Grind or resharpen blade when:

1. Nicked (grind).
2. Unusually dull (grind).
3. Not nicked and slightly dull (resharpen on oil-stone).
4. Slight bevel on flat side (grind).
5. Undesirably beveled and improperly squared with sides (grind).

B. Proper angle and shape of cutting edge is:

1. 22 to 25 degrees. Rule of thumb (bevel twice thickness of tool).
2. Less for use on softwood.
3. Greater for hardwood.

C. Procedure for grinding plane bits and wood chisels.

1. Hold tool against wheel to produce a smooth bevel of 22-1/2 degrees.
2. Adjust work rest to get the desired angle.
3. Hold tool with first finger coming against rest in order that the tool may be replaced at the same angle after removal.
4. Wheel should turn toward cutting edge.
5. Turn wheel moderately fast at a steady speed.
6. Hold tool against wheel with medium firm pressure.

7. Move tool from side to side.

8. To prevent over heating, dip tool in water frequently.

9. Inspect work frequently to see if you are obtaining proper shape and angle of bevel.

10. Continue grinding until:

    a. Dull edge is removed and nicks are removed.

    b. Edge is straight and square and the bevel is of the desired angle.

D. Procedures for whetting plane blade or chisel.

1. Use a good oil stone such as carborundum or India.

2. Use a good oil of 50-50 kerosene and motor oil.

3. Whet plane blade at a 35 degree angle.

4. Whet chisel same as grind bevel.

5. Remove burrs by turning blade over and placing flat on oil stone.

6. Keep the blade flat and use very light pressure.

E. Methods for checking sharpness.

1. Draw the blade across the finger nails to detect nicks.

2. Blade will shave if it is sharp enough.

3. A sharp edge cannot be seen with the eye.

Method: Class discussion and individual participation.

Problem: Fitting a steel drill bit.

References: Fitting Farm Tools, L. M. Roehl; Shopwork on the Farm, M. M. Jones.

Objective: To enable students to become more familiar with the proper procedure for grinding a drill bit.

Introduction: A sharp drill is necessary for good work. Many people grind the drill incorrectly while many do not grind it at all.

Pivotal Points:

A. Grind both cutting lips so that each will be the same length and each will form a 59 degree angle with the axis of the drill.

B. The heel should be approximately 12 degrees below the cutting edge of the cutting lip to give sufficient clearance for the cutting edge to bite into the metal.

Method: Class discussion and participation.

Problem: Planning shop facilities.

Reference: Shopwork on the Farm, M. M. Jones.

Objective: To become familiar with planning a home farm shop.

Introduction: A farm shop of some kind is necessary to keep farm machinery, buildings, and equipment in good repair.

Pivotal Points:

A. Selecting the site.

1. Depends upon location and arrangement of other buildings and fences on the farmstead.
2. Locate handy to machines and implements.
3. Ideal location is next to machinery shed.

B. Planning shop building.

1. No standardization.
2. Shop combined with machinery building.
3. Shop combined with garage.
4. Separate shop building.
5. Size of shop--20 to 24 feet wide by 24 to 32 feet long.
6. Foundation or floor--concrete is best.
7. Building materials--brick, tile, or concrete block.

C. Selecting tools, equipment, and supplies.

1. Clean the tools you have on hand.
2. Add to the supply as needed and as you can afford them.
3. A good supply of hand tools should be acquired first.
4. Power tools may be acquired as you can afford them.

D. Shop equipment.

1. Work benches.
    a. 2 inch lumber.
    b. 24 to 30 inches wide.
    c. 30 to 34 inches high.
    d. 6 to 12 feet long.
2. Portable work bench--3 feet long, 26 inches wide, and 32 inches high.
3. Blacksmith's vise.

E. Arranging the interior and storing tools.

1. Workbenches and heavy equipment arranged along one side or end of the shop.
2. Have a large area for working on equipment.
3. Woodworking tools and equipment arranged about one bench.
4. Metal working tools arranged about another bench.
5. Tools can be arranged on tool cabinets or tool boards.

F. Storing supplies and materials--keep supplies and materials where they can be easily and readily found, but keep them up out of the way.

Method: Class discussion. Have students plan a shop to fit their individual needs.

Problem: Arc welding.

References: Arc Welding Lessons for School and Farm Shop, Lincoln Arc Welding Foundation; Shopwork on the Farm, M. M. Jones; Forney Arc Welding Manual, Forney Manufacturing Co.

Objective: To enable the students to better understand the fundamentals of arc welding.

Introduction: The process of welding with heat from an electric arc was developed at the end of the nineteenth century. Arc welding machines are now owned by many farmers who own a considerable amount of machinery.

Pivotal Points:

A. Types of arc welders.

1. A.C.--alternating current.

a. Flow of current is in one direction and then in the other direction.

b. Transformer type welders.

c. It steps down the voltage and increases the amperage.

2. D.C.--direct current.

a. Direct flow of current in only one direction.

b. This is a generator type machine similar in design to the generator used on an auto or tractor to furnish lights.

