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A STUDY OF FARM ORGANIZATION IN SOUTHWESTERN MINNESOTA

BY

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A STUDY OF FARM ORGANIZATION IN SOUTH-WESTERN MINNESOTA

By George A. Pond and Jesse W. Tapp

INTRODUCTION

Farmers, in their efforts to make the best possible use of their resources, are constantly making changes, some at one point, some at others, endeavoring to benefit from their own experiences and the experiences of others as these come to their knowledge and are proved to be satisfactory. The differences observed in the organization and management of different farms, affecting the production of farm products, are the result of these changes. These differences are sometimes striking, but generally they are so moderate, so numerous, and so variable in their effect on final results as to obscure the relationships of the factors of the problem of which they are only parts.

The analytical study here summarized was undertaken in order to measure the effect of differences in methods and material resources on the efficiency of farm operations, so that farmers to whose farms the results apply may promptly and satisfactorily make such adjustments in their productive enterprises as will increase their returns. The farmers contributing the details of their operations live in Cottonwood and Jackson counties, Minnesota, and fairly represent the present general scheme of farm organization and operation in effect in that section of the state. Their present practice reflects their past experience and their theory of production economics, so far as circumstances have enabled them to put these into effect.

The discussion of the data is presented in three parts:

I. An account of the development of the agriculture of the area from the time of settlement, showing the changes in the crop and livestock enterprises with some of the main reasons therefor, and leading up to conditions under which farming is at present conducted.

II. A detailed statement and analysis of the amounts and distribution of labor and materials used in the production of the different crops and classes of livestock on the farms contributing data, and of the miscellaneous work incident to the operation of these farms.

III. A discussion of the principles involved in the application of the data to the constantly recurring problems of choice and combination of enterprises and their adjustment to changing economic conditions and to more local conditions on particular farms, together with illustrations.

PART I DESCRIPTION AND HISTORY OF AGRICULTURE OF THE AREA

LOCATION AND DESCRIPTION OF AREA

LOCATION

The farms studied are located in Cottonwood and Jackson counties, and are grouped about Windom, the county seat of Cottonwood County. This city had a population of 2123 in 1920. It is the principal market town of the community. The townships in which these farms are located are outlined on the state map, Figure 1.

MINNESOTA.

Fig. 1. Location of Area Studied

SOIL AND TOPOGRAPHY

The prevailing soil type in this area is a rich black boulder clay with a pebbly clay loam subsoil. By far the larger portion of the soils of Southwestern Minnesota is of this type. Small areas of outwash sand and gravel are found, but they contain sufficient clay to be fairly productive. Most of this area is quite level. Natural drainage has to be supplemented with tile on the majority of these farms in

order to make the entire area tillable every year. There is no natural timber except along the streams and near the lakes. Practically the entire acreage of every farm is tillable except some low, undrained areas that are pastured or cut for hay.

CLIMATE

Data covering the climatic conditions in the Windom area for the three years of this study and for the ten-year period are presented in Table I.

Fig. 2. Monthly Precipitation at Windom for 1920, 1921, and 1922, and 10-Year Average

The monthly distribution of rainfall for each of the three years and for the ten-year period is shown in Figure 2. Seventy-five per cent of the total precipitation normally falls during the growing season, and nearly 50 per cent in May, June, and July.

TABLE I
CLIMATIC CONDITIONS—WINDOM 1913-1922*

	1920	1921	1922	10-yr. av. 1913-1922 inclusive
Maximum temperature	94	95	100	95
Minimum temperature	-16	-16	-20	-21
Mean temperature, annual	46.0	48.4	47.1	44.6
Mean temperature, April 1 to Sept. 30...	62	66	65	62
Precipitation, April 1 to Sept. 30.....	23.14	21.46	12.42	21.77
Precipitation, Oct. 1 to March 31.....	8.63	4.17	8.25	6.95
Precipitation, total annual	31.77	25.63	20.67	28.72
Last killing frost in spring	May 2	May 15	Apr. 26	May 11
First killing frost in fall	Sept. 30	Oct. 7	Oct. 12	Sept. 30
Frost-free days	150	144	168	141

* U. S. Weather Bureau, Climatological Data, Minnesota Section. Data for years 1914 to 1918 are from records kept at Windom. Data for 1919 to 1922 were recorded at Worthington, thirty miles southwest of Windom.

