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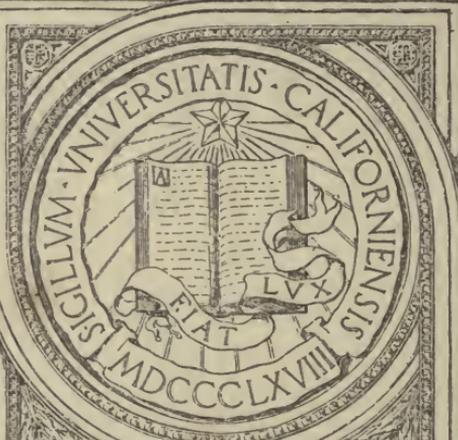
SPECIAL BULLETIN No. 1

THE PENNSYLVANIA STATE COLLEGE
SCHOOL OF AGRICULTURE
RURAL LIFE DEPARTMENT

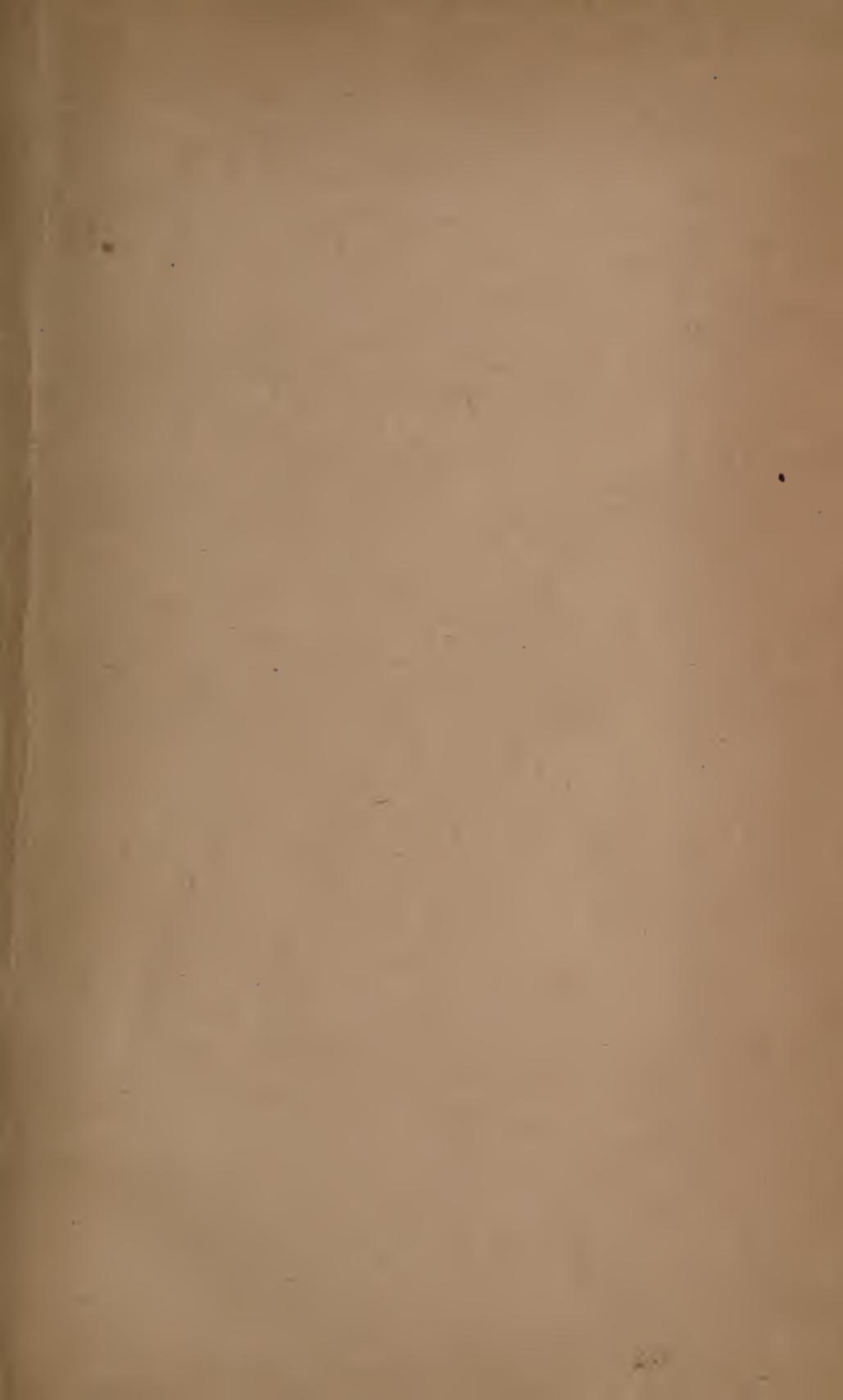
FARM SHOP WORK
IN PENNSYLVANIA

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FARM SHOP WORK IN PENNSYLVANIA

A study of repair and construction work as carried on by farmers, and as practiced in the vocational agricultural schools of Pennsylvania.

By

F. THEODORE STRUCK

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THE PENNSYLVANIA STATE COLLEGE

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FOREWORD

With the growth of vocational agriculture in the secondary schools there has developed, especially within the last few years, a widespread interest in the problem of the farm shop. State supervisors of agriculture, and men in charge of teacher training work in agricultural education are zealous in giving impetus to the movement. It is recognized, in the first place, that there are a multiplicity of aims or purposes in the minds of teachers giving this work. What teachers of farm shop work need most to do at this time is to analyze the subject matter used into its significant elements. This analysis should be made on the basis of relevance to the promotion of a better and more productive agriculture. We ought to know in terms of the region we serve, what kinds of work are most frequently performed, and distinction needs to be made between construction work on the one hand as distinguished from repair work on the other.

The following study was made by Professor F. Theodore Struck, and submitted in partial fulfillment of the requirements for the Ph.D. degree at Columbia University. It represents results obtained in large part through a survey made through the pupils pursuing vocational agriculture in every community of the State of Pennsylvania in which vocational agricultural education was given. The object of these local surveys was to find out the exact nature and extent of the kinds of agriculture carried on, and to see what specific kinds of repair and construction work are performed by the successful farmers of these regions. This was desired in order that there might be available a fact basis for determining essential and significant elements that need to be covered in teaching farm shop work.

It is felt that this study is of considerable value to teachers and supervisors of farm shop work in Pennsylvania. The Department of Rural Life of The Pennsylvania State College is publishing it with the hope that it may prove of interest and value to teachers of farm shop work, to those concerned with the training of agricultural teachers, and to supervisors and administrators of agricultural education in the several states.

W. S. TAYLOR

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PREFACE

Grateful acknowledgement is due the teachers and principals in the schools of Pennsylvania giving work in vocational agriculture, for their cooperation and assistance in making this study possible. Thanks are due my associates at The Pennsylvania State College, and to Mr. L. H. Dennis, with whom many points were discussed. Deepest appreciation is felt for the encouragement and helpful criticism received from Professor Bonser, Professor Dean, and Professor Snedden, of Teachers College, Columbia University, and from Professor W. S. Taylor, of The Pennsylvania State College.

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PART I.

GENERAL INTRODUCTION

Organization of Vocational Agricultural Education in Pennsylvania.—Public vocational agricultural education in Pennsylvania is organized somewhat differently from the way it is in other states of the Union. In 1913 Mr. L. H. Dennis, State Director of Vocational Education, visited the various kinds of schools in the states that led in agricultural education. As a result of his study he organized the "Rural Community Vocational Schools" of Pennsylvania. These schools differ from the County High Schools of Massachusetts and Wisconsin, and from the Congressional District Schools of Alabama and Georgia in that the rural community vocational school is established where it may serve a rural community rather than have its sphere defined by arbitrary geographical lines.

Since the rural community vocational schools were designed especially to meet the needs of farm boys and girls it was decided that the underlying purpose of the instruction offered should be to prepare for a more productive agriculture and happier rural living. The schools are of high school grade, although boys and girls over 14 years of age may pursue vocational agriculture or vocational home-making without having completed the eighth grade. These vocational courses are required of all pupils for the first two years. After that they may continue the vocational work for two more years, or may elect college preparatory work. In the vocational courses half of the time is spent in vocational work and half in general education and in related subjects.

Vocational agricultural education is also given in Pennsylvania in high school departments of agriculture as is the case in New York and other states. In Pennsylvania there is little difference in the quality and character of the agricultural education given in the rural community vocational schools and in agricultural departments in general high schools. In the latter schools the work, however, is optional to boys. Agricultural education in both kinds of schools is organized under the Federal Vocational Education Act of 1917, as administered by the Federal Board for Vocational Education

acting through the State Board for Vocational Education. The schools meet the requirements of the Act, and receive state and federal aid. This makes it possible to give to rural children the kind and quality of education that is adapted to the needs of rural life.

The Federal Vocational Education Act, through the standards that it sets up, and by means of the supervision that it provides is greatly improving the quality and character of secondary agricultural education.

Certain Preliminary Assumptions Regarding Needs for Vocational Education.—Modern educational theory postulates that there be tangible relationships between school work and the future activities of pupils. Vocational education is a means to that end. It is recognized as essential to economic production, and as an effective means of insuring against an unskilled and uneducated proletariat which menaces our social and political institutions.

Vocational agricultural education is the birthright of every American boy who wishes to become a farmer.

A STUDY OF FARM SHOP WORK IN PENNSYLVANIA

CHAPTER I.

Reason for the Study.—Far-reaching changes have taken place within the last two decades in the methods employed, and in tools and machinery used in agriculture. The wide introduction of power driven machinery, of factory and shop made “parts”, such as drop forgings, pipe fittings, hardware and plumbers’ supplies, have resulted in much change in the nature of farm shop work, so that there is need for determining the validity of certain practices dominant in the past, in order to determine whether or not they should be included in modern programs for vocational agricultural education.

It is commonly accepted by leaders of vocational education that it is most essential to teach those phases, or elements of given vocations that have proved to be of demonstrable value (including social and civic values), to the adult, successful followers of the vocations and to society at large. With this thought in mind this study seeks to establish certain facts pertinent to a restricted field of vocational agricultural education—namely to farm shop work.

The study is undertaken at the joint request of the Agricultural Division of the State Bureau of Vocational Education, Harrisburg, and the Department of Rural Life of The Pennsylvania State College.

Definition of Farm Shop Work.—The term “farm shop work” is taken to mean repair and construction work in various materials of construction performed by farmers in pursuit of their vocation. The work is done with the aid of hand tools and appliances, as distinguished from machinery. Some of this work is performed in sheds or repair shops during inclement weather, or at slack seasons when work with crops or animals is not urgent; the remainder of it is performed anywhere on the farm where the need arises.

Definition of the Problem.—Education in farm shop work in Pennsylvania, as in other of our states, is passing through a stage of transition. The little school training received by the teachers who pioneered in the work was usually received in manual training

classes, with the result that the exercise method, conventional manual training equipment, and related methods and ideals were largely carried over into the new field. In order to enable a possible closer correlation and adaptation between farm shop work as practiced by successful farmers and education in farm shop work as given in the vocational agricultural schools and departments already mentioned, this study has been undertaken.

In Part I, the attempt has been made to find out:

1. What kinds of construction work do farmers perform in wood, concrete and in iron and steel?
2. What kinds of repair work do farmers perform in the same materials?
3. What kinds of construction work in the materials mentioned do farmers leave to expert mechanics such as carpenters, concrete workers and blacksmiths.
4. What kinds of repair work in the same materials do farmers leave to expert mechanics?

Part II consists of a presentation of conditions as they exist in the schools with which this study is concerned. It covers a study of the teaching force and a discussion, based on the facts found in the study, and on personal observation, and interviews of various phases of farm shop work as a part of a vocational agricultural education program.

Scope of the Problem.—The data for Part I of the study were secured from 400 farmers who are distributed in thirty of the thirty-three communities of the state in which rural community vocational schools, and vocational agricultural departments in high schools, were in operation during the school year of 1918-1919. Figure 1 shows the location of these schools, that twenty-three are rural community vocational schools, and that the remaining ten are agricultural departments in high schools. The communities not included in Part I of the study are at Waynesburg, Blain and Newtown Square. Data were not secured here because of illness of the agricultural teachers.

Facts presented in the second part of the study were obtained from:

- a. The thirty-three supervisors of agriculture. These supervisors are the teachers of agriculture, being so

called because they supervise the home project work which every pupil is required to carry. Detailed information about the supervisors is given later.

- b. A second source of information was that of personal observation and discussion at the schools, supplemented in many cases by special conferences and by correspondence.

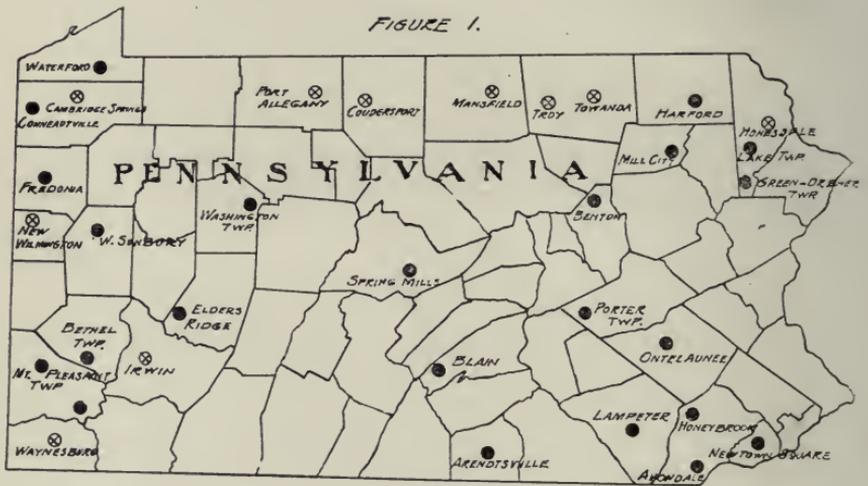
Method of Gathering Data.—It was deemed advisable to secure the data desired from the farmers through the pupils in the schools concerned. In order to accomplish this, personal visits were made to all of the schools. These visits were made in the course of two months, at the rate of 4 or 5 schools per week. In two cases slightly less than half a day was spent in the schools; in two other cases two days were spent in the schools; in the remainder the time spent varied from a half to a whole day. Owing to the topography of the state, and to distances traveled, it was not feasible to visit more than five schools per week. During the visits, printed questionnaires were distributed among the pupils, and were then carefully explained to both teachers and pupils. Pupils were asked, provided they lived on farms, to take the questionnaires to their fathers or to friends in case the latter were farmers. The pupils were furthermore asked to explain the questionnaires to whoever was to fill them out and to render assistance where it seemed advisable in the mechanics of scoring the questionnaires. Upon being filled out, the latter were in all cases first returned to the respective schools, in order that they serve as a basis for discussion, and for action in connection with the educational work affected. Later the questionnaires were sent to the writer.

In order to find out more about farming conditions than could be revealed through the question blanks sent out through the pupils, and by visiting the schools, personal visits were made to a number of farms selected at random. In addition, the supervisors of agriculture were asked to give their ratings and classifications of the farms studied through the pupils.

The Farms Studied a Selected Group.—Figure 1 shows that as regards location, the communities selected for study form, for practical purposes, a random distribution. On the other hand an effort was made to secure returns from the "fair" and "good" farms

of the respective communities rather than from the "poor" ones, as the prevailing practice on poor or unsuccessful farms has little bearing on the question of what kind of work the schools should prepare for.

Table 1 shows that almost 94 per cent of the farms come within the classifications of "good" and "fair". In arriving at the classifications, the supervisors were advised to use reasonable standards of



VOCATIONAL AGRICULTURAL SCHOOLS AND DEPARTMENTS 1918-1919



LEGEND: ● RURAL COMMUNITY VOCATIONAL SCHOOLS.
⊗ AGRICULTURAL DEPARTMENTS IN HIGH SCHOOLS.

judgment. The financial success of the farmer was taken to be the best single criterion in arriving at these judgments, though general appearance, up-keep of the farm and the character and extent of home conveniences were not overlooked. In view of the fact that the supervisors of agriculture have had unusual experience and education in the field of agriculture, and since each man rated only the farms in the community in which he lives and works, it is felt that the classification is as reliable as are individual expert judgments in that particular thing.

Method of Treatment.—The information secured from the farmers was grouped in three distinct ways:

1. In view of the fact that over 70 per cent of the farming in the state is of the general farming type, it was thought advisable to group all of the data secured in the first classification, namely on the basis of all farms studied. It is believed that the facts brought out in this classification closely fit conditions in the entire state. It may be argued that poultry raising is quite different from dairying, but the former, as a distinct type of agriculture, is found on only half of one per cent of the farms.
2. The data secured was next grouped on the basis of the ages of the farmers giving the information in order to show a possible relationship between age and the kind or variety of repair and construction work performed.
3. The information was grouped according to the type of farming pursued, in order to see if this has a material influence on the kind or variety of repair and construction work undertaken by farmers.

Classification.—In presenting the data secured from the farmers, the following distinctions have been made:

1. Construction work in a given material is taken to mean "making" work. It also includes repair work when performed on the objects originally constructed by farmers as it is assumed, that with a possible few exceptions, more skill is required to make an object than to repair it.
2. Repair work includes only the repair work done on objects not made by farmers. It will be kept in mind that the actual amount of repair work done is greater than shown in this classification as explained in the preceding paragraph.
3. Work done by expert mechanics is that work which farmers leave to men who follow vocations such as that of carpenter, concrete worker and blacksmith.

Size of Farms.—Information about the size of farms becomes significant especially when considered in connection with the type

of agriculture pursued. A truck farm or an apple orchard of forty acres may require more labor and yield a larger income than a

Figure 2.
 SIZE OF FARMS IN PENNSYLVANIA
 By Size Groups

Legend:

Areas bounded by continuous lines represent 365 Pennsylvania farms studied. (Median: 87.8 acres).

Areas bounded by dash lines represent 219,295 Pennsylvania farms reported in 1910 census. (Median: 73.8 acres).