B. Equipment.

1. Electrode holders are attached to the end of the electrode cable.

2. Ground clamp connects the ground cable to the work being welded. It completes the circuit.

3. Chipping hammer and brush are used to chip off the slag.

4. Head and face shields must be used for the protection of the operator.

5. Gloves must be used to protect the hands from burning.

C. Electrodes are the metal rods which conduct the current from the electrode holders through arc to base metal.

1. Coating on outside.

a. Contains from five to fifteen different materials.

b. Silica flour, titanium dioxide, asbestos, clay, and calcium carbonate are some common materials used in coating. These materials are bound together with sodium silicate.

2. Purpose of coating.

a. It forms a gaseous shield which reduces oxidation.

b. It forms a coating on the weld.

c. It improves the fusion of metals.

3. Size.

a. Size is expressed in diameter and length. Core wire is measured at bare end for diameter.

b. Electrode sizes most commonly used in farm shops are 1/8 and 5/32.

c. There is usually a gauge on the welder which tells you the size of electrode and setting of machine for certain thicknesses of metal.

D. Striking an arc and running a flat bead.

1. Prepare the material. Have the metal clean.

2. Methods of striking an arc.

a. Tapping is usually used when the arc is broken while welding.

b. Scratching. The arc is made by scratching the electrode as you would strike a match.

3. Correct arc length.

a. Approximately the length of the diameter of the bare end of the electrode being used.

b. Measure from base of crater to tip of steel core wire.

4. Speed of travel.

a. Electrode tipped 15 to 25 degrees in the direction of travel.

b. Lower electrode as it burns.

c. Move so that completed bead has even ripples and is not wider than one and a half times the diameter of the electrode.

(1) If you move it too slowly, the metal piles up and rolls over giving you excessive overlap.
(2) If you move it too fast, it will not deposit enough weld metal and the bead will be small with irregular shape.

E. Type of welds.

1. Welds are classified as follows:

a. Bead--made on surface with single pass of electrode.

b. Fillet--one or more beads run in the angle or corner between two surfaces.

c. Groove--one or more beads deposited in a groove.

2. Type of welding joints.

a. Butt weld is formed by placing the edges of two plates together and passing a weld down the joint.

(1) Closed butt joints--end to end. This is used for metal 1/8 to 3/16 inches thick.
(2) Open butt--an opening of 3/32 to 1/8 inch is left. This is a stronger weld because you get easier penetration.
(3) Vee butt is used on metal over 1/8 or 3/16 inch thick.

b. Lap.

c. Tee.

d. Corner.

F. Some reasons for poor welds.

1. Improper machine adjustment--not hot enough or too hot.

2. Improper size of electrode for metal being welded.

3. Electrode is moved too fast or too slowly.

4. Electrode is held at improper angle.

5. Base metal is improperly prepared.

6. Incorrect length of arc.

G. Distortion. Metal is distorted when it is pulled permanently out of position due to uneven heating during welding or by rapid cooling. Avoid distortion by:

1. Not overwelding.

2. Using proper edge preparation.

3. Using fewer passes.

4. Placing weld near neutral axis.

5. Using intermittent welds.

Method: Class discussion and individual participation.

Problem: Selection of electrodes for the farm shop.

References: How to Teach Arc Welding in Farm Mechanics, A. H. Hollenberg; Arc-Welding Lessons for School and Farm Shop, H. L. Kugler.

Objectives: To develop understanding of:
1. Why we have different kinds of electrodes.
2. How to identify electrodes.
3. Which electrodes would be best suited for the farm shop.

Introduction: There are many kinds and types of electrodes available. Different metals require different types of electrodes. To be able to do a satisfactory welding job, the correct electrode for the metal being welded must be selected.

The first electrodes used for arc welding were bare steel wires which gave poor results. Arc welding was not extensively used until coated electrodes were discovered.

Pivotal Points:

A. Why have different kinds of electrodes?

1. Different kinds of steel.

2. Different kinds of metal.

3. Different types of current--A.C. and D.C. A.C. rods will work on D.C. equipment, but D.C. rods will not work on A.C. equipment.

B. Use of electrodes.

1. Many kinds and sizes of electrodes are used in industry.

2. Only a few kinds and sizes are recommended for the farm shop.

a. Steel.

b. Cast iron.

c. Hard surfacing.

C. Classification of electrodes. The American Welding Society (A.W.S.) and the American Society of Testing Metals (A.S.T.M.) have issued specifications for classification of electrodes. Manufacturers make electrodes to meet these specifications and mark

their electrode packages with identifying numbers.

1. Major consideration on which electrodes are classified:

   a. Type of metal for which it is intended.

   b. Type of welding current--A.C. or D.C.--to be used.

   c. Welding position.

   d. Strength of weld metal and certain operating characteristics.

2. Electrode size is expressed in:

   a. Length--overall length from tip to tip. Standard lengths are 12, 14, and 18 inches.

   b. Diameter--size of core--3/32, 3/16, 1/8, and 5/32 inches.

3. Standard electrode that should be used for welding mild steel in the farm shop is E 60 13. It is considered the best all aroung rod and can be used for overhead, horizontal, and vertical welding.

   a. E means arc welding electrode.

   b. 60. The first two digits give the tensile strength in thousand pounds per square inch.

   c. 1. The third digit indicates the welding position.

   d. 3. The fourth digit gives the subgrade identification.