HISTORY OF THE AGRICULTURE OF THE AREA

PURPOSE OF HISTORICAL STUDY

In order properly to understand the problems of farm organization which are found in the area at present, it is necessary to know something of the development of the area and the factors which made this development what it has been.

With the development of a new area, changes in the acreage of crops grown and the number and kinds of livestock kept are largely the result of expansion and of efforts to discover the lines of production best adapted to the soil and to climatic and other conditions of the area. Once the physical possibilities with respect to crop and livestock production become known, subsequent changes in the relative importance of different lines of production are the result of changes in economic conditions which affect the profitableness of different enterprises. The changes in prices or in conditions which affect the different enterprises may be only temporary or they may be more or less permanent. To appraise properly the significance of these changes as they occur or in advance of their occurrence is essential if the proper adjustments are to be made. There is frequently a considerable lag in the adjustments. Too often changes from one enterprise to another are made just when the relative advantage of these enterprises is beginning to be reversed.

A brief historical study of this area is presented in order to show how these adjustments have led to the present type of farming and to emphasize the importance of quickly making such adjustments as will allow a more profitable utilization of the factors of agricultural production.

SETTLEMENT AND AGRICULTURAL DEVELOPMENT

The agricultural development of Cottonwood and Jackson counties is quite typical of a large area at the northern limit of the corn belt bordering closely the region of scanty rainfall. In general, the trend has been for wheat to displace grazing on the open prairie and later for corn, oats, livestock and a more diversified type of farming to replace wheat. The development of this part of the state took place about two decades later than the development of Southeastern Minnesota.¹

Cottonwood County was created in 1857, but was not organized until 1870. One settler was found by the surveyors in 1853. Two families were living in the county in 1860. They were of foreign birth but came directly from neighboring states. All those who settled in the county prior to 1862 were driven out or killed during the Sioux outbreak of that year. By 1870 there were 535 inhabitants in the county. At this time there were 6377 acres of land in 143 farms but only 782 acres of improved land (Table II). Many of these early inhabitants came directly from Norway, Sweden, and other European countries, others from adjoining states, particularly Wisconsin and Iowa. Later a colony of Mennonites came to the eastern part of the county. Many of these or their descendants are still farming in the county.

TABLE II
POPULATION, NUMBER OF FARMS, LAND IN FARMS, AND VALUE OF LAND
COTTONWOOD COUNTY, MINN. 1860-1920

Year	No. of farms	Total land in farms, acres	Average acreage per farm	Percentage of total farm land improved	Value of land and buildings per acre	Population
1860	2	260	130	23.0	\$10.00	12
1870	143	6,377	45	12.3	6.54	535
1880	1082	171,413	158	40.6	14.86	5,533
1890	1142	208,078	182	59.8	13.49	7,412
1900	1568	370,715	236	92.2	26.33	12,069
1910	1580	371,496	235	91.2	50.11	12,651
1920	1801	380,043	211	90.7	153.11	14,570

The period of most rapid development in Cottonwood County was from 1870 to 1900. The railroad reached the county in the summer of 1871 and greatly facilitated the expansion which took place during the seventies. Between 1870 and 1900 the population increased from 535 to 12,069 and the number of farms from 143 to 1568. During this period the average acreage per farm was rapidly increasing as well as the improved acreage. Table II shows that there has been little change in the percentage of improved land in farms since 1900. The value of land and buildings per acre doubled from 1870 to 1880, de-

¹ The statistical study of the history of this region is confined to Cottonwood County. However, the development in Jackson County was not different in any important respect.

creased slightly from 1880 to 1890, and doubled again between 1890 and 1900. By 1900 the major part of the land in the county was in farms and of this 92 per cent was improved.

From 1900 to 1910 there was little change in the population of the county and no significant change in the number of farms, total land in farms, or average acreage per farm. Again the price of land almost doubled during a decade. The census of 1920 revealed a substantial increase in the number of farms with a corresponding decrease in the average acreage per farm. The total land in farms and improved land in farms increased slightly, while the price of land and buildings per acre increased from \$50 to \$153.

CHANGES IN ACREAGE OF IMPORTANT CROPS

The crops which have been most important in the development of Southwestern Minnesota are wheat, oats, barley, flax, and corn. Figure 3 shows the distribution of the total grain acreage from 1870 to 1922. During the period of expansion, from 1870 to 1900, the acreage of most of the grain crops was increasing. Changes in the relative importance of the different grain crops are shown in a general way by the changes in the percentage distribution of the total grain area in Figure 3.