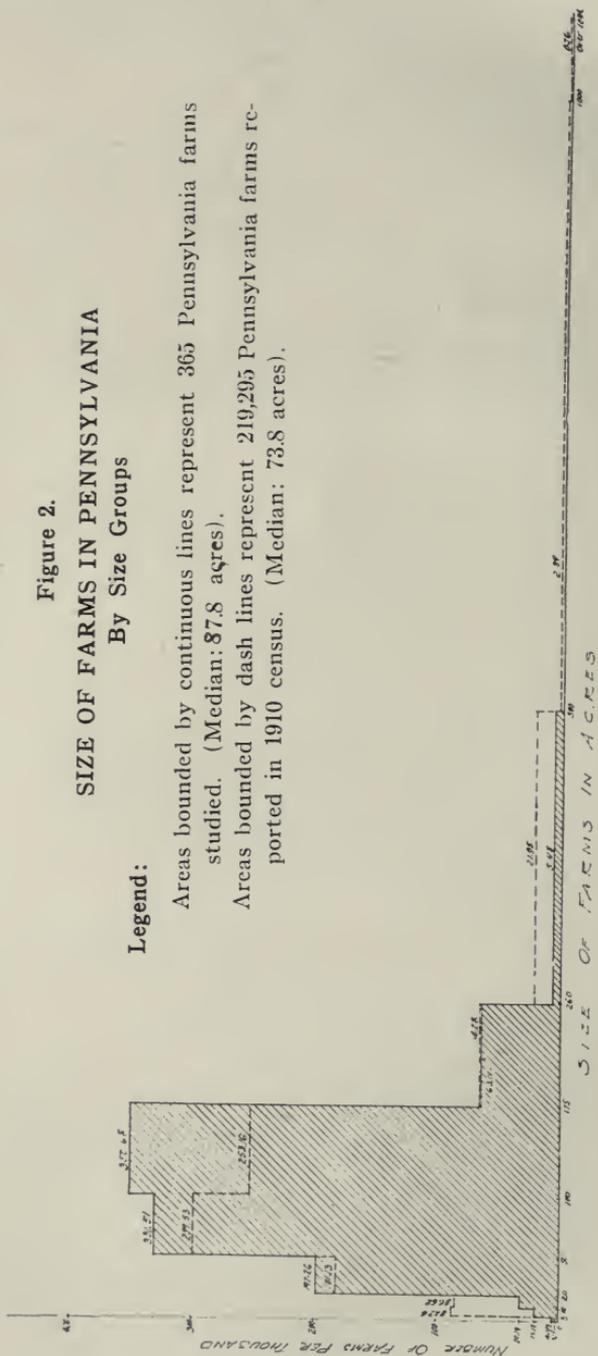


Table 1

Showing how the Supervisors of Agriculture rate 369 out of the 400 farms studied.

Rating	Number of farms	Per cent
Good	196	53.1
Fair	150	40.7
Poor	23	6.2

Table 2

SIZE OF FARMS IN PENNSYLVANIA

A. Farms Investigated				B. Farms reported in U. S. Census	
Acres	Mid Value	Frequency	Per 1000	Frequency	Per 1000
Less than					
3	1.5	1	2.74	972	4.43
3-9	6.5	7	19.18	19130	87.24
10-19	15	11	30.14	18556	84.62
20-49	35	72	197.26	39721	181.13
50-99	75	121	331.51	65687	199.53
100-174	137.5	128	350.68	55518	253.16
175-259	217.5	23	63.01	14096	64.28
260-499	330	2	5.48	4816	21.95
500-999	750			632	2.89
1,000 or over				167	.76
Total		365		219,295	
Median		87.8 Acres		Median	73.8 Acres

wheat ranch of ten times that area. Table 2 shows that most of the farms studied range in size between 50 and 175 acres, and that the median size is 87.8 acres. The same table also shows how these farms compare in size with all of the farms of the state as reported in the U. S. Census Report of 1910. It will be noted that there are proportionately less very small farms, and fewer very large farms in the group studied than exist in the state at large. In other words, the group selected is more central in its tendency as regards size, than the group embracing all of the farms of the state. Figure 2 shows the same facts graphically. The object in presenting the facts regarding the size of the farms is that it may favor accurate description in this report of the farms studied.

Type of Agriculture.—The major part 70.1 per cent to be exact—of the agriculture on the farms considered is general in type. The term “general” means that the income is derived from growing the usual animals and field crops of the region. By referring to

Figure 1 it will be noticed that the central and south central parts of the state do not possess many vocational agricultural schools. The farming in these sections is very probably more general there than in the rest of the state owing to soil, topography, climate and distance to large markets. Professor Warren* says that "if we except the cotton farms, probably over 95 per cent of the United

Table 3

Showing how the Supervisors of Agriculture classified 365 of the 400 farms studied, as to type of farming.

Classification	Number of farms	Per cent
General	256	70.1
Dairy	81	22.2
Truck	16	4.4
Fruit	9	2.5
Poultry	2	.5
Stock	1	.3

Table 4

Showing the major farm enterprises†, as reported by the Supervisors of Agriculture, on 369 of the 400 farms studied.

Enterprise	Number	Per cent.
Stock	112	30.3
No Major	77	20.9
Dairy	71	19.2
Crops	63	17.2
Truck	18	4.9
Fruit	17	4.6
Poultry	5	1.3
Flowers	1	.3
Sundry	5	1.3

States derive most of their income from a combination of crops and animals—general farming”.

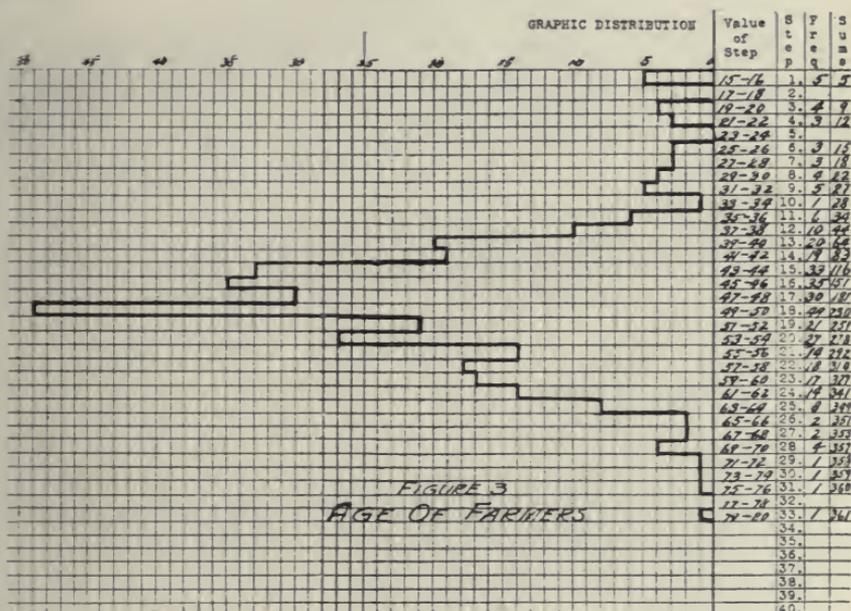
Table 3 shows that the only other type of farm largely represented, is the dairy type, whereas truck, fruit and poultry farms occur in negligible quantities. In studying these facts in relationship to agricultural education, it must be kept in mind that practically all Pennsylvania farmers keep in the neighborhood of fifty hens, produce their own milk and butter, and grow their own vegetables.

Farm Enterprises are Diversified.—As may be expected in a state in which general farming is predominant the major enterprises are diversified in nature. The facts shown in Table 4 confirm the validity of the practice obtaining in the vocational agricultural

*Warren, G. F., Farm Management, page 105.

†Those from which 40% or more of the income was derived.

schools of the state in respect to subject matter selected. The beginning is made through a study of soils in relationship to field crops. Practically all farming requires a knowledge of soils and field crops. Since the various types of farming have much in common in theory and practice, it is customary to approach this common subject matter through a study of the prevailing type of agriculture.



Age of Farmers.—It is interesting to note that the farmers who operate the more successful farms (classified as "good" and "fair") are not youthful as a class. Figure 3 shows that half of them are between 44 and 53 years of age. This, in connection with facts later presented in Table 21 bear out the wide spread belief that agriculture is one of the broadest of vocations due to the large number of elements it has in common with life. The latter table shows that the older farmers do about twice as many kinds of repair and construction work as the younger farmers. This is no doubt due in part to the fact that certain pieces of work, such as repairing or building a hog house, or a watering trough, is performed only occasionally, and so two or even five years of farm experience will not give opportunity to do all kinds of work incidental to farming.

It may be argued that the younger farmers hire more of their

repair and construction work done than do the older men, but this conclusion is not in harmony with the facts shown in Figure 4. The facts found point out that agriculture is a dynamic and energizing vocation that affords much opportunity for individual growth and development.

CHAPTER II.

Group I

Explanations.—The reasons for grouping the data secured from farmers in three classifications have already been given. In order to make the results found in Group I comparable with the others, values have been reduced to a percentage basis.

No time limit such as "during the last year" was indicated. In all cases, in this and in the other groups, the tables represent work performed at any time in the vocational life of the individuals concerned.

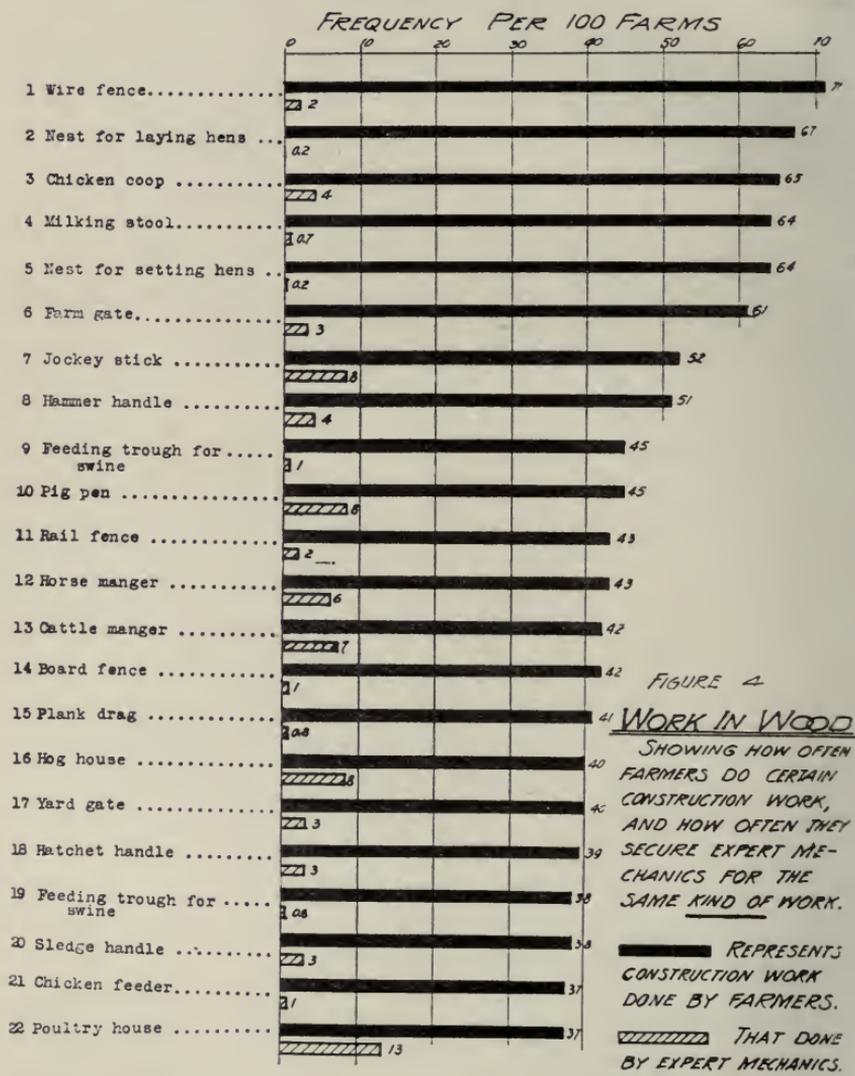
It may be observed that Group I deals with 400 cases, whereas Table 2, giving the size of farms contains 365, and Figure 3, showing the age of the farmers who supplied the information, deals with but 361 cases. This is due to the fact that not all farmers would give their age and that the size of the farms was not, in all cases, known to the supervisors of agriculture who supplied this particular information.

Construction Work in Wood.—The first table in Group I (Table 5), shows how many farmers per thousand have done certain kinds of construction work in wood. The list is quite different from the kind of work often advocated as a preparation for repair and construction work on farms. Near the top of the list are many kinds of work that the large majority of teachers of farm shop work never attempted to teach. This may be due in a large measure to the following reasons:

1. Traditional manual training ideals have influenced shop work in agriculture.
2. Text and reference books reflect the same tendencies to a greater or less degree.
3. Teachers have thought too much in terms of work that can be performed entirely within the school plant.

Table 5 shows the actual, as well as the relative number of times that certain construction work is done. If we compare with it, the kinds of work usually described in text books, we find considerable discrepancy, particularly in the relative order of import-

ance. For instance, thirteen farmers out of one hundred have made a bench hook—very commonly advocated, and seventy-one farmers per hundred built wire fence—a piece of work not common-



ly undertaken by schools. Many similar instances are apparent in the table.

A conclusion that must be drawn is that farm shop work should not be limited to the kinds of work that can be done within the school house, with materials and tools there available.

Table 5

Showing kinds of construction work in wood performed by farmers on 400 Pennsylvania farms. When the same object was both constructed and repaired by a farmer it was listed as construction work.

Job	Frequency per 400 farms	Frequency per 1000 farms
1. Wire fence	234	710.
2. Nest for laying hens	269	672.5
3. Chicken coop	253	645.
4. Milking stool	257	642.5
5. Nest for setting hens	256	640.
6. Farm gate	245	612.5
7. Jockey stick	207	517.5
8. Hammer handle	205	512.5
9. Feeding trough for chicks	181	452.5
10. Pig pen	178	445.
11. Rail fence	173	432.5
12. Horse manger	172	430.
13. Cattle manger	170	425.
14. Board fence	167	417.5
15. Plank drag	164	410.
16. Hog house	160	400.
17. Yard gate	153	395.
18. Hatchet handle	155	387.5
19. Feeding trough for swine	152	380.
20. Sledge handle	151	377.5
21. Chicken feeder	147	367.5
22. Poultry house	146	365.
23. File handle	139	347.5
24. Pick handle	133	345.
25. Saw horse	133	345.
26. Bins for grain	133	332.5
27. Mortar box	131	327.5
28. Hay rack	123	320.
29. Fruit ladder	123	320.
30. Evener	124	310.
31. Hand sled	123	307.5
32. Horse drawn sled	119	297.5
33. Tool box	117	292.5
34. Watering trough	116	290.
35. Trellis for grapes	116	290.
36. Saw buck	115	287.5
37. Wagon box	115	287.5
38. Wood picket fence	108	270.
39. Bird house	103	257.5
40. Corn crib	102	255.
41. Wagon jack	99	247.5
42. Window screen	99	247.5
43. Privy	92	230.
44. Wagon seat	92	230.
45. Smoke house	91	227.5
46. Flight of steps	91	227.5
47. Dog house	90	225.
48. Garden marker	89	222.5
49. Ironing board	88	220.
50. Crating	87	217.5
51. Well covering	87	217.5

Table 5 (Continued)

Job	Frequency per 400 farms	Frequency per 1000 farms
52. Feeding trough for stock	84	210.
53. Land leveler	84	210.
54. House ladder	80	200.
55. Wheelbarrow	79	197.5
56. Potato marker	78	195.
57. Trellis for tomatoes	78	195.
58. Seed corn testing tray	76	190.
59. Brush and currycomb cabinet	73	182.5
60. Trellis for small vines	73	182.5
61. Implement shed	72	180.
62. Rabbit trap	72	180.
63. Nail cabinet	71	177.5
64. Wood shed	70	175.
65. Door screen	69	172.5
66. Road drag	68	170.
67. Vise handle	67	167.5
68. Feeding trough for sheep	63	157.5
69. Rabbit coop	62	155.
70. Step ladder	62	155.
71. Batten door	61	152.5
72. Roughage feed rack for cattle	60	150.
73. Miter box	59	147.5
74. Bread board	57	142.5
75. Ice house	55	137.5
76. Wagon shed	53	132.5
77. Planting stick	52	130.
78. Bench hook	51	127.5
79. Chicken brooder	45	112.5
80. Grain bed	43	107.5
81. Beehive	42	105.
82. Kitchen stool	41	102.5
83. Roughage feed rack for swine	40	100.
84. Kitchen sink	37	92.5
85. Pigeon house	37	92.5
86. Seed corn curing frame	37	92.5
87. Tool carrier	37	92.5
88. Saw clamp	35	87.5
89. Sack holder	31	77.5
90. Lawn or porch seat	30	75.
91. Windlass	30	75.
92. Fly trap	29	72.5
93. Chicken crate	27	67.5
94. Ensilage rack	27	67.5
95. Kitchen table	27	67.5
96. Wagon top	27	67.5
97. Lumber rack	26	65.
98. Clothes rack	26	65.
99. Oats sprouter	26	65.
100. Porch chair	25	62.5
101. Egg tester	23	57.5
102. Combination barn	22	55.
103. Hive seat	22	55.
104. Dairy barn	20	50.
105. Horse barn	20	50.
106. Kitchen cabinet	17	42.5

Table 5 (Continued)

Job	Frequency per 400 farms	Frequency per 1000 farms
107. Seed corn tree	17	42.5
108. Sewing horse	17	42.5
109. Clothes line reel	16	40.
110. Seed corn shed	15	37.5
111. Trap nest	15	37.5
112. Kitchen bin	14	35.
113. Milk record sheet case	13	32.5
114. Sheep barn	11	27.5
115. Screw cabinet	10	25.
116. Unloading chute for cattle	10	25.
117. Cabinet for seeds	8	20.
118. Fireless cooker	7	17.5
119. Weight carrier	3	7.5

It is likewise evident from the very character of the work represented that it is highly important that both pupil and teacher receive their inspiration as to what to do from conditions found on the boy's home farm. The teacher will need to be tactful and wise in guiding his pupils' thoughts so that the latter will purpose to do the kind of work that is of educational value, within his capacity and related to the technical agriculture being studied at the time.

The Table shows that fireless cookers have been made by about two per cent of the farmers. It makes a difference whether an object such as this is comparatively new and unknown, or whether it is like the flail, old and less and less in demand as time goes on; but this much may be said: the school ought first to teach how to construct or repair such objects as have demonstrable value today in the vocation of farming. Less than one per cent of the farmers made a weight carrier. Perhaps they prefer to get rid of stones by hitching their teams to stone-boats.

Figure 4 shows graphically to what extent farmers do certain kinds of construction work in wood, and to what extent they leave such work to carpenters or other expert mechanics. The graph shows conclusively that farmers do almost all of such work themselves, leaving little for expert mechanics to do. No doubt the latter can do much of this work faster and better than can farmers, but there are several factors that counterbalance this:

1. Mechanics expect to be paid for time and cost of traveling to and from an out-of-town job. For small jobs, this is especially uneconomical.

2. When mechanics are brought to the farm, they must be fed, and sometimes lodged—often an added burden to the farmer's busy wife.
3. It is frequently impossible for farmers to secure the service of good mechanics. The latter do not, as a rule, like to go out-of-town for work lasting only a few hours, and the majority likewise object to being away from home at night. As good roads become more frequent, this objection will have decreasing weight.
4. The farmer can do much repair and construction work at times when crops and animals do not need his attention, or when the weather is unfavorable for other work.

The educational value of Figure 4 lies primarily in the fact that it shows how many farmers per hundred do the kinds of work described, and how that compares proportionately with similar work left to carpenters or other mechanics.

Table 6

Showing kinds of repair work in wood occurring 50 or more times per 1000 farms, as found on 400 Pennsylvania farms.