4. Two types of cast iron electrodes:

   a. Cast iron that is machinable. Use an electrode with a nickel or nickel alloy core.

   b. Cast iron that is not machinable is less expensive.

5. Hard surfacing materials can be applied to tools that are subject to abrasive or impact wear. Electrodes and powders are available to do this type of welding.

6. Electrode coatings.
    a. Titanium dioxide.
    b. Ferro-manganese.
    c. Silica flour.
    d. Asbestos.
    e. Clay.
    f. Calcium carbonate.
    g. Wood pulp (cellulose).
7. Various coatings have different primary purposes.
    a. Cellulose--gas-shielding agent.
    b. Titanium dioxide--slag former.
    c. Ferro-manganese--reducing agent.
    d. Asbestos--produces arc force and forms slag.
8. Color markings.
    a. Primary--spot on tip end of electrode.
    b. Secondary--spot on side near tip of electrode.

Method: Class discussion.

Problem: Oxyacetylene welding.

References: Shopwork on the Farm, M. M. Jones; Welding and Its Application, B. E. Rossi.

Objective: To enable students to better understand the fundamentals of oxyacetylene welding.

Introduction: Oxyacetylene welding is a fusion-welding process. Oxyacetylene welding and cutting equipment is very valuable in the farm shop. It can be used in heating, cutting, various welding, building up worn surfaces, and hard surfacing.

Pivotal Points:

A. Major use.

1. Welding small objects.
2. Welding non-ferrous metals.
3. Cutting metal.

B. Gases used.

1. Oxygen.
   a. Colorless, tasteless, and odorless.
   b. Supports and intensifies heat.
   c. It combines violently with oil or grease under pressure at ordinary temperatures.
      (1) Never handle with oily or greasy hands.
      (2) Never oil regulators or connections.
   d. One fifth of the atmosphere is composed of oxygen.
2. Acetylene.
   a. Colorless with a characteristic odor.
   b. Combustible gas.
   c. Is explosive when mixed with air and oxygen.
   d. Never use over 15 pounds per square inch. This is a national law because it will explode.

e. Calcium carbide and water gives acetylene and hydrated lime.
Ca C_2 & H_2O Gives C_2H_2 & Ca $(oh)_2$

C. Some factors causing poor welds.

1. Improper flame adjustment.

2. Improper tip size.

3. Dirty tips.

D. Three types of flames.

1. Excess oxygen flame or oxidizing flame.

a. For preheating metal when cutting.

b. For oxidizing impurities in non-ferrous metal--mostly brasses and bronze.

c. How to recognize.

(1) Many sparks fly from metal.
(2) Blows holes in this metal.
(3) Flame makes hissing sound.

2. Excess acetylene or carburizing flame.

a. Free carbon is deposited on metal.

b. The main alloy of iron is carbon. Carbon combines readily with iron when welding with a carburizing flame.

(1) Carbon increases hardness of iron. This would cause a brittle weld which would be easily broken.
(2) Makes weld porous.
(3) Lowers melting point of iron.

3. Neutral flame.

a. Well-defined white inner cone. Only 2 cones present.

b. Inner cone is 5,800 to 6,300 degrees F.

c. You use equal parts of oxygen and acetylene from the tank for a neutral flame.

E. Oxygen cylinders.

1. Green hose.

2. Right hand threads on connections.

3. 2200 pounds per square inch at 70 degrees F.

F. Acetylene cylinders.

1. Red hose.

2. 250 pounds per square inch.

3. Cylinders are closely packed with an absorbent filler which is saturated with acetone. Acetylene is dissolved in the acetone. This prevents large amounts of acetylene from being free under pressure.

4. Never use over 15 pounds per square inch. This is a national law because it will explode.

G. Lighting and adjusting torch.

1. Open acetylene half a turn and light by using a friction spark lighter.

2. Turn flame up until it burns clean with no smoke or soot.

3. Open oxygen valve and adjust for a neutral flame.

H. Shutting off the torch.

1. Close acetylene valve.

2. Close oxygen valve.

3. Close cylinder valves.

4. Release pressure by opening the torch valves.

5. Release adjusting valves on regulators.

Method: Class discussion, demonstration, and individual participation.

Problem: Using oxyacetylene cutting torch.

References: Elementary and Applied Welding, H. P. Rigsby; Shopwork on the Farm, M. M. Jones.

Objectives:

1. To enable students to become familiar with cutting metal by the oxyacetylene process.
2. To enable students to develop skill in using the cutting torch.

Introduction: Oxyacetylene cutting equipment is very valuable in repairing and maintaining farm implements. In some cases it is preferred over the arc welding equipment.

Pivotal Points:

A. Cutting torch parts.

1. High-pressure oxygen valve.
   a. Lever.
   b. Buttom.
   c. Trigger.
2. When the valve is opened or released, a jet of pure oxygen goes through the cutting tip and blows molten metal away--thus cutting the metal.
3. Tip.
   a. Has 5 openings.
   b. 4 openings spaced around edge of tip form a square. These outter holes provide a flame for heating the metal so it can be cut.
   c. They contain a mixture of oxygen and acetylene.
   d. The fifth hole is in the center of tip. This provides the cutting oxygen.