The early settlers devoted most of their attention to the production of wheat, oats, and corn. From the beginning wheat occupied the most prominent place and with the exception of a few temporary changes because of grasshopper damage and unfavorable seasons continued to do so until about 1905. In 1873, 1874, 1875, and 1876, the small grain and corn crops were almost entirely destroyed by migratory grasshoppers, and as a result the percentage of the total grain acreage in wheat was reduced from 72.3 per cent in 1872 to 43.5 per cent in 1876. Corn increased in relative importance during this period. There has been no recurrence of grasshopper damage since 1876. The severe damage from this source caused the abandonment of many farms in the area. There was a 40 per cent decrease in the total grain area from 1875 to 1876. An unusually good wheat yield in 1877 encouraged a continuance of expansion, and again wheat overshadowed all other crops in importance.

The expansion which followed the disappearance of the grasshoppers was soon checked by a general decline in grain prices and a combination of circumstances which resulted in low wheat yields. The seasons of 1880 and 1881 were wet and unfavorable to wheat. There was a slight shift from wheat to corn on this account for three years. Also, wheat frequently returned a very low yield or failed entirely on land broken out of prairie one or two years. The growing of flax helped to remove

Fig. 3. Five-Year Moving Averages of the Percentage Distribution of Grain Acreage in Cottonwood County and of the December 1 Farm Prices of Grains in Minnesota, 1872-1920

this difficulty and this crop rapidly increased in importance during this period. From 1881 to 1886 flax occupied from 25 to 40 per cent of the grain acreage while wheat occupied from 19 to 38 per cent. The extent to which this expansion in flax acreage was the result of high prices of flax seed can not be determined, as no data on prices are available. The general expansion of the total grain acreage began again in 1886 and continued until the end of the nineties.

About 1900 there began a rapid shift away from wheat and toward oats and corn. Prior to this time the production of these crops was confined principally to the needs of the work stock, cattle, and hogs that were kept on the farms. Unfortunately no data are available on the yields of wheat obtained during the period when the shift was made from wheat to corn and oats. Interviews with men who were farming at that time seem to substantiate the opinion that low wheat yields as a result of rust damage, hot winds, and depletion of soil fertility were largely responsible for the rapid change. Among the farmers, much significance is attached to the fact that farmers came into the country from the corn area of Iowa during this period, bringing with them a knowledge of the proper practices in corn growing that resulted in improved corn yields. The development of varieties of corn better adapted to the conditions in the area was also a significant factor in the expansion of the corn crop in this region. For the last four years, 1919-22, during which figures on local yields of crops are available, those for corn, oats, and barley are relatively more satisfactory than those for wheat. There were no significant shifts in the relative prices of these crops during this period. Corn and oats began to replace wheat as cash grain crops about 1905, and since 1910 wheat has been relatively unimportant. Wheat prices have not been quoted on local markets since 1916.

CHANGES IN NUMBER AND KIND OF LIVESTOCK

The increase in the importance of the different classes of livestock in Cottonwood County, with a few exceptions, has followed the general trend of the expansion of the cultivated area. The classes of productive livestock that have been important in this area are hogs, dairy cattle, beef cattle, and sheep. The changes in the number of these from 1872 to 1920 and the prices of the different livestock products are shown in Figure 4.

Strictly speaking, there have never been many cattle of purely dairy type in the county. The cattle are principally of a type commonly known as "dual-purpose." During most of the decades, 1870 to 1890, the milk cows were kept primarily for the production of milk for home use and for the calves raised. Beginning with the latter part of the eighties, the production of butter for eastern markets has gradually increased in importance.

Fig. 4. Five-Year Moving Averages of Numbers of Livestock in Cottonwood County and of Prices of Livestock and Livestock Products, 1872-1920

From 1870 to 1890 the "other cattle"² consisted of oxen used for farm work and young stock raised from the cows kept. The expansion of the livestock enterprises during the early years was held in check by lack of feeds as a result of low yields during the period of grasshopper damage and unfavorable seasons, and also because of the inability to obtain loans for the purchase of breeding stock. Cattle have never been shipped into these counties for feeding on any large scale. The period of the early nineties was one of low beef prices and there was a temporary decline in the number of other cattle produced.