Job	Frequency per 400 farms	Frequency per 1000 farms
1. Door screen	94	235.
2. Wheelbarrow	93	232.5
3. Rail fence	74	185.
4. Window screen	74	185.
5. Horse manger	73	182.5
6. Cattle manger	73	182.5
7. Bins for grain	69	172.5
8. Wire fence	68	170.
9. Wagon box	65	167.5
10. Horse barn	64	160.
11. Combination barn	60	150.
12. Hog house	59	147.5
13. Dairy barn	54	135.
14. Board fence	53	132.5
15. Farm gate	52	130.
16. Corn crib	51	127.5
17. Pig pen	46	115.
18. Poultry house	45	112.5
19. Horse drawn sled	45	112.5
20. Fruit ladder	44	110.
21. Wagon bed	44	110.
22. Hay rack	43	107.5
23. Wood picket fence	40	100.
24. Yard gate	40	100.

Table 6 (Continued)

Job	Frequency per 400 farms	Frequency per 1000 farms
25. Wagon seat	39	97.5
26. Privy	38	95.
27. Chicken coop	37	92.5
28. Step ladder	37	92.5
29. Nest for laying hens	36	90.
30. Batten door	34	85.
31. Hammer handle	34	85.
32. Pick handle	34	85.
33. Implement shed	34	85.
34. Kitchen table	33	82.5
35. Nest for setting hens	33	82.5
36. Hatchet handle	31	77.5
37. Smoke house	31	77.5
38. Oats sprouter	30	75.
39. Jockey stick	30	75.
40. Kitchen sink	30	75.
41. Sledge handle	30	75.
42. Wood shed	29	72.5
43. Milking stool	28	70.
44. Watering trough	28	70.
45. Flight of steps	27	67.5
46. Wagon top	27	67.5
47. Hand sled	26	65.
48. Chicken crate	25	62.5
49. File handle	24	60.
50. Well covering	22	55.
51. Ice house	21	52.5
52. Potato marker	21	52.5
53. House ladder	20	50.
54. Land leveler	20	50.
55. Mortar box	20	50.

The above table covers 58 out of 122 jobs reported on. Those not listed occur less than 50 times per 1000 farms. The table covers only such repair work as was performed on objects not originally built by the farmers. Repair work on objects built by farmers is included in Table 5.

The graph shows, furthermore, the necessity of teaching certain things that are not at present a part of the school program. Just what these things are, varies from school to school.

Repair Work in Wood.—In interpreting Table 6 it must be kept in mind that the table covers only such repair work as was performed on objects not originally built by farmers. This accounts for the lower frequency shown for repair work as compared with construction work in the same material. As the results stand, they argue in favor of teaching considerable construction work—as much as is practicable considering that repair and construction work must always be regarded as a minor in agriculture. If, on the other hand, the relative frequency of repair work as such, were

greater than that of construction work, then it would mean that farm boys ought to be taught to repair work as distinguished from constructing the same.

Construction Work in Wood Done for Farmers by Expert Mechanics.—As might be expected, barns, poultry houses and cabinet work are largely found at the top of the list given in Table 7. That certain work rather generally done by farmers is also found in this table, is probably due to the fact that there are always some farmers who, because of lack of experience or for other reasons, hire such work done.

Table 7

Construction work done in wood for farmers by expert mechanics who follow such work as a vocation, as found on 400 Pennsylvania farms.

Job	Frequency per 400 farms	Frequency per 1000 farms
1. Combination barn	77	192.5
2. Kitchen sink	61	152.5
3. Poultry house	53	132.5
4. Dairy barn	49	122.5
5. Horse barn	39	97.5
6. Kitchen cabinet	36	90.
7. Door screen	35	87.5
8. Kitchen table	35	87.5
9. Privy	34	85.
10. Hog house	33	82.5
11. Implement shed	32	80.
12. Jockey stick	32	80.
13. Pig pen	30	75.
14. Window screen	30	75.
15. Wheelbarrow	30	75.
16. Corn crib	29	72.5
17. Cattle manger	29	72.5
18. Woodshed	25	65.
19. Step ladder	25	62.5
20. Ironing board	24	60.
21. Horse manger	24	60.
22. Wagon box	23	57.5
23. Smoke house	22	55.
24. Kitchen bin	22	55.
25. Flight of steps	21	52.5
26. Wagon bed	21	52.5
27. Wagon jack	20	50.
28. Horse drawn sled	20	50.
29. Bread board	19	47.5
30. Bins for grain	19	47.5
31. Wagon top	19	47.5
32. Pick handle	18	45.
33. Sheep barn	17	42.5
34. Fruit ladder	17	42.5
35. Saw filing	17	42.5
36. Clothes rack	16	40.

Table 7 (Continued)

Job	Frequency per 400 farms	Frequency per 1000 farms
37. Wagon seat	16	40.
38. Lawn or porch seat	16	40.
39. Chicken coop	15	37.5
40. Hammer handle	15	37.5
41. Hay rack	15	37.5
42. Farm gate	13	32.5
43. House ladder	13	32.5
44. Chicken brooder	12	30.
45. Ice house	12	30.
46. Kitchen stool	12	30.
47. Sledge handle	11	27.5
48. Hatchet handle	11	27.5
49. Yard gate	11	27.5
50. Porch chair	11	27.5
51. Hand sled	11	27.5
52. Vise handle	10	25.
53. Miter box	10	25.
54. Saw buck	10	25.

The above table shows the kinds of work that were done 25 or more times in 1000 cases. It covers 54 out of 122 kinds of work reported.

Work in Cement and Concrete

Construction Work.—The Portland Cement Association and similar organizations, the extension departments of state colleges, the United States Bureau of Agriculture, farm papers and other agencies by means of literature, lantern slides, moving pictures and demonstrations, have shown farmers the possibilities of the building material—concrete—that largely aided the Romans in becoming the greatest builders of their age.

Figure 5 shows graphically to what extent farmers in Pennsylvania are using the material. Almost a third of them use it in floor work and in building foundations. The Figure also shows that out of nineteen objects or things listed only two are more frequently done by mechanics than by the farmers themselves. These are cisterns and silos. This is probably due to the circular form work involved in their construction.

Under pioneer farming conditions, there was not the same need for a permanent building material that there is today when the design of farm structures has been greatly standardized, and when the size of farms and the location of farmsteads is more stable. In considering whether or not concrete should be used in preference to some other material, one must consider initial cost along with the

cost of up-keep and permanence. The initial cost will vary largely according to the price of sand and gravel or crushed rock used as aggregate for the mixture.

Showing proportion of farmers who construct certain kinds of concrete work, and those who have the same work done by expert mechanics who follow such work as a vocation.

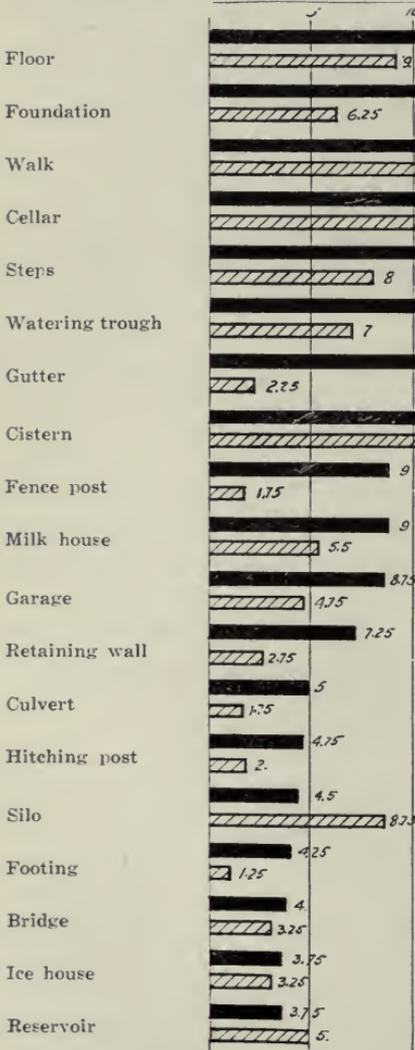


FIGURE 5
CONCRETE WORK

LEGEND.
 ■ Construction work done by farmers.
 ▨ Construction work done by expert mechanics.

Data secured from 400 Pennsylvania farms.

A conclusion of educational value to be drawn from the facts shown in Figure 5 and in Table 8, is that cement and concrete work deserves a place among the materials used in teaching farm shop

work. A material that is used by thirty-one per cent of the farmers should not be overlooked on our program for vocational agricultural education.

Table 8

Kinds of construction work in concrete occurring 37.5 or more times per 1000 farms, as found on 400 Pennsylvania farms. The work listed represents that done by farmers.

Job	Frequency per 400 farms	Frequency per 1000 farms
1. Floor	164	310.
2. Foundation	108	270.
3. Walk	88	220.
4. Cellar	68	170.
5. Steps	68	170.
6. Watering trough	54	135.
7. Gutter	47	117.5
8. Cistern	47	117.5
9. Fence post	36	90
10. Milk house	33	90
11. Garage	35	87.5
12. Retaining wall	29	72.5
13. Culvert	20	50.
14. Hitching post	19	47.5
15. Silo	18	45.
16. Footing	17	42.5
17. Bridge	16	40.
18. Ice house	15	37.5
19. Reservoir	15	37.5

The above table includes 19 cases having the greatest frequency out of 29 kinds of work reported on.

Table 9

Kinds of repair work in concrete, occurring 15 or more times per 1000 farms.

The list represents repair work done by farmers, and does not include repair work done on jobs originally constructed by farmers.

Job	Frequency per 400 farms	Frequency per 1000 farms
1. Cellar	19	47.5
2. Floor	18	45.
3. Foundation	16	40.
4. Steps	13	32.5
5. Walk	12	30.
6. Silo	12	30.
7. Cistern	10	25.
8. Fence post	10	25.
9. Gutter	8	20.
10. Hitching post	7	17.5
11. Retaining wall	7	17.5
12. Dam	7	17.5
13. Footing	6	15.
14. Watering trough	6	15.

The above table includes 14 out of 28 kinds of work reported on.

Repair Work in Concrete.—A glance at Table 9 reveals that there is little repair work done in concrete. This is no doubt largely due to the permanance of the material as well as to the fact that it is not used as frequently as is wood. For purposes of agricultural education, the field of construction work in concrete is more promising than that of repair work.

Table 10

Kinds of construction work in concrete, occurring 27.5 or more times per 1000 farms, as found on 400 Pennsylvania farms. The work done is that done by expert mechanics who follow such work as a vocation.

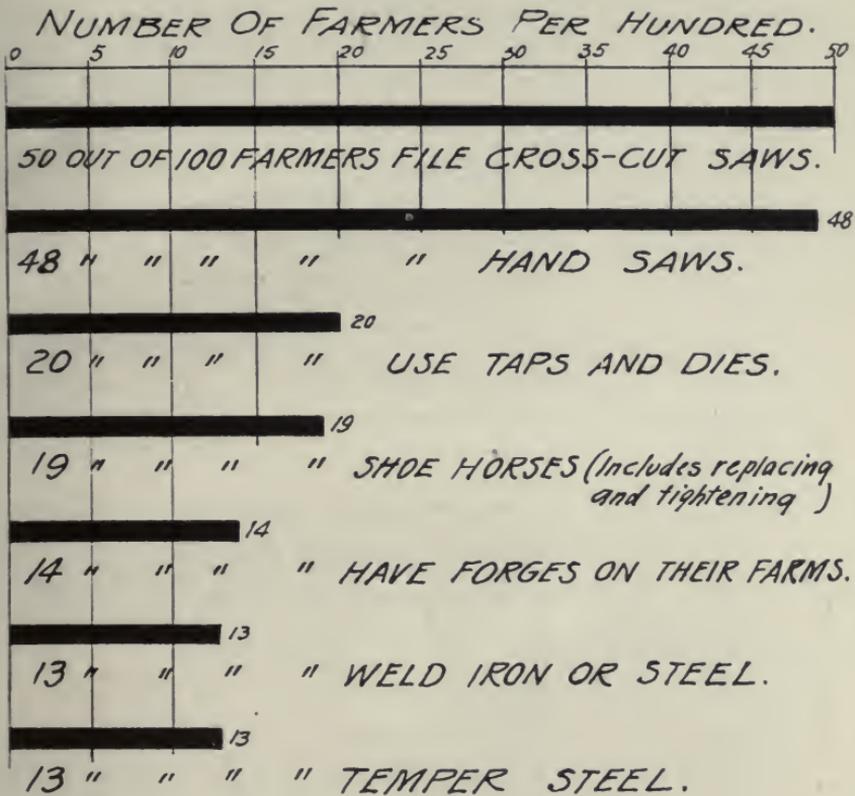
Job	Frequency per 400 farms	Frequency per 1000 farms
1. Cellar	52	130.
2. Cistern	49	122.5
3. Walk	41	102.5
4. Floor	37	92.5
5. Silo	35	87.5
7. Watering trough	28	70.
8. Foundation	25	62.5
9. Milk house	22	55.
10. Reservoir	20	50.
11. Garage	19	47.5
12. Bridge	13	32.5
13. Ice house	13	32.5
14. Retaining wall	11	27.5

The above table covers 14 out of 29 kinds of work reported on.

Work Done by Mechanics.—The kinds of work mechanics perform in concrete for farmers, (Table 10) is similar to that undertaken by the latter. The significant thing brought out is that farmers do most of such work themselves. The fact that equipment for work with cement is inexpensive is an added reason why it should not be overlooked in agricultural education.

Work in Iron and Steel

Much has been said for and against the practice of requiring agricultural students to take forge work as a part of their secondary education. In Pennsylvania, on the 400 farms studied, fourteen farmers per hundred have forges on their farms and, of that fourteen, thirteen do welding and tempering. (See Figure 6). The following diagram, Figure 7, shows how many farmers per hundred construct the twenty-one objects listed and how many repair such work, but do not make it. In the latter group, the clevis, punch, cold chisel and tongs are most prominent relatively.



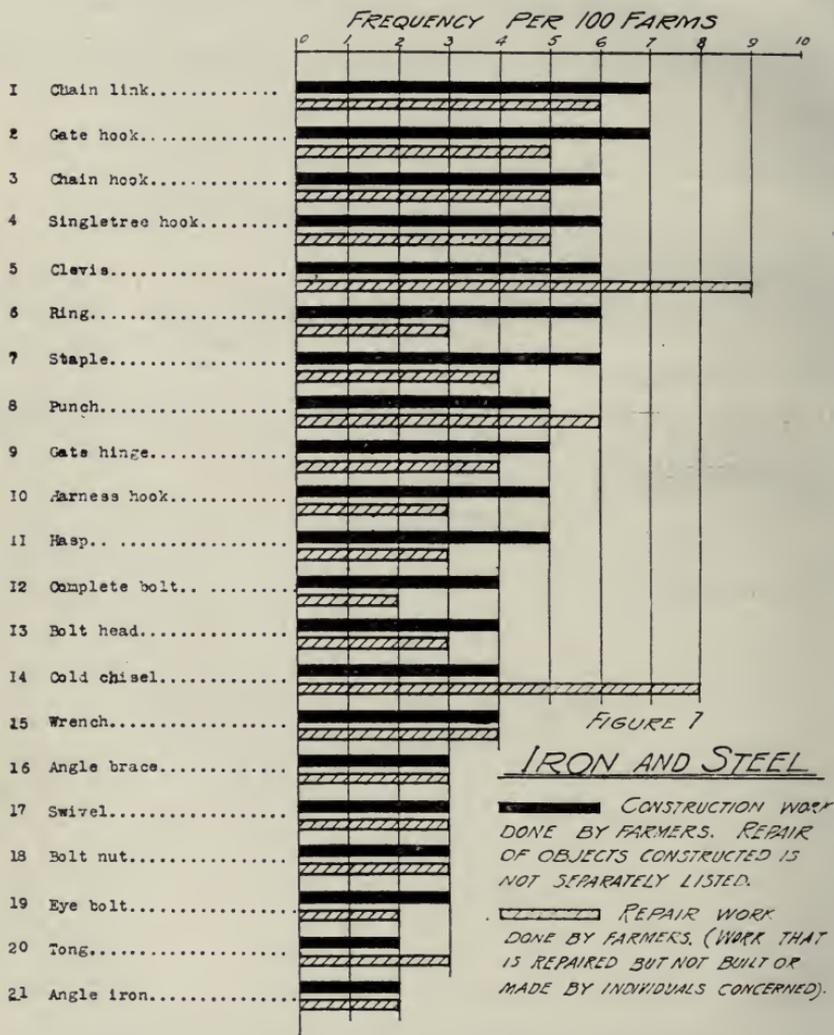
IRON AND STEEL

FIGURE 6

The following are some of the variable factors entering into the question of whether or not a farmer ought to have a forge on his farm:

1. Distance to a reliable blacksmith
 - (a) Is the latter there the year around?
 - (b) Are his charges reasonable?
2. Character of roads and available means of transportation.
3. Amount and character of work to be done.
4. Mechanical ability of the farmer.

With so many variable factors to consider, it is unwise to make positive assertions of a specific nature without a careful and detailed study and analysis of conditions obtained in given localities. It may be said in general that aside from vocational values,



experience in forge practice has considerable value from the standpoint of general education in that it makes possible first hand, intimate acquaintance with tools and materials important in providing food and shelter for the human race. The work should naturally lead to a better understanding of characteristics peculiar to iron and steel, and should give appreciation for structural design.

Table 11

Construction work in iron and steel performed by farmers on 400 Pennsylvania farms. This table includes repair work on objects that were originally constructed by farmers.

Job	Frequency per 400 farms	Frequency per 100 farms
1. Chain link	23	7
2. Gate hook	23	7
3. Chain hook	25	6
4. Singletree hook	24	6
5. Clevis	23	6
6. Ring	23	6
7. Staple	23	6
8. Punch	21	5
9. Gate hinge	19	5
10. Harness hook	18	5
11. Hasp	18	5
12. Complete bolt	16	4
13. Bolt head	15	4
14. Cold chisel	15	4
15. Wrench	14	4
16. Angle brace	13	3
17. Swivel	13	3
18. Bolt nut	12	3
19. Eye bolt	12	3
20. Tong	10	2
21. Angle iron	7	2

Table 12

Repair work in iron or steel performed by farmers on 400 Pennsylvania farms. (Objects not constructed by farmers).