B. Opening and regulating gas pressure.

1. Oxygen.
   a. Be sure adjusting screw or pressure regulator is loose.

b. Open oxygen cylinder valve slowly until it is completely open. High-pressure regulator will register approximately 2200 pounds at 70 degrees F.

c. Tighten adjusting screw on the regulator until desired working pressure is reached on the low-pressure regulator--usually 30 to 40 pounds per square inch.

2. Acetylene.

a. Be sure adjusting screw on pressure regulator is loose.

b. Open acetylene cylinder valve slowly about 3/4 of a turn. If cylinder is full, high-pressure regulator will register about 250 pounds per square inch.

c. Tighten adjusting screw until desired working pressure is reached--usually about 7 pounds per square inch.

d. Never use over 15 pounds per square inch--national law--it may explode.

C. Lighting and adjusting torch.

1. Acetylene.

a. Open acetylene valve or torch 1/4 of a turn.

b. Light gas at tip with spark lighter.

c. Adjust valve until flame burns clean giving off some smoke--usually just before flame begins to leave tip.

d. Flame should not separate from tip.

2. Oxygen.

a. Open valve at hose fully.

b. Open oxygen valve on torch slowly until green, unburned acetylene disappears from the blue cone at the end of tip.

D. Cutting--use neutral flame.

1. Ratio of oxygen to acetylene.

a. Beginners--8 to 1.

b. Experienced workers--will vary with individual. Range 5-1 to 8-1.

2. Hold torch with both hands.

a. One hand to regulate flow of oxygen.

b. Other hand to move torch.

3. Preheat metal at point where you are going to cut.

4. Hold flame about 1/16 inch from work.

5. Hold torch stationary until a flame begins to sparkle.

6. Open high-pressure oxygen valve all the way.

7. Cutting will begin.

8. Move torch at a uniform rate of speed along cutting line.

E. Angle at which to cut.

1. Thin metal--1/8 inch--tip should be at about 20 degree angle to the horizontal and pointed in direction of travel.

2. Thick metal--tip inclined toward vertical.

3. Metal 1/2 inch or more--tip at right angle to work.

F. Turning off torch.

1. Close acetylene valve on torch.

2. Turn off oxygen valve on torch.

3. Shut off both cylinder valves.

4. Release pressure on hoses by opening valves on torch.

5. Loosen regulator adjusting screws.

Method: Class discussion, demonstration, and individual participation.

Problem: Braze welding, brazing, or bronze welding.

Reference: Shopwork on the Farm, M. M. Jones.

Objective: To enable student to understand braze welding.

Introduction: Brazing is used for repairing broken parts which cannot be successfully welded by the fusion process and for repairing worn surfaces.

Pivotal Points:

A. Metals which may be braze welded.

1. Steel.

a. There is little advantage in brazing steel because it is easy to weld by the fusion process.

b. Coating with bronze is often done for resistance against corrosion and resistance against metal-to-metal wear.

2. Gray cast iron.

3. Malleable iron.

4. Galvanized iron or steel. Zinc fumes are toxic; adequate ventilation must be provided.

5. Brass and bronze if their fusion temperatures are higher than the filler material used.

6. Dissimilar metals if each metal is suitable for braze welding.

B. Advantages of braze welding.

1. Lower bonding temperatures allows faster welding with lower consumption of gases.

2. Mechanical properties compare favorably with those of parent material.

3. Bronze is plastic at 500 degrees F. Contraction of metal usually occurs above that temperature.

C. Disadvantages of braze welding.

1. It cannot be used where welds will be subjected to temperatures of 500 degrees F. or higher.

2. The bond may be destroyed by subjection to heating and cooling cycles.

3. The filler and parent metal may not match in color.

D. Procedure for braze welding.

1. Oxyacetylene and carbon-arc are the most common sources of heat.

2. Joints should be free of rust, scale, paint, grease, and other foreign material.

3. Bevel metal over 1/8 inch thick.

4. Use either a powder or liquid flux.

5. A slightly oxidizing flame is used.

6. Heat the work to a dull red heat.

7. Do not overheat or melt the surfaces.

   a. If the work is not hot enough, the bronze will tend to stick and remain in drops.

   b. If the work is too hot, the bronze will give off white fumes and form drops which roll around but will not stick.

8. Heat the end of the filler rod and dip it into the flux.

9. Tin metal with light coating of bronze.

10. Add the bronze near the rear of the puddle.

11. Move the torch in a circular motion using a slow, steady speed.

E. Braze welding cast iron.

1. Preheat the cast iron uniformily and extensively.

2. It is better to chip than to grind pieces of cast iron to be brazed.

3. Use the above procedure.

4. When the weld is completed, play the torch back and forth over it to relieve strains caused by unequal expansion and contraction.

5. Allow the weld to cool slowly to room temperature. Bury it in lime, ashes, or warm sand or cover it with asbestos paper to insure slow cooling if possible.

Method: Classroom instruction and individual participation.

Problem: Servicingand repairing farm machinery.

References: Operation, Care, and Repair of Farm Machinery, John Deere and Co.; Shopwork on the Farm, M. M. Jones.