These dairy and other cattle provide a market for the supplies of natural pasture, wild and tame hay, and other non-marketable feeds common to the area. They also provide productive employment for labor during the winter months when little or no crop work can be done. These factors have no doubt been of much importance in the expansion of the dairy and mixed cattle enterprise.

It was not until the wheat crop began to decline in relative importance that the production of beef and pork reached any significant proportions. During the two decades, 1900 to 1920, the relative increase in the importance of hogs and "other cattle" is closely related to the rapid increase in the total production of corn (Fig. 5). Prior to

Fig. 5. Five-Year Moving Averages of Acreages of Corn, Numbers of Hogs and of "Other Cattle" in Cottonwood County, 1895-1920

1895 the hogs were kept primarily for the production of pork for local consumption. Since that time the two significant facts in the increase in pork production are the general increase in pork prices from 1900 to 1919 and the rapid increase in the production of corn.

² "Other cattle" includes all cattle other than cows.

Sheep were very important in this area from about 1880 to 1895. They were brought in to utilize the large areas of pasture that were not under cultivation. With the passing of the range pasture and the increase in improved land that took place during the nineties, there was a very rapid decline in the number of sheep.

It is evident that in response to changing conditions individual farmers have been continually making adjustments in the kind of crops and livestock produced. This has resulted in a complete shift from a system of cash grain farming with wheat as a major crop to a system of livestock and grain farming with corn and oats the principal crops and these largely marketed through the livestock. Conditions affecting the profits in different lines of production will continue to be dynamic. Consequently farmers who would secure the greatest continuous returns from their resources must constantly make adjustments in methods of conducting different enterprises and their relative size.

STUDY OF PRESENT DAY AGRICULTURE IN COTTONWOOD AND JACKSON COUNTIES

METHOD OF SECURING DATA

In order to determine how farmers might make these adjustments, an analysis has been made of the data showing the requirements of and returns from the different enterprises. These data were secured by the complete cost route method. The study was begun in March, 1920. Twenty-four farms in the vicinity of Windom, as nearly representative of the farms of the area as possible, were selected. The farmers made a record of all cash receipts and expenses as well as of the amount of labor used on different crops and livestock, amount of feeds fed to livestock, amount of crop and livestock production, etc. These records were collected by a route man stationed at Windom who visited each farm two or three times each week. Inventories were taken at the beginning and end of each year. All fields were accurately measured each year and the crop acreages determined. The data presented were obtained during 1920, 1921, and 1922. Of the 24 farmers who cooperated in the work each year, 6 moved away during the year and one failed to furnish usable records. During the three years, 65 complete farm records were obtained. Altogether, 36 different farms are included in this study. Records from 7 were obtained for three years, from 15 for two years, and from 14 for one year.

SIZE OF FARMS AND DISTRIBUTION OF CROP ACREAGE

The average size of the farms studied was 187 acres of which 137 acres were in crops, 40 acres in pasture, 5.5 acres in farmstead, and the rest in waste land. The total acreage is slightly less than the average

for the two counties, but the crop acreage is slightly greater. The distribution of crop acreage on these farms is shown in Table III. This distribution is also compared with the distribution for all farms in the two counties. The farms studied had more land in corn, less in wild hay, and less in such miscellaneous crops as wheat, buckwheat, soybeans, sorghum, beans, and potatoes, than did the two counties as a whole. However, they are probably as typical of the general type of farming in the area as any that could be selected.

TABLE III
DISTRIBUTION OF CROP ACREAGES ON FARMS STUDIED AND ON ALL FARMS IN
COTTONWOOD AND JACKSON COUNTIES

Crop	Farms studied*						All farms
	Total acreage	No. of farms grow- ing the crop	Acres per farm			Percent of total crop acreage	Percent of total crop acreage†
			Average	Maximum	Minimum		
Corn	3852	65	59	130	8	43.4	32.2
Oats	2818	64	44	107	8	31.7	33.9
Tame hay ...	954	48	20	60	1	10.7	8.8
Wild hay ...	507	38	13	39	1	5.7	11.9
Barley	317	18	18	39	4	3.6	3.4
Rye	194	11	18	35	6	2.2	2.7
Alfalfa	124	21	6	14	2	1.4	0.2
Flax	69	6	12	30	2	0.8	1.5
Miscellaneous..	48	42	1	12	1	0.5	5.4

* Average for 65 farm years, 1920 to 1922 inclusive.

† Data from the U. S. Census for 1919.