Job	Frequency per 400 farms	Frequency per 100 farms
1. Clevis	37	9
2. Cold chisel	33	8
3. Chain link	22	6
4. Punch	22	6
5. Singletree hook	20	5
6. Chain hook	19	5
7. Gate hook	18	5
8. Staple	16	4
9. Gate hinge	16	4
10. Wrench	16	4
11. Harness hook	13	3
12. Hasp	13	3
13. Ring	13	3
14. Tong	13	3
15. Bolt head	12	3
16. Angle brace	11	3
17. Bolt nut	11	3
18. Plow share	11	3
19. Swivel	10	3
20. Twist drill	9	2
21. Complete bolt	8	2
22. Angle iron	7	2
23. Star drill	6	2
24. Eye bolt	6	2

Saw Filing.—By referring to Figure 6 it is seen that half of the farmers have filed cross-cut saws—meaning timber saws—and that forty-eight per hundred file their own hand saws. In view of the fact that a sharp saw will cut twice as fast as a dull one, and that less effort is required to use the former, it would seem that every farm boy ought to know how to file saws—or to “fit” saws to use the terminology of mechanics. The fifty per cent of farmers who do not file their saws probably would do so if they knew how. It is poor policy to depend upon someone else for a thing of that sort, as one may run his saw on a hidden nail, or otherwise dull it in a few minutes.

Taps and Dies.—A small set of taps and dies will often save a trip to town, or to a repair shop, for farmers. As farm machinery of the more complex sort is much more common today than it was two decades ago, it has become desirable that farmers know how to use taps and dies. Figure 6 shows that at present one in every five farmers uses them.

Shoeing Horses.—Nineteen per hundred farmers shoe horses. This figure includes replacing and tightening. Occasionally farmers who find it difficult to secure the services of good horse shoers, advocate that their sons be taught horse shoeing in the vocational agricultural school. The absurdity of the request is apparent to all who realize how much skill and strength such work requires.

CHAPTER III.

Group II

Findings When Information Secured Was Grouped According to the Age of the Farmers.—In order to see if there is a relationship between age and the kind or variety of farm shop work undertaken, the information secured was grouped according to the three principal age groups represented, namely: 35 to 44 years, 45 to 54 years, and 55 to 64 years. The other age groups are too small to lend themselves usefully to statistical treatment.

Construction Work in Wood.—When construction work performed by farmers is classified on the basis of age, the results are as shown in Tables 13, 14, and 15. In order that these results may be viewed comparatively, Table 16 has been arranged. If we call the column headed "Age 35 to 44", Column 1, the one headed "Age 45 to 54", Column 2, and the one headed "Age 55 to 65", Column 3, it will be noticed that there is not a single item in column one that is not excelled in column three, and that there are but five items in column two that are larger than the corresponding ones in the third column. Viewed as a whole, there is a steady increase in the kinds of work done from the youngest group to that of 45 to 54 years of age and again from the latter to the older group.

Table 13

Showing the number of farmers per hundred who perform certain construction work in wood. Data secured from 89 farmers, 35 to 44 years of age.

Job	Frequency per 100	Job	Frequency per 100
1. Wire fence	67	19. Rail fence	33
2. Nest for laying hens	65	20. Tool box	33
3. Chicken coop	60	21. Saw buck	31
4. Farm gate	57	22. Bins for grain	30
5. Milking stool	57	23. Evener	30
6. Nest for setting hens	54	24. Board fence	30
7. Hammer handle	47	25. Screw cabinet	30
8. Feeding trough for chicks	46	26. Wagon box	30
9. Horse manger	39	27. Plank drag	29
10. Sledge handle	39	28. Feeding trough for swine	28
11. Chicken feeder	37	29. Hay rack	27
12. Hatchet handle	36	30. Trellis for grapes	27
13. Hog house	36	31. File handle	26
14. Pig pen	35	32. Hand sled	26
15. Poultry house	34	33. Jockey stick	25
16. Yard gate	34	34. Cattle manger	25
17. Pick handle	34	35. Wagon seat	25
18. Mortar box	33		

Table 14

Showing the number of farmers per hundred who perform certain construction work in wood. Data secured from 152 farmers, 45 to 54 years of age.

Job	Frequency per 100	Job	Frequency per 100
1. Wire fence	76	24. Pick handle	37
2. Chicken coop	73	25. Horse manger	36
3. Milking stool	73	26. Fruit ladder	36
4. Nest for laying hens	73	27. Mortar box	35
5. Farm gate	67	28. Watering trough	35
6. Nest for setting hens	64	29. Chicken crate	34
7. Hammer handle	51	30. Saw buck	34
8. Rail fence	50	31. Trellis for grapes	34
9. Plank drag	50	32. Bins for grain	33
10. Board fence	48	33. Tool box	33
11. Feeding trough for chicks	47	34. Jockey stick	32
12. Yard gate	46	35. Evener	32
13. Poultry house	46	36. Corn crib	31
14. Hatchet handle	45	37. Horse drawn sled	31
15. File handle	43	38. Hand sled	30
16. Chicken feeder	41	39. Wagon box	29
17. Feeding trough for swine	41	40. Bird house	28
18. Cattle manger	40	41. Ironing board	27
19. Hog house	40	42. Wagon jack	27
20. Sledge handle	40	43. Land leveler	27
21. Hay rack	40	44. Wood picket fence	26
22. Pig pen	40	45. Smoke house	26
23. Saw horse	39	46. Garden marker	25

Table 15

Showing the number of farmers per hundred who perform certain construction work in wood. Data secured from 71 farmers, 55 to 64 years of age.

Job	Frequency per 100	Job	Frequency per 100
1. Wire fence	78	30. Flight of steps	40
2. Nest for laying hens	76	31. Wagon box	38
3. Chicken coop	73	32. Watering trough	38
4. Nest for setting hens	73	33. Window screen	37
5. Farm gate	70	34. Corn crib	35
6. Milking stool	70	35. Dog house	35
7. Hammer handle	68	36. Hay rack	35
8. Pig pen	63	37. Horse drawn sled	35
9. Hatchet handle	59	38. Tool box	35
10. Rail fence	58	39. Feeding trough for stock	35
11. Board fence	58	40. Wood picket fence	34
12. Yard gate	52	41. Smoke house	34
13. Mortar box	51	42. Bird house	32
14. Horse manger	49	43. Saw buck	32
15. Cattle manger	49	44. Ironing board	30
16. Plank drag	49	45. Wagon seat	30
17. Pick handle	48	46. Wheel barrow	30
18. File handle	48	47. Well covering	30
19. Saw horse	48	48. Wagon jack	28
20. Feeding trough for chicks	48	49. Wood shed	28
21. Bins for grain	46	50. Vise handle	27
22. Hog house	45	51. Garden marker	27
23. Sledge handle	44	52. Chicken crate	25
24. Fruit ladder	44	53. Evener	25
25. Hand sled	44	54. Implement shed	25
26. Feeding trough for swine	44	55. Jockey stick	25
27. Poultry house	42	56. Land leveler	25
28. Privy	41	57. Wagon bed	25
29. Chicken feeder	40		

Table 16

Showing the number of farmers per hundred who perform certain construction work in wood. Data secured from farmers grouped according to age.

Job	Frequency per 100		
	Age 35-44	Age 45-54	Age 55-64
1. Wire fence	67	76	78
2. Nest for laying hens	65	73	76
3. Chicken coop	60	73	73
4. Nest for setting hens	54	64	73
5. Farm gate	57	67	70
6. Milking stool	57	73	70
7. Hammer handle	47	51	68
8. Pig pen	35	40	63
9. Hatchet handle	36	45	59
10. Rail fence	33	50	58
11. Board fence	30	48	58
12. Yard gate	34	46	52
13. Mortar box	33	35	51
14. Horse manger	39	36	49
15. Cattle manger	25	40	49
16. Plank drag	29	50	49
17. Pick handle	34	37	48
18. File handle	26	43	48
19. Saw horse	27	39	48
20. Feeding trough for chicks	46	47	48
21. Bins for grain	27	33	46
22. Hog house	36	40	45
23. Sledge handle	39	40	44
24. Fruit ladder	22	36	44
25. Hand sled	32	30	44
26. Feeding trough for swine	28	41	44
27. Poultry house	34	46	42
28. Privy	19	22	41
29. Chicken feeder	37	41	40
30. Flight of steps	15	24	40
31. Wagon box	30	29	38
32. Watering trough	22	35	38
33. Window screen	24	24	37
34. Corn crib	19	31	35
35. Dog house	20	21	35
36. Hay rack	27	40	35
37. Horse drawn sled	24	31	35
38. Tool box	33	33	35
39. Feeding trough for stock	18	22	35
40. Wood picket fence	16	26	34
41. Smoke house	21	26	34
42. Bird house	22	28	32
43. Saw buck	31	34	32
44. Ironing board	19	27	30
45. Wagon seat	25	24	30
46. Wheelbarrow	15	21	30
47. Well covering	18	22	30

Table 16 (Continued)

Job	Frequency per 100		
	Age 35-44	Age 45-54	Age 55-64
48. Wagon jack	21	27	28
49. Wood shed	12	17	28
50. Vise handle	17	14	27
Totals	1531	1915	2276

Note: There were 89 farmers 35 to 44 years of age, 152 farmers 45 to 54 years of age, and 71 farmers 55 to 64 years of age.

Table 17

Showing the number of farmers per hundred who perform certain repair work in wood. Data secured from 89 farmers, 35 to 44 years of age.

Job	Frequency per 100	Job	Frequency per 100
1. Door screen	27	13. Corn crib	14
2. Wheelbarrow	22	14. Hog house	14
3. Rail fence	21	15. Privy	14
4. Wagon seat	21	16. Dairy barn	12
5. Wire fence	19	17. Chicken coop	12
6. Window screen	19	18. Hay rack	12
7. Horse manger	17	19. Wagon box	12
8. Horse barn	15	20. Farm gate	11
9. Board fence	15	21. Kitchen table	10
10. Cattle manger	15	22. Step ladder	10
11. Combination barn	14	23. Poultry house	10
12. Bins for grain	14	24. Wagon bed	10

Table 18

Showing the number of farmers per hundred who perform certain repair work in wood. Data secured from 152 farmers, 45 to 54 years of age.

Job	Frequency per 100	Job	Frequency per 100
1. Horse manger	26	17. Poultry house	12
2. Door screen	24	18. Wood picket fence	12
3. Wheel barrow	24	19. Batten door	11
4. Bins for grain	23	20. Implement shed	11
5. Window screen	23	21. Step ladder	11
6. Cattle manger	22	22. Pig pen	11
7. Rail fence	20	23. Chicken coop	10
8. Horse barn	18	24. Farm gate	10
9. Wire fence	18	25. Yard gate	10
10. Hog house	18	26. Horse drawn sled	10
11. Wagon box	18	27. Kitchen table	10
12. Dairy barn	16	28. Hatchet handle	10
13. Combination barn	16	29. Fruit ladder	10
14. Wagon seat	15	30. Wagon top	10
15. Corn crib	12	31. Wagon bed	10
16. Board fence	12		

Table 19

Showing the number of farmers per hundred who perform certain repair work in wood. Data secured from 71 farmers, 55 to 64 years of age.

Job	Frequency per 100	Job	Frequency per 100
1. Door screen	31	25. Hay rack	14
2. Horse manger	28	26. Batten door	13
3. Wheel barrow	27	27. Jockey stick	13
4. Wire fence	24	28. Step ladder	13
5. Farm gate	21	29. Milking stool	13
6. Cattle manger	21	30. Nest for laying hens	13
7. Fruit ladder	21	31. Wagon seat	13
8. Window screen	20	32. Dairy barn	11
9. Combination barn	20	33. Horse barn	11
10. Bins for grain	20	34. Wood picket fence	11
11. Rail fence	18	35. Pick handle	11
12. Pig pen	18	36. File handle	11
13. Corn crib	18	37. Chicken crate	10
14. Board fence	17	38. Chicken coop	10
15. Yard gate	17	39. Chicken feeder	10
16. Hammer handle	17	40. Evener	10
17. Hog house	17	41. Wagon jack	10
18. Horse drawn sled	17	42. Potato marker	10
19. Wagon bed	17	43. Nest for setting hens	10
20. Wagon box	17	44. Plank drag	10
21. Hatchet handle	16	45. Porch chair	10
22. Sledge handle	16	46. Privy	10
23. Poultry house	16	47. Flight of steps	10
24. Watering trough	16	48. Hand sled	10

Table 20

Showing the number of farmers per hundred who perform certain repair work in wood. Data secured from farmers grouped according to age.

Job	Frequency per 100		
	Age 35-44	Age 45-54	Age 55-64
1. Door screen	27	24	31
2. Horse manger	17	26	28
3. Wheelbarrow	22	24	27
4. Wire fence	19	18	24
5. Farm gate	11	10	21
6. Cattle manger	15	22	21
7. Fruit ladder	9	10	21
8. Window screen	19	23	20
9. Combination barn	14	16	20
10. Bins for grain	14	23	20
11. Rail fence	21	20	18
12. Pig pen	9	11	18
13. Corn crib	14	12	18
14. Board fence	15	12	17
15. Yard gate	6	10	17
16. Hammer handle	6	9	17
17. Hog house	14	18	17
18. Horse drawn sled	6	10	17
19. Wagon bed	10	10	17
20. Wagon box	12	18	17
21. Hatchet handle	3	10	16
22. Sledge handle	5	9	16

Table 20 (Continued)

Job	Frequency per 100		
	Age 35-44	Age 45-54	Age 55-64
23. Poultry house	10	12	16
24. Watering trough	5	6	16
25. Hay rack	11	9	14
26. Batten door	2	11	13
27. Jockey stick	3	3	13
28. Step ladder	10	11	13
29. Milking stool	6	6	13
30. Nest for laying hens	9	7	13
Totals	344	410	549

Note: There were 89 farmers 35 to 44 years of age, 152 farmers 45 to 54 years of age, and 71 farmers 55 to 64 years of age.

Repair Work in Wood.—Here as in the previous classification where all farms were used as a basis of study it will be necessary to remember that repair work means only such repair work as was done by farmers on objects not made by farmers. Tables 17, 18, and 19 give the results for the age groups and Table 20 gives a comparison of the three groups.

The kinds of work done in the age groups is summarized in Table 21. Since the work done by very few farmers per hundred is less significant in general for purposes of secondary education, only that repair work was included in the latter table which was done by 10 or more persons per hundred. Likewise for the construction work the limit was set at work done by 25 or more persons per hundred.

Table 21

Showing the relative frequency with which certain repair and construction work in wood is done by farmers grouped according to age.

	Age 35-44	Age 45-54	Age 55-64
Number of kinds of repair work performed by 10 or more persons per hundred	24	31	48
Number of kinds of construction work performed by 25 or more persons per hundred	35	47	58

Interpretation of Group II.—It has been shown that farmers 35 to 44 years of age do fewer kinds of repair and construction work than is done by farmers 45 to 54 years of age, and that the latter group do fewer kinds of work than farmers 55 to 64 years of age.

If farmers had much of their repair and construction work done by mechanics, it might be inferred that the younger farmers depend more largely on mechanics for such work than do the

older farmers. But Figure 4 shows, as far as the kinds of work treated in this study are concerned, that the amount of work is negligible that farmers leave to mechanics. It is consistent with accumulated experience to interpret the facts to mean that agriculture is a vocation so broad that it actually requires a number of years in order to obtain a well rounded training in it. Rotations in crops and changes brought about by special market conditions are some of the reasons why the work varies from year to year. Certain objects such as hog houses are built only occasionally, and certain repair work has to be done only every few years. Successful farmers are always learning and grow constantly in their vocation. A lifetime of successful farm experience is not time enough in which to master the skills and acquire the technical knowledge that may be used in the pursuit of an agricultural career.

CHAPTER IV.

Group III

Findings on the Basis of Type of Agriculture Pursued

It was found in Table 3 that there are 256 general farms and 81 dairy farms among the 400 farms studied. Tables 22 and 23 show the number of farmers per hundred on the general farms who do certain construction and repair work in wood, and Tables 24 and 25 give similar results for dairy farms, while Table 26 gives a comparison of construction work as performed on the three principal groups of farms; namely, the group containing all farms, the one containing general farms and the one made up of dairy farms. Table 27 gives a comparison of repair work as performed on the groups of farms just mentioned.

Interpretation of Facts Found in Group III.—The comparative tables show that, as regards the kinds of work studied, there is much similarity in the three groups of farms. There are several reasons for this. In the first place the group headed "General farms", makes up approximately 70 per cent of the first group which contains all of the farms included in the study. Again, the farmers

Table 22

Showing the number of farmers per hundred who perform certain construction work in wood. Data secured from 256 farmers operating general farms.

Job	Frequency per 100	Job	Frequency per 100
1. Wire fence	73	20. Poultry house	37
2. Farm gate	65	21. File handle	36
3. Nest for laying hens	65	22. Mortar Box	35
4. Milking stool	64	23. Pick handle	35
5. Chicken coop	63	24. Saw horse	34
6. Hatchet handle	59	25. Chicken feeder	33
7. Nest for setting hens	56	26. Trellis for grapes	33
8. Hammer handle	50	27. Fruit ladder	32
9. Rail fence	45	28. Horse drawn sled	30
10. Board fence	45	29. Hand sled	30
11. Yard gate	42	30. Bins for grain	30
12. Feeding trough for chicks	41	31. Jockey stick	30
13. Plank drag	40	32. Hay rack	29
14. Horse manger	39	33. Watering trough	28
15. Sledge handle	38	34. Evener	28
16. Pig pen	38	35. Saw buck	27
17. Hog house	38	36. Wagon box	27
18. Feeding trough for swine	38	37. Wood picket fence	26
19. Cattle manger	37	38. Chicken crate	26

Table 23

Showing the number of farmers per hundred who perform certain repair work in wood. Data secured from 256 farmers operating general farms.

Job	Frequency per 100	Job	Frequency per 100
1. Door screen	29	15. Corn crib	13
2. Wheelbarrow	23	16. Fruit ladder	13
3. Window screen	22	17. Pig pen	13
4. Horse manger	18	18. Board fence	13
5. Farm gate	18	19. Horse drawn sled	12
6. Wagon box	17	20. Wagon bed	11
7. Bins for grain	17	21. Step ladder	11
8. Cattle manger	17	22. Yard gate	11
9. Hog house	16	23. Chicken coop	11
10. Wagon seat	15	24. Nest for laying hens	10
11. Rail fence	15	25. Nest for setting hens	10
12. Combination barn	15	26. Poultry house	10
13. Wire fence	15	27. Wood picket fence	10
14. Horse barn	15	28. Hatchet handle	10

Table 24

Showing the number of farmers per hundred on dairy farms who perform certain construction work in wood.

Job	Frequency per 100	Job	Frequency per 100
1. Milking stool	65	24. Corn crib	35
2. Nest for laying hens	65	25. Board fence	35
3. Chicken coop	59	26. Hatchet handle	35
4. Wire fence	59	27. Watering trough	35
5. Nest for setting hens	54	28. Chicken feeder	33
6. Farm gate	52	29. Yard gate	33
7. Hammer handle	52	30. Mortar box	33
8. Horse manger	47	31. Hand sled	32
9. Bins for grain	46	32. Tool box	32
10. Hay rack	46	33. File handle	31
11. Saw horse	42	34. Saw buck	31
12. Sledge handle	41	35. Fruit ladder	30
13. Cattle manger	41	36. Window screen	28
14. Feed trough for swine	41	37. Horse drawn sled	28
15. Wagon box	41	38. Chicken crate	26
16. Rail fence	40	39. Smoke house	26
17. Hog house	40	40. Land leveler	26
18. Plank drag	37	41. Potato marker	26
19. Feeding trough for chicks	37	42. Crating	25
20. Evener	36	43. Wood picket fence	25
21. Pick handle	36	44. Wagon jack	25
22. Poultry house	36	45. Flight of steps	25
23. Pig pen	36		

in all three groups keep cows—not to the extent that those do who run dairy farms, but enough to give them similar experiences. In similar manner, practically all farmers keep chickens, horses, swine, raise some garden truck, some field crops and have other experiences in common. It may be concluded from this that practically

Table 25

Showing the number of farmers per hundred on dairy farms who perform certain repair work in wood.