Objective: To become familiar with a few of the more important and common activities of repairing farm machinery.

Introduction: Each of the topics listed in this guide will not be taught to the group as a whole. Individuals will bring in their machinery and receive individual instruction for its repair.

Pivotal Points:

A. Removing worn or broken machine parts.

1. Using wrenches.
2. Removing rusted nuts and bolts.
3. Extracting broken bolts and screws.

B. Repairing and adjusting the cutting parts of a mower.

1. Replacing knife sections.
2. Sharpening a mower knife.
3. Straightening a mower knife.
4. Replacing guard plates.
5. Adjusting other cutter bar parts.
6. Aligning a cutter bar.

C. Repairing and adjusting sprocket chains.

D. Sharpening plowshares.

E. Sharpening harrow teeth.

F. Sharpening and adjusting ensilage-cutter knives.

G. Sharpening disks and cutters.

H. Sharpening and setting cultivator shovels.

I. Protecting machinery from rust.

J. Lubricating machinery.

K. Cleaning engine.

Method: Class discussion and individual participation.

APPENDIX B

Problem: Adjusting engine valves.

References: Auto-Mechanics. Book I: The Engine, R. F. Kuns; Operation, Care, and Repair of Farm Machinery, John Deere and Co.

Objectives:
1. To familiarize students with the adjusting of engine valves.
2. To enable students to adjust engine valves.

Introduction: Proper adjustment of engine valves is necessary to the proper performance of the engine.

Pivotal Points:

A. Checking valve clearance.

1. Use thickness gauge.

2. Set according to instruction book or operator's manual.

B. Adjust clearance.

1. Valve clearance is the distance between the end of valve stem and the top of the valve lifter.

2. Learn clearance specified for the particular engine.

3. Select proper blade on thickness gauge.

4. Turn engine over until the piston for cylinder one is on top dead center, compression stroke.

5. This can be determined by checking the position of rotor when rotor is in position to valves.

6. Exhaust closes, intake opens.

7. Turn hand crank one full turn from point at which exhaust has just closed.

8. Check valves for that cylinder and follow same procedure until all cylinders have been checked.

C. Adjusting valves.

1. Check with clearance blade.

2. If out of adjustment:

a. Hold the adjusting ball screw or nut.

b. Loosen lock nut.

c. Turn adjusting screw up or down.

d. Check with thickness gauge, if correct.

e. Lock nut and check again.

f. Clearance is about .008 inch.

Method: Class demonstration.

Problem: Engine ignition system.

Reference: Operation, Care, and Repair of Farm Machinery, John Deere and Co.

Objectives:
1. To familiarize students with the tractor ignition system.
2. To enable students to service and make minor repair of ignition systems.

Introduction: Two common types of ignition systems are:
1. Magneto system--current is produced by the turning of the armature of the magneto.
2. Battery system--current is produced by chemical action within the battery. The battery type ignition is the most commonly used system today.

Pivotal Points:

A. Battery-distributor type ignition system consists of the following.

1. Battery or batteries for the source of power.

2. Coil to transform low-voltage current to high-voltage.

3. Distributor carries high-voltage current to spark plugs.

4. Spark plugs release the spark in the combustion chamber.

5. Generator is required to keep the battery charged.

6. Ignition switch breaks and connects the circuit.

B. Checking the ignition system.

1. Good hot spark.

2. Check spark.

a. Remove wire from plug.

b. Hold 1/4 inch from engine.

c. Crank engine. If the spark jumps from wire to engine, the wire is in good condition.

3. Check spark plug.

   a. Clean if dirty.

   b. Replace plug if porcelain insulator is cracked.

   c. Set plug gap.

   d. Use spark plug gauge for correct setting.

   e. Keep spark plug cables clean.

   f. Fasten plug wire to plug terminal securely.

4. Check distributor.

   a. Check spark at distributor.

   b. If a spark is noted at the distributor, the distributor is operating satisfactorily.

   c. Check points.

      (1) Proper clearance according to tractor instruction book.
      (2) Replace if pitted, burned, or dirty.
      (3) Set to proper spacing.
      (4) If no spark occurs, remove the unit and take to tractor dealer for expert repair service.
      (5) Follow manufacturer's instruction book when replacing the ignition parts.

5. Battery and its care.

   a. 6 and 12 volt systems.

   b. Do not replace a heavy duty battery with one which is not recommended by the manufacturer.

   c. Clean top of battery every 120 hours of work or once a month.

   d. Clean corrosion around terminal with stiff bristled brush.

   e. Use a solution of 1/4 pound of baking soda to one quart of water. Wash off with clear water.

   f. Check acid water at least once a month.

g. Add distilled water or soft water.

h. Don't permit water level to go below top of cell plates.

i. Always follow the manufacturer's manual when storing a battery or installing the battery in the tractor.

Method: Class discussion and group participation.

Problem: Replacing and adjusting clutches.

References: Atuo-Mechanics. Book 4: The Power Flow, R. F. Kuns; Operation, Care, and Repair of Farm Machinery, John Deere and Co.

Objective: To develop ability to make minor repair and adjustments of farm tractors on the farm.