Job	Frequency per 100	Job	Frequency per 100
1. Dairy barn	27	17. Potato marker	12
2. Rail fence	26	18. Milking stool	12
3. Horse manger	25	19. Pick handle	11
4. Horse barn	23	20. Hay rack	11
5. Wheelbarrow	22	21. Smoke house	11
6. Wire fence	21	22. Kitchen sink	11
7. Bins for grain	18	23. Kitchen table	11
8. Board fence	18	24. Pig pen	11
9. Door screen	17	25. Window screen	11
10. Wagon seat	17	26. Wagon bed	11
11. Cattle manger	16	27. Woodshed	11
12. Poultry house	16	28. Chicken brooder	10
13. Combination barn	15	29. Hammer handle	10
14. Hog house	15	30. Fruit ladder	10
15. Farm gate	12	31. Step ladder	10
16. Ice house	12	32. Wheel barrow	10

Table 26

Comparing construction work in wood as found on (a) All farms, (b) General farms, and (c) Dairy farms. The number of farms in each group is given in Table 3.

Job	Number of times per 100 farms		
	All Farms	General Farms	Dairy Farms
1. Wire fence	71	73	59
2. Nest for laying hens	67	65	65
3. Chicken coop	61	63	59
4. Milking stool	61	61	65
5. Nest for setting hens	61	56	54
6. Farm gate	61	65	52
7. Jockey stick	52	30	16
8. Hammer handle	51	50	52
9. Feeding trough for chicks	45	41	37
10. Pig pen	44	38	36
11. Rail fence	43	45	40
12. Horse manger	43	39	47
13. Cattle manger	42	37	41
14. Board fence	42	45	35
15. Plank drag	41	40	37
16. Hog house	40	38	40
17. Yard gate	40	42	33
18. Hatchet handle	39	59	35
19. Feeding trough for swine	38	38	41
20. Sledge handle	38	38	41
21. Chicken feeder	37	33	33
22. Poultry house	36	37	36
23. File handle	35	36	31
24. Pick handle	34	35	36
25. Saw horse	34	34	42
26. Bins for grain	33	30	46
27. Mortar box	33	35	33
28. Hay rack	32	29	46
29. Fruit ladder	32	32	30
30. Evener	31	28	36

Table 26 (Continued)

Job	Number of times per 100 farms		
	All Farms	General Farms	Dairy Farms
31. Hand sled	31	30	26
32. Horse drawn sled	30	30	28
33. Tool box	29	23	32
34. Watering trough	29	28	35
35. Trellis for grapes	29	33	17
36. Saw buck	29	27	31
37. Wagon box	29	27	41
38. Wood picket fence	27	26	25
39. Bird house	23	24	23
40. Corn crib	23	22	35
41. Wagon jack	25	24	25
42. Window screen	25	19	28
43. Privy	23	22	18
44. Wagon seat	23	22	22
45. Smoke house	23	23	26
46. Flight of steps	23	22	26
47. Dog house	22	22	17
48. Garden marker	22	18	22
49. Ironing board	22	23	21
50. Crating	22	18	25

Table 27

Comparing repair work in wood as found on (a) All farms, (b) General farms, and (c) Dairy farms. The number of farms in each group is given in Table 3.

Job	Number of times per 100 farms		
	All Farms	General Farms	Dairy Farms
1. Door screen	24	29	17
2. Wheel barrow	23	23	10
3. Rail fence	18	15	26
4. Window screen	18	22	11
5. Horse manger	18	18	23
6. Cattle manger	18	17	16
7. Bins for grain	17	17	18
8. Wire fence	17	15	21
9. Wagon box	17	17	5
10. Horse barn	16	15	23
11. Comb'nation barn	15	15	15
12. Hog house	15	16	15
13. Dairy barn	14	11	27
14. Board fence	13	12	18
15. Farm gate	13	18	12
16. Corn crib	13	13	9
17. Pig pen	12	13	11
18. Poultry house	11	11	16
19. Horse drawn sled	11	12	9
20. Fruit ladder	11	13	10
21. Wagon bed	11	11	11
22. Hay rack	11	11	11
23. Wood picket fence	10	10	5
24. Yard gate	10	11	6
25. Wagon seat	10	15	17
26. Privy	10	8	7
27. Chicken coop	9	11	11

Table 27 (Continued)

Job	Number of times per 100 farms		
	All Farms	General Farms	Dairy Farms
28. Step ladder	9	10	10
29. Nest for laying hens	9	10	7
30. Batten door	8	8	9
31. Hammer handle	8	9	10
32. Pick handle	8	9	11
33. Implement shed	8	9	9
34. Kitchen table	8	4	11
35. Nest for setting hens	8	10	5
36. Hatchet handle	8	10	9
37. Smoke house	8	9	12
38. Oats spouter	8	1	0
39. Jockey stick	8	5	6
40. Kitchen sink	8	4	11

all farmers in Pennsylvania except the very few who grow nothing but truck, a variety or two of fruit, flowers, etc., have many experiences in common and do much the same kind of repair and construction work. It is granted that this work varies in amount with the type and size of farm operated.

In planning courses of study for vocational agricultural schools, one is forced by economic considerations to consider primarily the best interests of the majority of pupils. Rural schools cannot now, as a rule, offer as many options to pupils as can the schools of urban centers. It is hardly economically feasible for most agricultural schools of secondary grade in Pennsylvania to offer separate specialized courses in agronomy, horticulture, animal husbandry, poultry raising and other major phases of agriculture. There are other reasons why it is not attempted.

The conclusion drawn is that the repair and construction work that was done most commonly by the farmers in Group I (which contained all of the farms studied) closely represents essentials for over 90 per cent of the farming of the state of Pennsylvania.

P A R T I I.

CHAPTER V.

The Teaching Force

At the time this study was made (1919), there were 33 teachers of agriculture (exclusive of assistants), in the schools shown in Figure 1. It has already been mentioned that these men are called Supervisors of Agriculture because they supervise home project work in agriculture. In addition, they are frequently called upon to render various forms of educational service to the adult population of the community. All this tends to widen their sphere of usefulness to the community and makes them bigger and abler men than if their efforts were restricted to those of the class room and laboratory. The supervisors are young men as is shown in Figure 8. Twenty-four of them are between twenty-six and thirty years of age.

The pertinence of the graph lies largely in a probable relationship (to which there are exceptions) between age and personal adaptability to teach successfully a growing and dynamic vocation such as that of agriculture.

More significant than age, however, is the background of previous experience that teachers possess. Figure 9 shows how many years the supervisors have lived in urban centers, in rural communities, but not on farms, and on farms.

Experience in Shop Work.—In describing the experience that the supervisors of agriculture have had in shop work, a distinction is made between school experience and that obtained outside of schools. Figure 10 shows that of thirty-three supervisors twenty-nine have had normal school or college training in woodwork, and that twelve have had training in iron and steel, that is, forge practice. No attempt was made to show the exact nature and amount of this school experience. In the case of 82 per cent of the men—those graduated in agriculture from the Pennsylvania State College—it probably consisted of one three-hour period per week for one semester. The woodwork given was largely joinery. The course of study for agricultural students in effect when the men graduated

required either the course just described or one in forge practice for an equal length of time. The work covered is similar to what is usually given in elementary forge practice in schools of engineering. The Pennsylvania State College now requires students in agricultural education to take farm shop work for six hours per week for one semester.

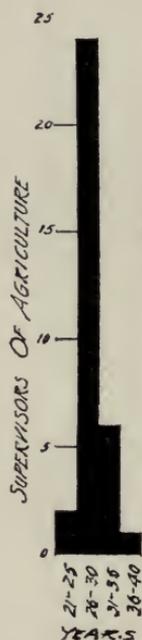


Figure 8

Age of supervisors of Agriculture, September 1, 1919

In addition to the experience obtained in normal school or college in working with materials of construction, most of the supervisors had practical experiences with tools and materials of repair and construction, incidental to their farm life. This work no doubt varied considerably with the men in amount and in character, but farmers as a class do considerable work with hand tools; this must not be overlooked in spite of the fact that we have no exact measure of the amount, nor can we describe its quality in a scientific way. After all may not the description: "five years of practical farm experience in general farming in Pennsylvania", give as clear a notion of how much experience in farm repair and construction work a

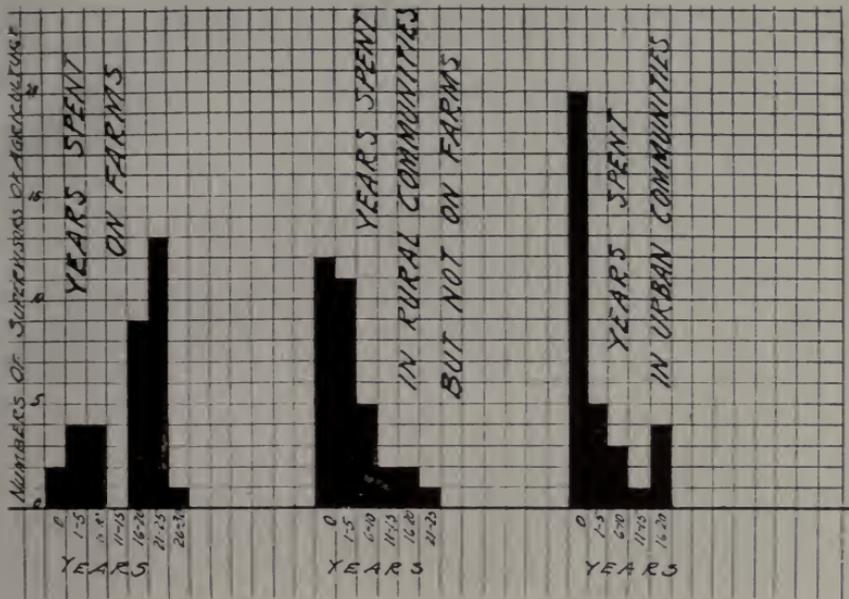


Figure 9

Showing the time in years that the supervisors of agriculture lived on farms, in rural communities but not on farms, and in urban centers.

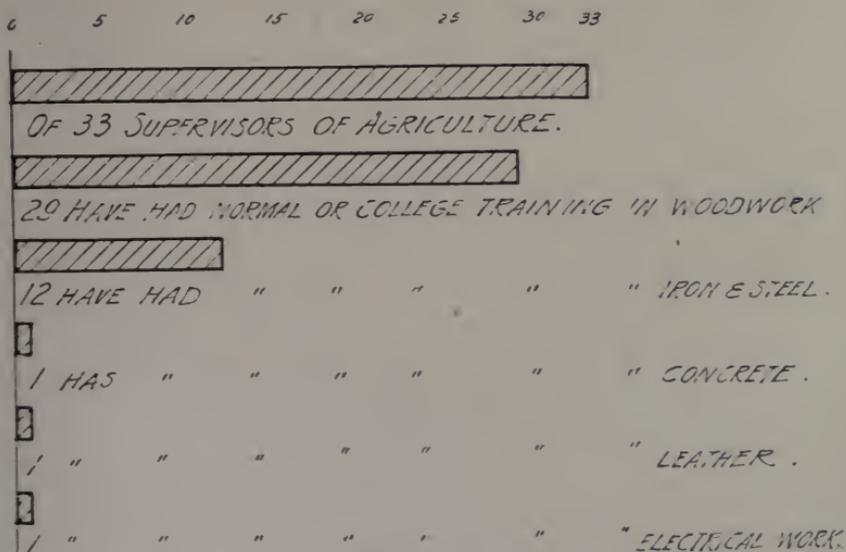


Figure 10

Types of shop work pursued in Normal School or in College by Supervisors of Agriculture.

person has had as to say he has "worked for five years at carpentry", or "has had a three-credit course in farm shop work at an agricultural college?"

The number of years the supervisors have lived on farms is graphically shown in Figure 9. The diagram does not distinguish between years spent in early childhood and years spent later in life, but the graph shows that over two-thirds of the men have lived sixteen or more years on farms.

Table 28

Experience in teaching farm shop work

Individual No.	1918-1919				1917-1918				1916-1917				1915-1916			
	Wood	Iron and steel	Concrete	Miscellaneous	Wood	Iron and steel	Concrete	Miscellaneous	Wood	Iron and steel	Concrete	Miscellaneous	Wood	Iron and steel	Concrete	Miscellaneous
1	x															
2	x	x														
3	x	x														
4	x				x	x										
5	x				x											
6	x	x	x		x	x	x		x	x	x		x	x	x	
7	x				x				x							
8	x	x	x		x	x	x		x	x	x					
9	x								x							
10	x	x	x													
11	x															
12	x	x			x											
13	x				x				x	x			x	x		
14	x	x	x		x				x							
15	x	x														
16	x				x								x	x		
17	x				x				x							
18	x								x							
19																
20	x	x	x		x				x	x	x					
21	x	x			x	x	x		x				x			
22	x	x			x	x			x				x			
23	x															
24	x				x				x							
25	x				x											
26	x				x											
27	x				x											
28	x	x			x				x							
29	x	x	x		x		x		x							
30	x															
31	x	x			x	x			x	x			x			
32	x				x				x							
33	x	x			x	x	x		x		x					
To't	32	15	6		22	7	5		18	7	4		6	2	2	

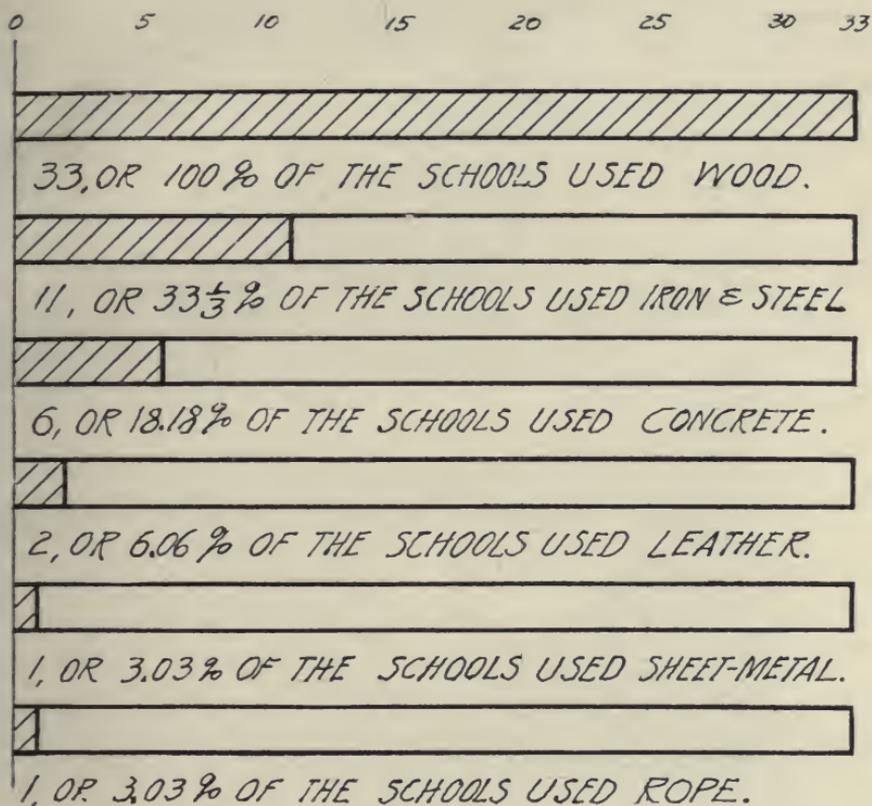


Figure 11

Materials chiefly used in farm shop work in the schools

Experience in Teaching Farm Shop Work.—In Pennsylvania, the supervisors of agriculture, without exception, teach the farm shop work. Table 28 shows the kinds of materials used and the number of years that each supervisor has taught this work. Figure 11 shows graphically what materials were used. That the farm shop work is still influenced by manual training ideals is brought out in Table 31. This shows that of 33 schools, 10 were in 1919 devoting their efforts to repair and construction work, such as is followed by farmers in the pursuit of their vocation, and that the character of the work was good as measured by standards obtaining in good farm practice. Three more schools were doing the same kind of work with a fair degree of skill. Fourteen combined good farm shop work with cabinet work. Four schools gave cabinet work almost exclusively. One restricted its efforts almost entirely to

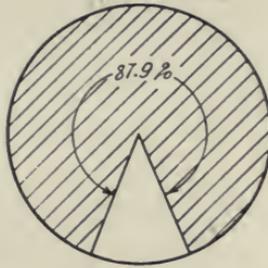
making models—that is small scale samples—of objects useful on the farm, and one school gave no time to farm shop work during the year. A list of shop projects cannot well be given as there is no uniform practice in kinds selected.

Table 29

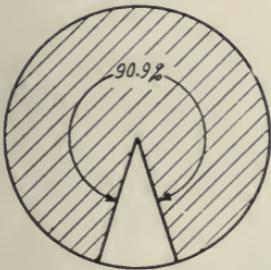
Where teachers received training, and amount received

Individual	High School, Academy, or Prep. School			Normal School			College		
	Pa.	Outside Pa.	Years	Pa.	Outside Pa.	Years	Penn State	Outside Pa.	Years
1	x		3.5				x		4
2	x		4.				x		4
3	x		3.				x		4
4		x	4.					x	4
5	x		4.				x		4
6	x		5.				x		4
7				x		6	x		2
8	x		1.				x		6
9	x		4.0				x		4
10		x	4.				x		4
11	x		4.				x		2
12	x		4.				x		4
13				x		2	x		4
14	x		2.				x		4
15	x		4.				x		2
16		x	4.5					x	4
17	x		2.5				x		4
18	x		4.				x		4
19	x		4.				x	x	6
20	x		3.5				x		4
21	x		4.				x		4
22	x		5.					x	4
23	x		4.					x	4.5
24	x		4.					x	5
25	x		3.				x		4
26	x		4.				x		4
27	x		3.				x		4
28	x		4.				x		4
29				x		2.5	x		4
30	x		4.				x		4
31	x		3.				x		4
32		x	4.					x	4
33	v		3.				x		4
Tot'ls	26	4	110.	3		10.5	27	7	1315
			av. 3.34			av. .318			av. 4.00

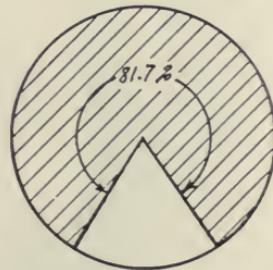
Where Teachers Received Their Training, and the Amount Received.—Almost 88 per cent of the supervisors of agriculture received their high school education in Pennsylvania, and about 82 per cent of them are graduates of the School of Agriculture of The



PROPORTION OF SUPERVISORS OF AGRICULTURE WHO RECEIVED THEIR HIGH SCHOOL EDUCATION OR ITS EQUIVALENT IN PENNSYLVANIA. (87.9%)



90.9 PER CENT OF THE SUPERVISORS OF AGRICULTURE HAVE NOT HAD NORMAL SCHOOL TRAINING.



81.7 PER CENT OF THE SUPERVISORS OF AGRICULTURE HAVE RECEIVED THEIR AGRICULTURAL COLLEGE EDUCATION AT THE PENNSYLVANIA STATE COLLEGE.