Introduction: The purpose of the clutch is to connect the power of the engine to the load. It is necessary for the transmission of power to the various power outlets and for changing speeds and direction of travel. To work properly, the clutch should engage smoothly, thus picking up the load gradually without a jerking motion.

Pivotal Points:

A. Types of clutches.

1. Single-plate--for light cars.

2. Double-plate--for heavy cars.

B. How the clutch works.

1. The clutch pressure plate turns with the flywheel at all times.

2. Another plate is mounted on the clutch shaft. The clutch shaft connects with the transmission shaft.

3. When the clutch is disengaged, the two plates are separated in order that the plate turning with the flywheel will not cause the driven plate mounted on the clutch shaft to move.

a. The car cannot be driven while the clutch is disengaged.

b. This allows you to put the vehicle in a different gear.

4. When the clutch is engaged, the plates are together. The friction material on the driven plate engages the plain faces of the clutch-pressure plate, and they turn together causing the vehicle to move.

C. Adjusting the clutch (John-Deere)

1. Draw up all nuts to exactly the same tension.

2. The clutch operates with a snap, requiring some pressure to lock it. To tighten the clutch, each nut must be turned down to the same tension, disregarding the number of threads exposed.

D. Replacing clutch facings.

1. Remove dust cover and clutch-adjusting plate.

2. Install a new clutch facing.

a. Be certain that the inside or first clutch facing is in proper position while clutch drive disk is being replaced.

b. Install second clutch facing in clutch adjusting plate, making sure the three short springs are in place.

c. Adjust clutch as described.

E. Always refer to the operator's manual for proper directions for servicing your particular tractor.

Method: Classroom discussion and demonstration.

Problem: Splicing rope and tying knots and hitches useful on the farm.

Reference: Shopwork on the Farm, M. M. Jones.

Objectives:
1. To develop ability to splice rope.
2. To develop ability to tie knots and hitches that can be used on the farm.

Introduction: There are always many opportunities to use rope on the farm. It is very important to use knots that will hold.

Pivotal Points:

A. Splicing rope.

1. There are two main types of broken rope splices.

a. A long splice is used if the rope is to pass through a pulley or if a neat splice is desired.

b. A short splice enlarges the diameter of the rope at the splice, but this is not objectionable for some uses. A short splice is used when only a short length of rope can be spared for making the splice.

2. Other splices that are useful.

a. Eye splice is used where a permanent loop is to be made in the end of a rope.

b. Loop splice is used for making a loop or eye in a rope at a point other than the end.

c. Well knot is used at the end of a rope.

B. Useful knots.

1. Figure 8 knot is used where a large, bulky knot is needed on the end of a rope to keep it from going through a hole or through a pulley.

2. Overhand knot is sometimes used as an end knot in a rope.

3. Tying the ends of rope together.

a. Square knot is one of the most useful for joining the ends of twine, string,

or rope.

(1) Granny knot is often mistaken for a square knot.
(2) A square knot will hold. A granny knot will slip under strain and should not be used normally.

b. Fisherman's knot.

c. Weaver's knot (sheet bend) is used for joining two ropes, particularly ropes of different sizes.

4. Loop knots

a. Slip knot--tying a loop around an object.

b. Bowline knot--one of the most useful. Holds securely, yet it will not slip or draw up tight.

c. Double-bowline is used for holding hogs while ringing.

d. Hitching or manger knot is used for tying an animal to a hitching post.

e. Lariat knot.

f. Bowline on bight is a loop in the middle of a rope.

g. Well-pipe hitch--securing a rope to a pipe or other cylindrical object.

h. Sheep shank is used for shortening a rope temporarily.

C. Hitches.

1. Half hitch is mostly used in combination with other hitches.

2. Timber hitch is used for holding or moving logs.

3. Clove hitch is used for fastening a rope to a post or stake.

4. Miller's or grain-sack knot is used for tying grain sacks.

5. Black wall hitch is used to temporarily fasten a rope to a hook.

6. Cat's paw is used to fasten a rope to a hook.

7. Snubbing or running hitch--snubbing animals or pulling in a rope against a force and fastening it to prevent it from being pulled out again.

Method: Class discussion and individual participation.

Problem: Planning the electric wiring system.

References: F. F. A. Farm Electrification Manual, Texas Power and Light Co.; Electric Wiring, A. A. Schuhler; Rural Electrification, J. P. Schaenzer.

Objectives:
1. To enable students to become familiar with careful planning of the electrical wiring system.
2. To plan electric wiring for comfort and convenience in the home.

Introduction: Wyoming has 12,200 farms with electricity; that represents 96.6 per cent of the farms in the state. Wherever electricity is put to work on the farm, the standard of living on that farm is raised.

Pivotal Points:

A. Planning the house wiring system.
   1. Consider the appliances and equipment which will be used.
   2. List the equipment to be used in each room.
   3. Plan for convenience outlets.
   4. Plan for future needs.

B. Plan equipment for each room.
   1. Kitchen.
   2. Bath.
   3. Porch.
   4. Living room.
   5. Bedrooms.
   6. Utility room.
   7. Basement.
   8. Hallways.

C. Locating outlets.
   1. Draw floor plan.

2. Locate outlets from one to three feet above floor.

3. Locate kitchen outlets 42 inches above floor.

4. Combination light and outlet in bathroom above the mirror.

5. Use of light outlets for appliances is not recommended.

D. Locating lights.

1. Kitchen.

a. Ceiling light.

b. Light over sink or work table.

2. Living room.

a. Ceiling light.

b. Floor lamps.

c. Table lamps.

3. Bedrooms.

a. Ceiling light.

b. Bed lamps and wall lamps.

c. Wall outlets spaced every 12 feet of useable wall space.

4. Bathroom.

a. Ceiling light.

b. Mirror light.

5. Location of other ceiling lights.

a. Closets.

b. Stairways.

c. Cellar or basement.

d. Porches.

e. Utility room.

f. Hallways.

E. Locating switches.

1. Convenience and satisfaction of lighting depends upon ease of regulating the lighting.

2. Light switches near doors.

3. Locate switches so main passageway is lighted ahead of you.

4. Porch lights should be controlled inside the house.

5. Two-way switches where needed.

a. Stairways.

b. Long hallways.

c. Breezeway and garage.

F. Total number of outlets depends upon the needs of the family.

G. Kinds and number of circuits.

1. Appliance circuits (20 amperes).

2. General purpose circuits (15 amperes).

3. Special appliance circuits (20 to 50 amperes).

4. Lack of enough circuits gives poor electrical service.

Method: Class discussion and visual aids.

Problem: Estimating cost of electric wiring.

References: Rural Electrification, J. P. Schaenzer; Electric Wiring, A. A. Schuhler.

Objective: To enable students to determine what he will need and the approximate cost.

Introduction: The proper wiring of a house means a fuller use of your investment.

Pivotal Points:

A. Cost depends upon the following factors:

1. Size of home.
2. Number of convenience and power outlets.
3. Whether the building is under construction or already built.

B. Methods of preparing wiring estimates.

1. Vary according to contractor's experience and practice.
2. Unit cost per outlet.
3. Large outlets and lighting fixtures are extra.

C. Steps in estimating wiring cost.

1. Study of plans and specifications.
2. Calculate the sizes of feeders and branches.
3. Divide outlets into groups or into circuits.
4. Estimate material needed.
5. Estimate amount of labor required.
6. Be sure everything shown in plans has been considered.
7. Add the estimated cost of labor to the estimated cost of materials.

Method: Class discussion.

Problem: Installing electric wiring.

References: Rural Electrification, J. P. Schaenzer; Electric Wiring, A. A. Schuhler. Electric Wiring for Home or Farm, Sears, Roebuck and Co.; Farm Electrification, Texas Education Agency.

Objectives:
1. To familiarize students with the mechanics of installing simple wiring.
2. To develop ability of student to plan and make diagrams of simple wiring jobs.

Introduction: Simple wiring jobs which can be done by the student can be of economical value.

Pivotal Points:

A. Consult local R.E.A. Cooperative or Power Company.
   1. Size and type of service entrance.
   2. Amount of installation they will do.

B. Wiring permit.
   1. Service entrance switch.
      a. Main distribution panel.
      b. Safety valve for whole system.
   2. Grounding system.
      a. Protects against electrical shocks.
      b. Connect ground terminal to water pipe or to rod in ground.
   3. Branch circuits.
      a. Each circuit has wires.
         (1) White--neutral.
         (2) Red or black--hot.
      b. Each circuit carries electric power to a portion of the house.
   4. Complete circuit--two wire circuit may carry current from entrance to the following places:
      a. Junction box.

(1) Used to run wires of branch circuit in two directions.
(2) Sometimes used as ceiling box for lights.
(3) Simple splice of white to white and hot to hot.

b. Convenience outlet.

(1) Tap of branch circuit so plug in type appliances can be used.
(2) Install plenty so you will not have to use long extension cords.

c. Wall bracket light fixture.

(1) Kitchen, bathroom, etc.
(2) Controlled by switch.
(3) Install in ordinary switch box.

d. Light switch.

(1) Device used to control circuit.
(2) Single switch used to control light from one point.
(3) 3-way switch is used to control circuit from two points as for stairways and hallways.

e. Light fixture.

(1) Comes wired.
(2) Connect circuit wires to fixture wires.

Method: Class discussion, demonstration, and practice wiring with supervision of local electrician.

Problem: Repairing electric wiring.

Reference: Rural Electrification, J. P. Schaenzer.

Objective: To develop ability of students to make simple repairs on electric wiring systems.

Introduction: There are very few repairs which will need to be made after the wiring is first installed. These repairs are usually made by the owner.

Pivotal Points:

A. Simple splices.

1. Removing insulation from wires.

a. Use knife and cut toward wire end at a 30 degree ang.e

b. Remove insulation.

2. End splice.

3. Rattail splice.

4. Tap or center splice.

B. Insulating the splices.

1. Soldering.

2. Rubber tape.

3. Friction tape.

4. Solderless connectors.

C. Making an eye on the end of a wire.

D. Using lugs for fastening wire.

E. Replacing plugs on cords.

Method: Class discussion, demonstration, and practice wiring under supervision of local electrician.

Problem: Filtering and treating water.