Figure 12

Pennsylvania State College. These facts are graphically shown in Figure 12, and are revealed by Table 29, which gives detailed information about all of the supervisors. Only three individuals, or less than 10 per cent, have had normal school training—that is, have had training in methods of teaching. They are among the best teachers. All but two of the supervisors are graduates of four-year courses in agriculture.

Tenure.—Of the thirty-three supervisors holding positions in 1919, five have served four years, eleven served three years, eleven served two years, and six served one year (see Figure 13). The number of changes that have been made are shown in the left hand group in the same figure. Thus, three of the five men who have taught for four years in Pennsylvania are holding their original positions, and sixteen have been in their present position but one year. There are at least two reasons for the latter fact. Many of

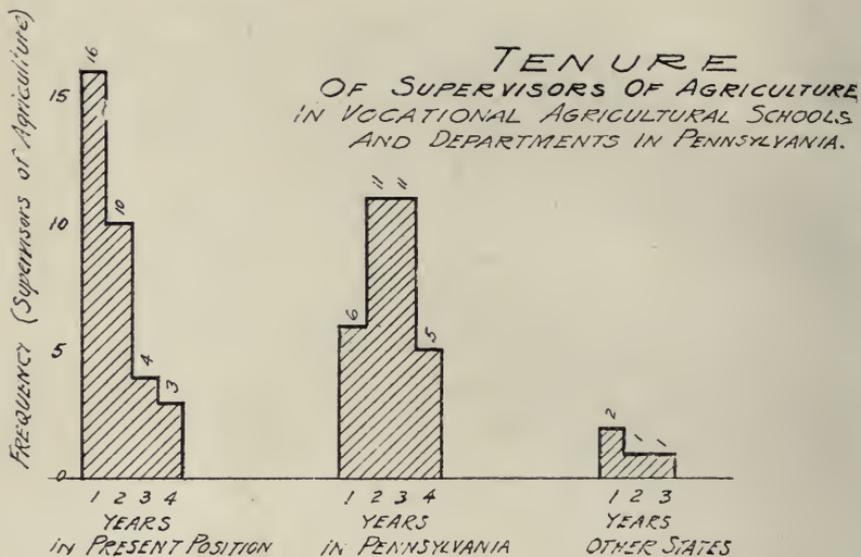


Figure 13

the men gave up their positions in order to go in the service of our country. Others were put in their places. When the former returned, they were often put in charge of other schools where men of experience and energy seemed especially to be needed. In other instances, men were promoted, or their experience and demonstrated ability were utilized in starting new departments of schools. During the first half of the present school year (1919-1920) five rural community vocational schools and three agricultural departments in high schools have been added—an increase of twenty-five per cent.

Farm Shop Product.—By letting boys make objects for themselves, one stimulates and increases their natural interest in work with hand tools. Figure 14 shows what proportion of the product of farm shop work goes to the boy, or to his home farm. The diagram shows that the practice among the schools is not uniform. Too much uniformity in this respect is undesirable, for some schools are well housed and equipped and need little construction work such as boys can do with educational advantage to themselves, while others have many things that need to be made that fit in with farm shop work requirements.

While it is desirable to encourage pupils by giving them some of the product of their efforts, it is likewise worth while to keep in mind a higher aim than the purely selfish one just referred to. By having pupils plan and execute work for the school, for instance, they are given the opportunity to do faithful work in the service of

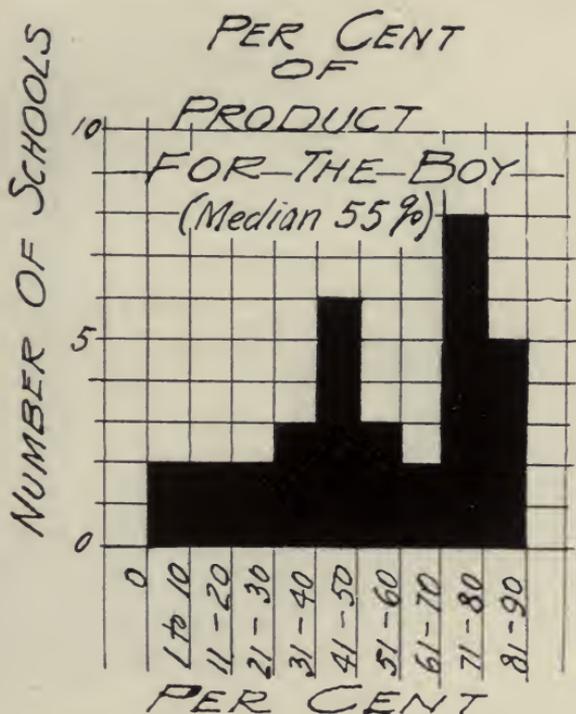


Figure 14

Per cent of school farm shop product for the boy, or for his home farm. the community (Table 15). To be worth while, such work must be within the capacity of the boys, and must be worth while educationally, otherwise it may result in exploitation of the pupils.

If the product in farm shop work is classified into two divisions, construction work and repair work, it is found that there is also quite a variation in the amount of the latter kind of work done by the schools. Figure 16 gives the distribution in terms of per cent of the work done for the year.

All but one of the schools show up fairly well on the basis of the per cent of shop product that is used after it is completed. (Figure 17). The aim should be one hundred per cent.

Cost of Material in Shop Work.—The cost of material per pupil per year varies a good deal. Table 30 shows that there are three schools having a cost of \$1.00 per pupil per year, and one school expends fourteen times as much.

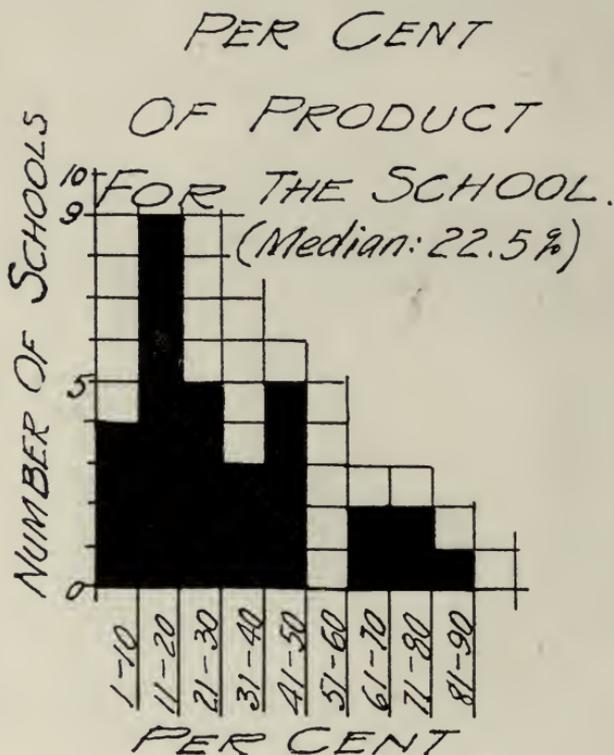


Figure 15

Showing the per cent of school farm shop product that is undertaken by the pupils for the school.

There are about 72 double periods (two 45 minute periods) devoted to shop work per year. Taking the median cost of \$2.63, it means that the cost of material per pupil for each period is less than four cents. Figuring lumber at 8 cents per foot, this allows one-half foot of lumber per pupil per period—provided he uses no other supplies. It is impossible to do satisfactory vocational work with so small an outlay for material. As a matter of fact, it is not being done. Pupils are usually required to pay for all material used for objects repaired or made for personal or home farm use. This is why the work is not costing the public more.

In one instance a supervisor was asked by his school board to get along entirely with box material which could be secured at stores for nothing. The result was unsatisfactory. It is a gross

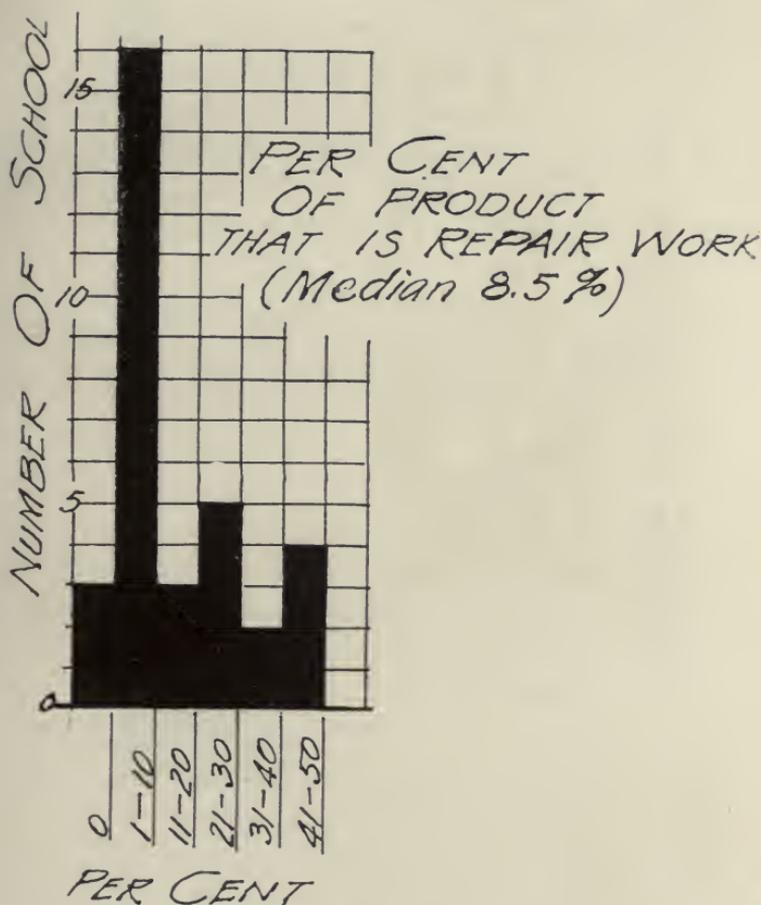


Figure 16

Showing the per cent of school farm shop product that is repair work, as distinguished from construction or "mak'ng" work.

waste of valuable time to have pupils size and surface material that may be had in stock sizes from dealers.

Shop Work and Related Subjects.—Drawing is correlated with farm shop work in twenty-one of the thirty-three schools. (See Figure 18). There is little correlation with arithmetic.

The shop work undertaken ought to grow out of, or at least fit into the technical agriculture that is being studied at the time, and

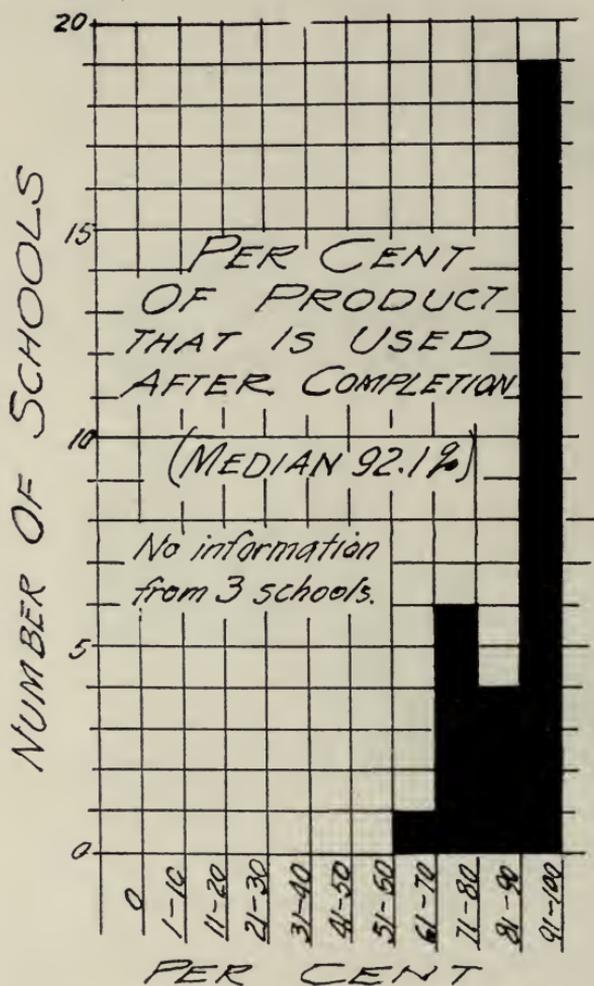


Figure 17

Showing the per cent of school farm shop product that is actually used after completion.

arithmetic and other related sciences should be closely correlated with the agricultural work—hence also with farm shop work. In a relatively new field of public education, this cannot be realized immediately. Before it can be brought about, there must be teachers of related subjects available who have both pedagogical training and the necessary vocational background required in the process

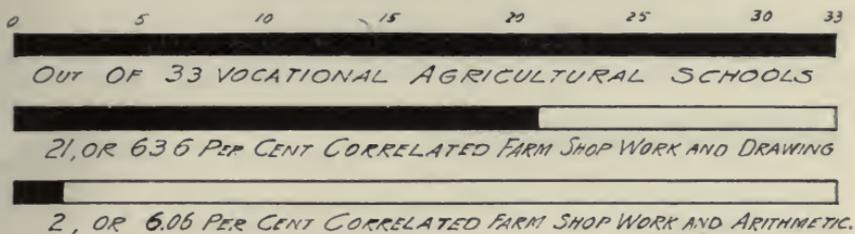


Figure 18

Showing extent to which related subjects are being correlated with farm shop work.

of making practical education the vehicle for conveying fundamental truths.

Aim or Purpose of Farm Shop Work in the Schools.—As the aim or purpose in teaching largely controls means and methods of instruction, it was thought advisable to have the supervisors state what their aims are for farm shop work. Figure 19 gives the result. It shows some confusion as to ultimate ends sought. There is no doubt about the desirability of acquainting pupils with tools

Table 30

Cost of material in farm shop work per pupil per year

Amount	Number of Schools	Amount	Number of Schools
\$ 1.00	3	\$ 9.00	0
2.00	5	10.00	1
3.00	4	11.00	0
4.00	2	12.00	0
5.00	3	13.00	0
6.00	1	14.00	1
7.00	1	(No information 12)	
8.00	0		

Median amount expended per pupil per year is \$2.63. Pupils are usually asked to pay for such material as they use in the construction of objects made for personal or home farm use, hence the cost per pupil to the school board is low.

and of developing skills of hand and accuracy of eye, but these things are purely means to an end and not ends in themselves.

The purpose of farm shop work should be to prepare for repair and construction work as performed by successful farmers. The aim is not the mastery of tools but production, and the self-realization or personal development that accompanies planning and executing honest work that is essential to society at large.

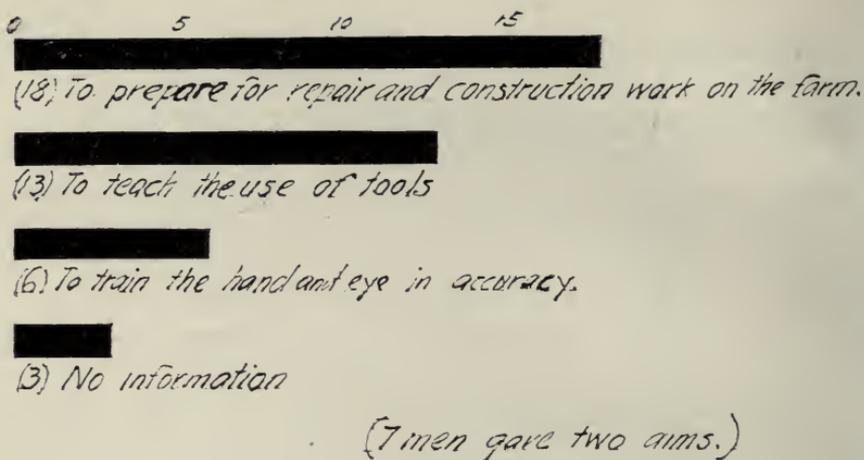


Figure 19

The aim or purpose of farm shop work as stated by the Supervisors of Agriculture.

Table 31

Showing character of work given in farm shop work in the vocational agricultural schools and departments.

Character of the work	Execution	No. of schools
Good farm shop work	Good	10
Good farm shop work	Fair	3
Combination of good work with cabinet work	Fair	14
Cabinet work almost exclusively	Fair	4
Models of good farm shop projects	Fair	1
No work		1

Separate or Combined Shops.—There is a question in the minds of many about what is the most desirable way of housing, in a school plant, the equipment required for instruction in farm shop work. With this thought in mind, the supervisors were asked whether, in the light of their experience, they favored having this equipment in one shop or whether they preferred separate rooms for different materials such as wood, concrete and steel. Their answers are shown in Figure 20. The result of the inquiry is not at all conclusive. All of the shops in the agricultural schools of the state are at present so arranged that work in wood is given in rooms separate from those in which forge practice is taught.

Equipment for Farm Shop Work

The subject of equipment for farm shop work is one of importance. Table 32 gives a list of equipment for work in wood that

has been recommended by the State Bureau of Vocational Education, but which the State Director feels needs revision. In order to find out how well the supervisors of agriculture are satisfied with it, the writer arranged the subject matter alphabetically and asked each supervisor to indicate just how many of the various tools or appliances he considered desirable for a unit of 12 boys. Column 2 of the table gives the median results. They would seem to show that the list is ample. This view is shared by the writer. Of course too much value must not be placed on the facts shown in column two, for many of the supervisors could not be considered competent judges in the matter owing to the small amount of training and education they have had for it.

Table 32

*Tools and equipment for woodworking recommended for a unit of twelve students by the State Bureau of Vocational Education, and the numbers desired by the Supervisors of Agriculture

Description of Tools and Equipment	1 Number recommended by State Dept. for unit of 12 students	2 Number desired by Supervisors of Agriculture (Median to nearest unit)
A. Axe, Forester's	1	1
B. Brace, Ratchet, 8" No. 323 Barbers	1	2
Bit, Auger, R. Jennings in Wooden Case	12	12
Bit, Drill, assorted, 1 each, 2, 3, 4, 5	12	4
Bit, Screw Driver, 1 each, $\frac{3}{8}$ ", $\frac{1}{2}$ ", Hamacher Schlemmer	2	2
Bit, Expansive, $\frac{3}{4}$ ", 3", Wright	1	1
C. Carborundum Stone No. 108, 8"x2"x1", Double Combination	1	1
Chisels, Socket Firmer, 1 each, $\frac{1}{2}$ ", $\frac{3}{4}$ ", $\frac{3}{8}$ ", $\frac{1}{2}$ ", $\frac{3}{4}$ ", $\frac{3}{8}$ ", 1" and 2"	8	8
Chisel, Socket Firmer, 12 each, $\frac{3}{8}$ ", 1"	24	12 ea.
Clamps, 3 ft.	3	3
Countersink, Rose, No. 10, $\frac{1}{2}$ "	1	1
D. Dividers, winged, 3"	1	2
Dowel Pin Cutters, Sheet Steel	1	2
Drawshaves, 8" Witherby	1	2
F. Files, Saw, 14 pt., 10 pt., $\frac{3}{8}$ " flat	9	3
Files, Wood, 1 each, Wood Rasp, flat, $\frac{1}{2}$ -round, rat-tail	4	3
G. Gauge, Bit	1	1
Gauge, Scratch, Stanley No. 64 $\frac{1}{2}$	6	6
Glue pot	1	1
Grinder, Bench, 8", Pike Whirlwind	1	1
Grindstone, Cyco, 20" to 22"	1	1
H. Hammer, 13 oz., Hammond, Bell Face	8	8

*Data of column 1 secured from Mr. L. H. Dennis. Arrangement is work of writer.

Table 32 (Continued)

Description of Tools and Equipment	1	2
	Number recommended by State Dept. for unit of 12 students	Number desired by Supervisors of Agriculture (Median to nearest unit)
Handscrew, Jourgensen's No. 2, 12"	6	5
L. Letters and Numerals, steel, 1 set each	2	2
Level, Spirit, Stanley No. 0, 24"	1	1
M. Mallets, No. 3, Second Growth Hickory	4	4
Mitre Box, Goodell Mfg. Co., 30" saw	1	1
N. Nail Sets, 1 each, Nos. 1, 2, 3, 4, H. S. Co.	4	4
P. Plane Block, Stanley No. 9½, 6"x1¼"	12	12
Plane, Combination, Stanley No. 45	1	1
Plane, Jack, Stanley, No. 5, 14"	12	6
Plane, Jointer, Stanley No. 7, 22"	2	2
Plane, Smooth, Stanley No. 3, 8"x1¼"	3	3
R. Reamer	1	1
Rule, Stanley No. 18, 2 ft. 2 fold	12	12
S. Saw, Back, Disston No. 4, 12"	6	4
Saw, Coping	1	1
Saw, Crosscut, Disston 24", 10 pt., 7 D.	4	4
Saw, Hack	1	1
S. Saw, Pruning, Disston, Nest	1	1
Saw, Rip, Disston 26", 7 pt. 7 D.	2	1
Saw, Set	1	1
Scraper, Cabinet 3"x6"	2	2
Screw Driver, 1 each, 4", 6", 8", New Century	3	3
Spokeshave, Iron handle, Planing blade	3	2
Squares, Framing, Sargent No. 100 br., 24"	4	3
Squares, Try, Disston No. 5½, 6"	12	12
W. Wrench, Monkey	1	1
Wrench, Stilson	1	1

Table 33

Tools and equipment for forge work recommended for a unit of twelve students by the State Bureau of Vocational Education. (This list has been in effect a number of years and is not satisfactory to the Bureau. It is given in order to give an idea of the kind of equipment the schools have where forge practice is taught).

Required for Unit of 12		Required for Unit of 12	
A. Anvil	4	Punch, Horseshoe (Desirable)	1
C. Chisel, Cold 1½"	1	S. Shovel	4
Chisel, Hot, 1½"	1	Square, Steel	4
D. Drill, Hand (Desirable)	1	Swage, Top, ½"	1
F. Files, Flat, 12"	2	Swage, Bottom, ½"	1
Flatters, 2"	2	T. Taps and Dies, (Desirable)	
Forge	4	Complete set	1
G. Groover, (Desirable)	1	Tongs, Bolt, ½"	4
H. Hammer, Ball Peen, 16 oz.	4	Tongs, Bolt, ¾"	4
Hammer, Flat, 32 oz.	4	Tongs, Bolt, 1"	4
Hardie, 1¼"	5	Tongs, 1½"	4
Heading Tool, ½"	4	Tongs ¾"	4
P. Poker	4	Tongs, ½"	4
Punch, Center	4	Tongs, ¾"	4
Punch, ½"	2	V. Vise, Blacksmith's 4½"	2

Table 33 shows the number of tools or appliances recommended by the State Bureau of Vocational Education for forge practice at the time the list given in Table 32 was sent out. It will be noticed



7 UNDECIDED.



9 FAVOR COMBINING.



*17 FAVOR SEPARATE SHOPS
FOR DIFFERENT MATERIALS OF CONSTRUCTION.
SUCH AS WOOD AND STEEL.*

Figure 20

Showing extent to which Supervisors of Agriculture favor combining all kinds of farm shop work, so that all equipment is in one shop.

that some articles are marked "desirable", meaning that they are not required to be purchased.

It is our purpose here to give these tables in order to describe the equipment found in the schools. This list, like the previous one, is not satisfactory to the State Director of Agricultural Education. The writer's views regarding them will be given later.

CHAPTER VI

Deductions and Conclusions

The purpose of this chapter is, to present conclusions based on the findings presented in the preceding pages, viewed in the light of the writer's acquaintance with farming needs and school conditions as they exist in the state.

What Should be the Aim or Purpose of Teaching Farm Shop Work as a Part of Vocational Agricultural Education?—The aim or purpose to be kept in mind in teaching farm shop work may be stated in this way: It is self-realization through individual purposing, planning and doing the kinds of repair and construction work that successful farmers of the region engage in. By self-realization is meant the development of one's best self in ways that promote and perpetuate the ideals and best interests of society.

When it is said that the purpose of farm shop work is to give manual skill, accuracy of eye, or a knowledge of tool processes, only a part of the story is told. All these enter into farm shop work but they are only means to ends instead of ends in themselves. To be sure, farm shop work as a part of vocational agricultural education must make a demonstrable contribution to vocational efficiency. If the instruction does not lead to economic production—to more prosperous agriculture—it fails in a vital way, but educationally it is important to think of the boy as the chief product of farm shop work instruction, and of the work performed merely as perhaps the best single, tangible evidence of his vocational development. Now this does not mean that good standards of workmanship are not essential. It means that through the application of certain well recognized laws of psychology and of pedagogy better material and social results can be secured through major emphasis on the individual pupil as a developing democratic citizen than can possibly be obtained through narrow vocational training the purpose of which is habit formation, as distinguished from vocational education the purpose of which is habit formation plus individual purposing and reasoning.

Kinds of Work That Should Be Undertaken.—The kind of work which farm boys need to know how to do is not that which

carpenters, cabinet makers, or toy makers commonly do, but that which successful farmers perform in the pursuit of their vocation. Facts have been given in this study that show what kinds of repair work and construction work are most frequently done with the materials commonly used for the purpose by farmers.

Furniture making by hand is practically obsolete today and does not function generally as a part of industrial education. Much less can it be sanctioned as vocational agricultural education.

Toy making has value as general education and as preparation for the vocation of toy making but cannot be considered adequate preparation for the kind of work adult farmers do.

In order to determine what kinds of repair and construction work should be given prospective farmers it will be necessary to analyze it on the basis of: Is it the kind of work that successful farmers perform in that type of farming, in that particular region, or are there good reasons for believing that it is a thing that farmers of the region should do?

Materials That Should Be Used.—An analysis of the kinds of work done by farmers as revealed in this study shows that the bulk of repair and construction work is done in wood, but it also shows the desirability of using in addition such materials as concrete, iron and steel. Instead of limiting the work during the first year (or during longer periods of time as is sometimes the case in the schools) to work in wood, it would seem to be much better to give whatever work needs to be done irrespective of the materials involved. For example: if a class in poultry wishes to build a poultry house, why not teach the class how to put in a concrete foundation? Or if a boy is making a wagon jack, why not have him do the iron work on it as soon as it needs to be done instead of having him wait until next year or later when forge practice is scheduled for him?

Size of Work Undertaken.—Raising an acre of potatoes or keeping several hogs or cows is better preparation for general farming than growing a bed of dahlias and raising a few kittens or pups. Similarly, doing the man-sized repair and construction work involved in farming practice is better preparation for the latter vocation than making nothing but small objects. The skills developed are not identical, and the related knowledge attained is not the

same in the two cases. Consequently the practice of making small-sized models of things—in order to save material and time—is less desirable than making the same objects full size.

Educational Considerations Condition the Kind of Work to Be Given.—The kind of work, while conforming to the fundamental requirements of the vocation, may well be selected so as to correlate closely with the technical agriculture pursued at the time. That is, the psychological time in which to consider the repair or construction of a potato bin is when field crops are studied, and the time to pay attention to hog houses is when animal husbandry is taken up. There are other considerations which make it difficult to follow this practice at all times. In general it may be said that the work selected should grow out of, or at least fit in with the technical agriculture being pursued at the time.

Another educational factor influencing the kind of work undertaken at any given time is the learning difficulty involved. More knowledge is required than is at present available before an accurate classification on the basis of "learning difficulty" involved can be made of repair and construction work done by farmers. It is feasible, however, at the present time to group such work roughly in this way, and it is highly desirable to do it. Instead of having a fixed number of things for pupils to do it would seem to be better to have outlined a number of groups of objects, arranged roughly according to learning difficulties involved, and let the pupils choose what they wish to make from a number of things suggested.

It is not desirable to have a sequence of an absolute type. If the teacher has to begin with a bare room the first things required are saw horses and work benches. By careful planning and detailed explanations these can properly be made by boys fourteen years of age.

Standards of Workmanship.—Since the purpose of farm shop work is not to make carpenters, cabinet makers or blacksmiths, but to contribute a tangible part to the vocation of farming, the standards of workmanship ought to be those obtaining for the specific work in mind in good farm practice. On the whole, the work will not need to be as fine in quality as is much of the work done by carpenters and other mechanics. It is essential, however, to do the work as well as it needs to be done for the purpose it is to serve. It has been said that a farmer in farm shop work needs to be a

“Jack of all trades”. This is an unfair way of putting the matter. It is true that a general farmer is called upon to do a large variety of work, but there is no reason why we should not do this as well according to the standards obtaining in farming as a plumber does his work according to trade standards. A farmer can be as much of a master of his entire vocation as a mechanic is of his. If instruction in farm shop work is intimately related to the work the farmer needs to do, there is no reason why he needs to be a “Jack of all trades”, which implies that he can do only a passable quality of work with tools and materials used in repair and construction work.

The Kind of Shop That Is Desirable.—It is traditional practice in Pennsylvania schools to have forge practice in separate rooms from those in which work in wood is given. This has the advantage of keeping coal smoke and dust away from where wood is used. That is its chief advantage. The disadvantages are: either the forge equipment must be large enough to accommodate the entire class or it makes the teacher’s work difficult in that he has to supervise a part of his class in one room and the remainder in another. In order to overcome this latter difficulty and at the same time avoid coal dust and smoke it is possible to concentrate the work in one shop. In one corner two or three forges may be placed. These can be enclosed with a wire glass partition with wainscoating underneath. In another part of the shop a similar arrangement can be made for work with concrete and again for work in wood. If floor space is scarce, concrete work can be given entirely out of doors. The detailed shop lay-out will depend upon the space available, and the number of pupils that will be at work at one time. The general idea is that equipment can be reduced to a minimum where work in various materials can be given at the same time. Out of a class of fifteen pupils, three may be working at forges, three more may be doing related drawing in the shop, one may be using taps and dies, one may be cutting and threading pipe and seven may be working with wood. A farm shop arranged so this work can be carried on at one time under the supervision of one teacher will facilitate shop work on a project basis, and the cost of equipment will be considerably less than if separate shop units are established for the various materials that should be used.

Equipment.—Lists of minimum equipment that are suggested are given in Table 34 in the appendix. It has been pointed out that

the amount of equipment needed depends to quite an extent upon the way the work is organized—whether separate shop units are established or whether the equipment is all placed in one shop.

Many schools at present have Langdon or Stanley miter boxes, Stanley number 45 universal planes and back saws. Farmers do not have sufficient use for steel miter boxes and universal planes to warrant purchasing them. A “home-made” miter box of wood is quite ample. Back saws are used only very rarely by carpenters and not at all by farmers. They should have no place in farm shop equipment. They lead to wrong methods of work. The easiest and quickest way to use a saw is at an angle of 45 degrees to the surface to be cut. This is impossible with back saws on all material over a few inches in width. Similarly, bench hooks are not used in practical carpentry and are not used by farmers. They too ought to be done away with. Pupils are inclined to use them too much. It is better to encourage their doing much of the work on saw-horses.

There is also a tendency to use block-planes for smoothing and even for jointing lumber parallel to the grain. Block planes are built with blades set at a low angle in order to facilitate end-grain planing. They are not well suited for the former operations mentioned because of their small size. It is well to use smooth planes for surfacing and jack planes or jointers for joining lumber.

Quite frequently the use of try-squares is encouraged to the exclusion of the framing square. The latter tool is worthy of greater study and use than it is at present receiving in the agricultural schools of the state.

Arrangement of Shop Equipment.—Benches should be so arranged as to receive the best possible light the room affords. Light should come from the left and back as pupils stand in position to plane. The benches should be located also in such a way as to permit easy passage about the shop. It is desirable to have a part of the floor space free of benches so that larger objects may be assembled or erected on the shop floor, or on saw horses. It is desirable to have eight feet of bench space for each vise. It is desirable but not necessary to have as many bench spaces as there are pupils in the class.

Several schemes are in use, each having advantages, for taking care of shop tools. If the tool equipment is of minimum size for

the pupils concerned, it may well be housed in a cabinet or two, or if very small, the tools may be arranged on a wall board. In either case each tool should have a definite place that may be easily recognized.

The schemes just mentioned have this disadvantage. At the beginning and at the close of each shop period, there is likely to be more or less congestion around the cabinet or tool board, and some time is taken in getting and returning tools. In order to reduce this to a minimum, it is often found advisable to have some individual equipment which may be kept on, in or under the benches. It is easier to see that boys keep their tools sharp and less time is wasted in getting and returning tools with individual equipment. The amount of individual tool equipment that should be found in a given school depends largely on the financial resources of the school. Perhaps the minimum amount for the Pennsylvania schools may be equitably set at one dollar per pupil. It need not exceed ten dollars per pupil in any case.

Method in Farm Shop Work

The methods of instruction used by the supervisors of agriculture in teaching farm shop work differ quite as much as do the aims they gave for this work. (Figure 19). In one school the work was entirely on an exercise basis. The majority combined work on an exercise basis with work on the project basis.

Manual training ideals and practices are plainly responsible for the exercise method existing to some extent in the agricultural schools. If teachers of farm shop work would draw upon their practical farm experience for guidance they would not attempt to teach joinery on an exercise basis to farm boys. But there seems oftentimes to be a tendency for men with vocational experience, but without much pedagogical training, to discount their practical experience in favor of traditional practice obtaining in schools. A graduate of an agricultural college who may have had a course in joinery for three hours per week for one semester is thus likely to promote the ideals and methods he came in contact with in this short time rather than to use the methods that his practical farm experience would dictate.

Farm shop work that aims to develop socialized individuals through vocational efficiency will need to keep in mind fundamental

educational considerations. The work should be given in such a way as to:

1. Develop in pupils initiative and the power to think independently.
2. Guide pupils that their thoughts and acts are truly social and not narrowly selfish.
3. Develop the spirit of cooperation.
4. Lead pupils to have the problem-solving attitude.

The project method is one that is particularly well adapted to the realization of the aim stated for the following reasons:

1. It offers opportunity for individual purposing and planning.
2. It enlists, at the outset, the pupil's interest in the thing to be done, or act to be performed.
3. It gives opportunity for, and in many cases requires co-operation; it involves the opposite of the "stay at your bench and do as you are told" method.
4. The method is pedagogically superior to the exercise method of shop instruction in that the psychological rather than the so-called logical order (as conceived by trained adult minds), is followed.
5. It emphasizes immediate as distinguished from deferred values. To put it tersely: it involves a minimum of "cold storage" process.

The project method in farm shop work is analagous to the same method in technical agriculture. It requires the pupil, under guidance, to take the initiative in purposing a given piece of work that he later plans and executes. The pupil keeps records of time and material and seeks to develop general truths from the specific work undertaken.

Projects in farm shop work cannot be as large in terms of time or labor required as can projects in a major enterprise in farming, such as crop or animal production. They must be limited to the time allowed for such work in the general plan of agricultural education.

Organization of the Project Basis.—If instruction is to be given in the kinds of work successful farmers do, as revealed in this

study, it means that school instruction must not be limited to the kinds of work that can be given only in the school shop. In order to make the work as practical and worth while as possible the following plan is suggested:

The teacher visits every boy's home farm during the summer months when school is not in session, and when he needs to supervise the home-project work the boy is doing. The purpose of the visit is to go over the farm carefully with the boy and with his father in order to determine jointly what repair or construction work may be needed on the farm. From this the boy can, under guidance, make his selections.

If the pupils have had little experience with tools commonly used it will be desirable to have them select "jobs" that can be performed at the school. Relatively small objects such as watering troughs, farm gates or fruit ladders can easily be made by boys individually. Larger jobs such as hog or poultry houses may well be treated as class projects. They can be planned and cut to size in the school if that seems desirable so that little time is used in assembling them on the farms.

Some desirable kinds of work cannot well be done within the school building or grounds. For such work the pupils should be taken to particular farms where they can have the opportunity to do the work according to detailed directions given by the instructor or someone who understands the work.

Boys Who Do Not Live On Farms.—In some rural communities, particularly where oil wells or coal mines are found, there are boys taking agricultural work who do not live on farms. There are therefore no jobs for them to do for the home farm. Such pupils can be provided for satisfactorily in several ways. The farm shops in the schools should have a good variety of full sized models of objects such as farmers need to make. These objects serve a two-fold purpose: they stimulate boys to similar efforts, and they serve as illustrative educational material in both technical agriculture and farm shop work. Boys from other than farm homes can work on such objects to advantage. As an alternative they may do desirable kinds of work for other members of the class or for other people.

Mechanical Drawing as Related to Farm Shop Work

Aim or Purpose of Mechanical Drawing.—The first, and undoubtedly a most fundamental question to be considered when dis-

cussing contemplated educational work, is the one regarding the aim or purpose that such work is to serve. Traditionally much emphasis is placed by teachers of drawing in secondary schools (particularly in technical high schools) on technique, on the science of orthographic and isometric projection, and on lettering. From the standpoint of developing draftsmen this procedure is justifiable; from the point of view of preparing for farming it is not.

In mechanical drawing the vocational agricultural schools of Pennsylvania are laboring under the handicap of tradition—the tradition of city schools that have been carried over into the rural schools without much question as to whether or not the aims are truly the same in industrial and technical schools as compared with those whose chief concern is to prepare for happier rural life and more productive agriculture.