Reference: Water Systems for the Farm Home, Okla. Ext. Service, Cir. 473, Okla. State Univ.

Objective: To make students aware of the importance of pure water and to enable them to purify their water supply.

Introduction: Unsafe water is a hazzard to good health. Water is a common carrier of diseases such as typhoid fever and dysentery. It is very important to make the water supply safe from possible contamination.

Pivotal Points:

A. Wells.

1. Location.

a. All wells and cisterns should be located at least fifty feet (preferably 100 feet) away from any source of pollution such as privies, cesspools, septic tanks, hog pens, poultry houses, and barn lots.

b. Wells and cisterns should also have good surface drainage and be on higher ground than any source of pollution.

2. Construction:

a. Construct a water-tight well platform--preferably concrete.

b. Construct a water-tight casing or curbing to a point at least ten feet below the surface of the ground, preferably to the water-tight strata.

c. A drilled well should be cased with wrought iron or steel well casing, or with other water-tight casing that is equally durably.

d. Dug wells:

(1) Remove old casing material to depth of ten feet.
(2) Widen hole six feet all of the way around.
(3) Replace casing material, mortaring each joint.

(4) Pour concrete in space around casing.
(5) Make sloping concrete platform.
(6) If a manhole is left, make a tight-fitting top.

e. All wells should have approved sanitary seals where the water pipe connects to the well casing or platform.

3. Treating new wells--all new wells should be treated just before sealing and after sealing.

a. When the system of piping is completed, pour a strong chlorine solution into the well.

b. Leave the solution in the well several hours.

c. Open all facuets until chlorine solution can be detected.

d. Close faucets and wait two hours before flushing chlorine out of the system.

e. Use this same treatment for all old wells which have been unsealed for repair.

B. Springs.

1. A concrete enclosure should extend several feet below the surface of the water-bearing stratum.

2. A concrete apron on the uphill side helps keep out surface drainage.

3. A top should fit tightly.

4. Fence the spring to keep livestock from polluting the water.

C. Cisterns need special attention. Rain water is comparatively pure, but it may contain polluted matter when it is collected from roofs.

1. Essential features.

a. Water-tight construction with smooth interior surface.

b. Close screening of inlet and overflow pipes.

c. A device for diverting the first part of a rainfall until the roof is thoroughly

washed.

d. An effective sand and gravel filtering system.

e. Cistern filter should be cleaned periodically.

f. Water should be treated after each rain with household bleach (chlorine).

2. Construction materials: brick, stone, or reinforced concrete.

a. Brick and stone should be laid with full motar joints.

b. Brick should be wet before laying.

c. Use two half inch plaster coats of 1:3 cement motar on the inside of brick or stone construction. This will aid in waterproofing.

d. Concrete or masonry cisterns should be allowed to cure for about thirty days before using.

3. Filters.

a. Cistern filters are designed to remove foreign matter which is washed from the collecting surfaces.

b. Filters cannot be expected to remove bacterial contamination as they must operate at high rates during heavy rains. Therefore, water should be treated after every rain, or at least once a month, if it is used for drinking purposes.

c. Size of filter depends on the size of the collecting surfaces and the intensity of rainfall.

(1) 1.25 square feet of filtering area per hundred square feet of roof surface is required for a two inch rainfall in 24 hours.
(2) A 24 by 30 foot roof area would require a filter that is three foot square.

Method: Classroom discussion.

VITA

Hoyt S. Morgan

Candidate for the Degree of

Master of Science

Report: A FOUR YEAR PLAN FOR TEACHING FARM MECHANICS TO YOUNG FARMERS IN THE FORT LARAMIE, WYOMING, VOCATIONAL AGRICULTURE DEPARTMENT

Major Field: Agricultural Education

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Personal data: Born in Waco, Texas, December 10, 1932, the son of Thomas C. and Myrtle Faye Morgan.

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THESIS TITLE: A FOUR YEAR PLAN FOR TEACHING FARM MECHANICS TO YOUNG FARMERS IN THE FORT LARAMIE, WYOMING, VOCATIONAL AGRICULTURE DEPARTMENT

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Title of Study: A FOUR YEAR PLAN FOR TEACHING FARM MECHANICS TO YOUNG FARMERS IN THE FORT LARAMIE, WYOMING, VOCATIONAL AGRICULTURE DEPARTMENT

Pages in Study: 117

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Scope and Method of Study: The ten young farmers who were enrolled in the Fort Laramie High School Vocational Agriculture Young Farmer Class during 1956-1957 were asked to respond to a prepared questionnaire. Questions were asked concerning (1) the size and type of farming operations, (2) the age, experience, and background of the farmers, (3) the kinds and types of farm machinery used, and (4) the areas in farm mechanics in which instruction was desired.

Findings and Conclusions: A tabulation and analysis of the information obtained from the selected young farmers indicated they were definitely interested in attending organized classes in which problems relating to farm mechanics were considered. Considerable interest was expressed in the areas of (1) farm power and machinery, (2) farm electrification, (3) farm shop, and (4) farm buildings and conveniences. A four year plan for teaching farm mechanics was developed and teaching guides were prepared to be used during 1957-1958.

ADVISER'S APPROVAL_____