Farmers are occasional readers, not makers, of blue-prints. They ought to know enough about conventional representation so that they can understand working drawings dealing with farm subjects. They ought also to be able to make working sketches, for the latter are useful in conveying ideas to others, and are essential to practically all mechanical progress.

Instead of placing major emphasis on technique, and on the science of drawing the requirements of an agricultural career may be better served by the kind of instruction that aims at developing:

1. Ability to read working sketches and blue-prints.
2. Ability to make working sketches. (These need not be to scale, but must show all necessary views, dimensions, and notes).
3. Ability to write simple specifications to accompany sketches.
4. Ability to make working drawings to scale.

In developing ability to make working sketches it may be advisable to let pupils take advantage of all mechanical aids (such as T-square, and triangles) at hand. While it is probably advisable to use mechanical aids, such as instruments, cross-section and isometric paper in introducing work in sketching for farm boys, it is always to be remembered that the objective held in view is the ability to make clear free-hand sketches, and the transition should be made as quickly as possible.

Methods in Teaching Drawing.—It is highly desirable to have a predetermined plan for all repair and construction work undertaken in the farm shop. This may be in writing, in the form of a sketch, or drawing, or a combination of these.

Since pupils differ greatly in their ability to visualize and represent objects, it will be best not to use the same method of approach for all. Individual instruction is possible in all agricultural schools in the state.

To begin with, sketches needed in farm shop work may be supplied by the pupil himself, by a more capable pupil, or by the teacher. If a pupil has special difficulty with drawing, it may be best to let him make a sketch from an object that has already been made, or from the object that he has made from a sketch furnished him. More capable pupils will be able to make sketches without having the object before them or without having made the same. This latter ability should be developed in all pupils as rapidly as possible.

Medium to Use.—The time that can be devoted to drawing in a program of agricultural education is so limited in amount that most satisfactory results can probably be attained by limiting the rendering to pencil work only.

Cream or buff colored paper is less likely to show the effects of frequent handling in the shop than is white paper.

Soft pencils are better for sketching than are hard ones. Drawings made with soft pencils are more inclined to smear, however, and so for purposes of making sketches that will be handled much in shop work a medium hard pencil is preferable.

APPENDIX

Table 34

MINIMUM EQUIPMENT SUGGESTED FOR FARM SHOP WORK

I. Work in Wood (Required)

Item	Amount	Description
1	1	Brace, ratchet, 10" sweep.
2	1	Set Auger bits, $\frac{1}{4}$ " to 1" by 16ths, in wooden box.
3	8	Bit stock drills, 2 each $\frac{1}{8}$ ", $\frac{3}{16}$ ", $\frac{1}{4}$ ", one each $\frac{3}{8}$ ", $\frac{1}{2}$ ".
4	1	Each Combination countersink and gimlet bit No. 0, 1, 2.
5	1	Expansive bit, $\frac{1}{4}$ " to 3" cutters.
6	1	Each Screw driver bit, $\frac{3}{8}$ ", $\frac{1}{2}$ ".
7	1	Oilstone 1",x2"x8" combination faces.
8	1	Slipstone $4\frac{1}{2}$ "x2 $\frac{1}{8}$ "x $\frac{1}{8}$ ".
9	12	Chisels, socket firmer, beveled edge, 2- $\frac{1}{4}$ ", 1- $\frac{3}{8}$ ", 3- $\frac{1}{4}$ ", 1- $\frac{5}{8}$ ", 3- $\frac{3}{4}$ ", 1-1", 1-1 $\frac{1}{4}$ ".
10	1	Countersink, rose, bit brace shank.
11	1	Drawing knife, 8" blade.
12	1	Divider, with wing and extension leg.
13	1	File, auger bit.
14	6	File, saw, three square regular taper 5".
15	6	File, saw, three square extra slim taper, 5".
16	1	Glass cutter, turret head.
17	1	Grinder, carborundum or emery wheels 7 $\frac{1}{2}$ "x1 $\frac{1}{4}$ ", 1 each medium and fine. Foot power attachment.
18	*N	Hammer, Adze eye bell face nail hammers, weight 16 oz. Curved claw.
19	1	Hand axe, 4 $\frac{1}{2}$ " handled.
20	1	Level, 30" adjustable.
21	3	Nail sets, cup points, assorted sizes.
22	1	Oiler, drawn steel, copper plated, 3 $\frac{1}{2}$ " diam., 5" spout.
23	1	Plane, block, 5 $\frac{1}{2}$ "x1 $\frac{3}{8}$ ", lever adjustment.
24	**N/2	Plane, smooth, 9"x2", smooth bottom.
25	**N/2	Plane, jack, 14"x2", smooth bottom.
26	1	Plier, combination, 5".
27	1	Putty knife, 2" flexible blade.
28	1	Reamer, $\frac{1}{16}$ " to $\frac{1}{8}$ "x $5\frac{3}{4}$ ", bit stock shank.
29	*N	Rules, 2 ft. 4 fold, 1" wide, brass tips.
30	1	Saw, crosscut, 8 point, 26".
31	2	Saw, crosscut, 10 point, 22".
32	3	Saw, crosscut, 10 point, 24".
33	2	Saw, rip, 5 $\frac{1}{2}$ point, 26".
34	1	Saw, compass, 14".
35	1	Saw, coping, with 12 blades.
36	1	Saw set.

*N—Quantity of tools equal to the number of pupils in the class.

**N/2—Quantity of tools equal to half the number of pupils in the class.

Table 34 (Continued)

Item	Amount	Description
37	1	Saw jointer (made by pupils).
38	1	Saw clamp (made by pupils).
39	1	Saw file handle (made by pupils).
40	1	Screw driver, 2½" blade, slim.
41	1	Screw driver, 4" blade, regular.
42	1	Screw driver, 7½" blade, cabinet.
43	1	Sliding T bevel, 6".
44	1	Square, framing, body 24"x2", tongue 16"x1½".
45	1	Square, framing, body 24"x2", tongue 16"x1½". (Of standard make other than item 44).
46	**N/2	Square, try, 6" blade, steel.
47	*N	Screw, bench, wrought iron, 1" diam., 15" long.
48	1	Vise, blacksmiths' solid box, 4" jaw.
49	1	Wrench, monkey, 8".

Additional Desirable Equipment

1	1	Brace, 12" ratchet.
2	1	Chuck, capacity 0-½", 3 jawed, bit stock shank.
3	1	Hack saw, adjustable 8"-12", with 1 doz. 10" blades.
4	1	File, flat bastard cut, 8".
5	1	File, half round, bastard cut, 8".
6	1	File, cabinet rasp, 12".
7	1	File, bastard cut, 10" round.
8	1	File, mill, single cut, 8".
9	1	Set Cross cut tools.
10	1	Pair Level sights (to fit item 20).
11	1	Tape, 50 ft., ½" corded linen, graduated to fourths.

II. Work In Iron and Steel (Required).

1	1	Breast drill for bit stock shanks and round shank drills.
2	3	Cold chisels, 1 each ¾", ½", ⅝".
3	1	Hack saw, adjustable, 8" to 12" with 1 doz. 10" blades.
4	1	Hammer, ball pene, 10 oz.
5	1	Punch, center, machinist's octagonal ⅝".
6	1	Set Screw plates, taper taps dies and collets cutting ¼"-20, ⅝"-18, ¾"-16, 7/16"-14, ½"-13.
7	1	Wrench, monkey, 8".
8	1	Wrench, monkey, 10".
9	1	Wrench, alligator, 5⅝".

Additional Desirable Equipment

1	1	Anvil, 100 lb.
2	1	Chisel, cold, 2 lb.
3	1	Chisel, hot, 1¼ lb.
4	1	Forge, 30"x36" hearth, fan 12" diam., water tank and half hood.
5	1	Hammer, ball pene, 1½ lb.

*N—Quantity of tools equal to the number of pupils in the class.

**N/2—Quantity of tools equal to half the number of pupils in the class.

Table 34 (Continued)

Item	Amount	Description
6	1	Hammer, 2 lb., blacksmith's, 18" handle.
7	1	Hardie, $\frac{3}{4}$ "; blade $1\frac{1}{2}$ ".
8	1	Pair Tongs, "V" notched jaws for $\frac{1}{4}$ " stock, 18".
9	1	Pair Tongs, bolt tongs, 18".
10	1	Pair, Tongs, straight lip, 18".
11	1	Pair Tongs, general forging, flat jaws.
III. Pipe Fitting (Optional)		
1	1	Cutter, $\frac{1}{2}$ " to $2\frac{1}{2}$ " capacity.
2	1	Oiler, drawn steel, copper plated, diam. $3\frac{1}{2}$ ", 5" spout.
3	1	Stock and die, adjustable, cutting pipe sizes $\frac{1}{2}$ ", $\frac{3}{4}$ ", 1", $1\frac{1}{4}$ ", 2", right and left.
4	1	Vise, capacity $\frac{1}{2}$ " to $2\frac{1}{2}$ ".
5	1	Wrench, pipe, 10".
6	1	Wrench, pipe, 18".
IV. Work in Cement (Required).		
1	1	Edger, 6"x3", $\frac{3}{8}$ " radius.
2	1	Jointer, 9"x3".
3	1	Square angle tool, outside, 8"x $2\frac{1}{4}$ ".
4	1	Square angle tool, inside, 8"x $2\frac{1}{4}$ ".
5	1	Trowel, cementer's, $11\frac{1}{2}$ "x $4\frac{3}{16}$ ".
6	1	Trowel, pointing, 5".
V. Soldering and Babbitting (Optional)		
1	1	Chisel, half round nose, $\frac{1}{2}$ ".
2	1	Chisel, plugging, $\frac{5}{8}$ ".
3	1	Gasoline torch.
4	1	Shave hook, triangular.
5	1	Pair snips, $3\frac{1}{2}$ " cut.
6	2	Soldering coppers, weight 1 lb. each.
VI. Drawing Equipment (Required)		
1	3	Boards, white pine 20"x26"x $1\frac{3}{16}$ " with end ledge flush with surface of boards.
2	3	Compasses, pencil.
3	3	T Squares, pearwood blades 30", fixed heads.
4	3	Triangles, 6"-45°.
5	3	Triangles, 8"-60°.
6	3	Scales, architect's 12", triangular boxwood.
Additional Desirable Equipment		
7	1	Pencil sharpener.
8	1	Eraser shield, brass, nickel plated.
9	1	Pair Paper shears, 10".
10	1	Yard stick, maple.
11	1	Set instruments, containing ruling pen, bow pen, compass, and attachments.

VII. Work in Leather (Optional).

Item	Amount	Description
1	1	Awl, automatic sewing, with straight and curved needles
2	1	Awl, Harness maker's collar or drawing, 8".
3	1	Awl haft, 4".
4	1	Edging tool, 5".
5	1	Knife, leather, 4".
6	1	Knife, Harness maker's, round.
7	1	Paper needles, Harness maker's, assorted sizes.
8	1	Rivet set No. 1.
9	1	Rivet set No. 2.
10	1	Spring punch, revolving, 4 tubes.

VIII. Desirable

1	1	Fire extinguisher, brass finish, with wall bracket for support.
2	1	First aid kit.
3	1	Oily waste can, with self closing lid. 12" diam., 18" high.

Table 35

In order that farm shop work may be correlated as closely as possible with technical agriculture, a number of "jobs" have been grouped under heads used in the study of agriculture. The list was taken from this study. It is merely suggestive, and is not meant to be exhaustive. Some objects may well appear under several of the heads used.

The items in each group are so arranged that they appear in the order of the number of farmers per hundred who make these objects

I. Soils and Field Crops

1. Plank drag	8. Planting stick
2. Bins for grain	9. Grain bed
3. Evener	10. Seed corn curing frame
4. Corn crib	11. Ensilage rack
5. Crating	12. Seed corn tree
6. Land leveler	13. Seed corn shed
7. Road drag	14. Weight carrier

II. Animal Husbandry and Dairy Husbandry

1. Milking stool	15. Feeding trough for sheep
2. Jockey Stick	16. Rabbit coop.
3. Pig pen	17. Roughage feed rack for cattle
4. Horse manger	18. Ice house
5. Cattle manger	19. Wagon shed
6. Hog house	20. Roughage feed rack for swine
7. Feeding trough for swine	21. Pigeon house
8. Hay rack	22. Combination barn*
9. Horse drawn sled	23. Dairy barn*
10. Watering trough	24. Horse barn*
11. Smoke house	25. Milk record-sheet case
12. Dog house	26. Sheep barn*
13. Feeding trough for stock	27. Unloading chute for cattle
14. Brush and curry comb cabinet	

Note: Items marked with * are too large to build for school work, but may present desirable repair work.

III. Horticulture and Vegetable Gardening

1. Fruit ladder	6. Step ladder
2. Trellis for grapes	7. Bee hive
3. Garden marker	8. Bee hive seat
4. Trellis for tomatoes	9. Sack holder
5. Seed corn testing tray	10. Cabinet for seeds

Table 35 (Continued)

IV. Poultry

- | | |
|------------------------------|--------------------|
| 1. Nest for laying hens | 7. Chicken brooder |
| 2. Chicken coop | 8. Chicken crate |
| 3. Nest for setting hens | 9. Oats sprouter |
| 4. Feeding trough for chicks | 10. Egg tester |
| 5. Chicken feeder | 11. Trap nest |
| 6. Poultry house | |

V. General

- | | |
|---------------------|---------------------|
| 1. Wire fence | 17. Implement shed |
| 2. Farm gate | 18. Nail cabinet |
| 3. Board fence | 19. Wood shed |
| 4. Yard gate | 20. Vise handle |
| 5. Saw horse | 21. Batten door |
| 6. Mortar box | 22. Miter box |
| 7. Tool box | 23. Bread board |
| 8. Saw buck | 24. Kitchen stool |
| 9. Wagon box | 25. Kitchen sink |
| 10. Wagon jack | 26. Tool carrier |
| 11. Privy | 27. Saw clamp |
| 12. Wagon seat | 28. Wind'ass |
| 13. Flight of steps | 29. Wagon top |
| 14. Ironing board | 30. Lumber rack |
| 15. Well covering | 31. Kitchen bin |
| 16. House ladder | 32. Fireless cooker |

Table 36

SELECTED BIBLIOGRAPHY FOR FARM SHOP WORK

I. Books

(Books marked with * are to be purchased first)

Woodwork

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II.

A Selected List of Free Bulletins Containing Subject Matter of Value to
Farm Shop Work

Belgian Hares

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Birds

Bird Houses and How to Build Them, Farmers' Bul. 609, 1918.

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Egg Tester

Egg Candler, Ext. Bul. 1, 1916-1917, Ag. College, Ohio State Univ.

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Webb Publishing Co., St. Paul, Minn.
John Wiley & Sons, 432 Fourth Avenue, New York City.

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(Compiled from "List of Workers in Subjects Pertaining to Agriculture, Home Economics and Marketing". 1918-1919. U. S. Department of Agriculture).

Alabama.	Alabama Polytechnic Institute and Agriculture Experiment Station, Auburn.
Arizona.	College of Agriculture and the Agricultural Experiment Station of the University of Arizona, Tucson.
Arkansas.	College of Agriculture and Agricultural Experiment Station of the University of Arkansas, Fayetteville.
California	College of Agriculture and the Agricultural Experiment Station of the University of California, Berkeley.
Colorado.	The State Agricultural College of Colorado and the Agricultural Experiment Station, Fort Collins.
Connecticut.	Connecticut Agricultural College and the Storrs Agricultural Experiment Station, Storrs. Connecticut State Agricultural Experiment Station, New Haven.
Delaware.	Delaware College and the Agricultural Experiment Station, Newark.
Florida.	College of Agriculture and the Agricultural Experiment Station of the University of Florida, Gainesville.
Georgia.	Georgia State College of Agriculture, University of Georgia, Athens. Georgia Experiment Station, Experiment.
Idaho.	College of Agriculture and the Agricultural Experiment Station of the University of Idaho, Moscow.
Illinois.	College of Agriculture and the Agricultural Experiment Station of the University of Illinois, Urbana.
Indiana.	Purdue University (The School of Agriculture and the Agricultural Experiment Station), LaFayette.
Iowa.	Iowa State College of Agriculture and Mechanic Arts and the Agricultural Experiment Station, Ames.
Kansas.	Kansas State Agricultural College and the Agricultural Experiment Station, Manhattan.
Kentucky.	College of Agriculture and the Agricultural Experiment Station of the University of Kentucky, Lexington.
Louisiana.	Louisiana State University and Agricultural and Mechanical College and the State Experiment Station, University Station, Baton Rouge.

Maine.	College of Agriculture and Agricultural Experiment Station of the University of Maine, Orono.
Maryland.	Maryland State College of Agriculture and the Agricultural Experiment Station, College Park.
Massachusetts.	Massachusetts Agricultural College and Agricultural Experiment Station, Amherst.
Michigan.	The Michigan Agricultural College and the Agricultural Experiment Station, East Lansing.
Minnesota.	Department of Agriculture (School of Agriculture and Agricultural Experiment Station) of the University of Minnesota, University Farm, St. Paul.
Mississippi.	Mississippi Agricultural and Mechanical College and Agricultural Experiment Station, Agricultural College.
Missouri.	College of Agriculture and the Agricultural Experiment Station of the University of Missouri, Columbia.
Montana.	Montana State College of Agriculture and Mechanic Arts and the Agricultural Experiment Station, Bozeman.
Nebraska.	College of Agriculture and the Agricultural Experiment Station of the University of Nebraska, Lincoln.
Nevada.	College of Agriculture and the Agricultural Experiment Station of the University of Nevada, Reno.
New Hampshire.	New Hampshire College of Agriculture and the Mechanic Arts and the Agricultural Experiment Station, Durham.
New Jersey	State College of Agriculture and the Mechanic Arts and Agricultural Experiment Station of Rutgers College and the State University of New Jersey, New Brunswick.
New Mexico.	New Mexico College of Agriculture and Mechanic Arts and the Agricultural Experiment Station, New Mexico.
New York	New York State College of Agriculture and the Agricultural Experiment Station at Cornell University, Ithaca. New York State Agricultural Experiment Station, Geneva.
North Carolina.	North Carolina State College of Agriculture and Engineering, West Raleigh, and the Agricultural Experiment Station, Raleigh, and West Raleigh.
North Dakota.	North Dakota Agricultural College and the Agricultural Experiment Station. Agricultural College.
Ohio.	The College of Agriculture and of Veterinary Medicine, Ohio State University, Columbus. Ohio Agricultural Experiment Station, Wooster.
Oklahoma.	Oklahoma Agricultural and Mechanical College and the Agricultural Experiment Station, Stillwater.
Oregon.	Oregon Agricultural College and the Agricultural Experiment Station, Corvallis.
Pennsylvania.	The School of Agriculture and Agricultural Experiment Station, State College.

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- Washington. State College of Washington and the Agricultural Experiment Station, Pullman.
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