CROPPING SYSTEMS AND ROTATIONS

Corn is the principal crop grown in the area and the cropping system is built around it. Altho no definite rotation is followed, the usual practice is to follow small grain with corn and keep the same land in corn for two years in succession. Fifty-four per cent of corn followed small grain, 34 per cent followed corn, and 12 per cent followed a grass crop. There was an increasing use of grass land for corn. In 1921 and 1922 three times as large a percentage of corn was planted on sod land as in 1920. Oats and barley usually follow corn. In 1922, 95 per cent of the oats followed corn. This practice is also increasing as only 76 per cent followed corn in 1921 and 67 per cent in 1920. Rye follows other small grain, as the corn crop is not harvested in time to seed the rye. Flax is grown on wild hay or pasture land that has just been broken. It is the first crop on new breaking but is seldom grown on land that has previously been cultivated.

DESCRIPTION OF LIVESTOCK

The number and kinds of livestock on the farms studied are shown in Table IV. A comparison is also made between these farms and the average for all farms in the two counties. The farms studied are somewhat more heavily stocked than the average farm of these counties.

TABLE IV

NUMBER OF LIVESTOCK PER FARM FOR THE FARMS STUDIED AND FOR ALL FARMS IN COTTONWOOD AND JACKSON COUNTIES

Kind of stock	Farms studied*					All farms†	
	Farms reporting	No. of head	No. per farm reporting			Average all farms	Average per farm
			Average	Maximum	Minimum		
Work horses..	65	404	6.2	10.9	3.4	6.2	6.2
Colts	43	110	2.6	7.7	0.1	1.7	1.5
Cows	65	684	10.5	29.8	3.1	10.5	9.6
Other cattle..	65	1292	19.9	74.2	2.9	19.9	13.4
Swine	65	2360	36.3	128.4	9.1	36.3	30.0
Poultry	65	8078	124.0	300.0	25.0	124.0	112.0
Sheep	28	711	25.4	59.3	1.7	9.1	2.6

* Average for 65 farm years, 1920 to 1922 inclusive.

† Data from U. S. Census, as of June 1, 1920.

Work horses.—Horses are the principal source of motive power on the Windom farms. Two or three farms used tractors, averaging 119 hours of field work and 12 hours of belt work per year. One farm in 1921 and two farms in 1922 used a truck for some hauling. Practically every farm has a car that is used for light hauling, such as delivering cream or purchasing supplies. Otherwise all field work and hauling are done by horses. These horses are practically all of common grade stock, averaging from 1300 to 1400 pounds in weight.

Colts.—In addition to the work horses, a few colts are raised on most of the farms, largely for the purpose of maintaining a supply of work horses, and any surplus is sold. They are not generally sold, however, until after they have been broken and worked for some time. Seven colts were foaled on all farms each year of this study. These would little more than offset the loss by death of work horses.

Cattle.—There are few strictly dairy cattle on these farms. Most of the cattle are either of beef breeding or of the type often classed as "dual purpose." For the purpose of discussion, all cattle are divided into three classes, dairy cows, young dairy stock, and mixed cattle. "Dairy cows" includes all cows in those herds in which the calves are weaned soon after birth and the cows are milked by hand throughout lactation. "Young dairy cattle" includes all cattle on these same farms not listed as dairy cows.³ As soon as a heifer freshens she is transferred from young dairy cattle to dairy cows and so classified during the rest of her life in the herd, whether milking or dry. "Mixed cattle" includes all cattle on those farms where the cows are allowed to nurse their calves during part or all of their lactation. In these herds part of the cows may be milked by hand all the time and most of them, except the purebred beef cattle, are milked by hand at least part of the

³ "Young dairy cattle" correspond to "other cattle" as defined in footnote 2, page 18.

time. However, since a complete record of the production for the herd could not be obtained, they are not classed with the dairy cows for which complete milk production records are available.

Most of the animals in both dairy and mixed herds are ordinary cattle. The cows are only fair milkers and few beef steers of high quality are produced. They are fairly representative of the great majority of cattle raised in that general area.

Swine.—Swine were the largest source of income during the three years of this study. They have furnished more than one third of the gross income. Swine are the best bred and represent the best type of any class of stock in this area. Purebred boars are used on all farms and purebred sows also on many of them.

Sheep.—Sheep are a minor enterprise on most farms. Usually there are so few that they require little care and can pick up most of their living about the farm and farmstead.

Poultry.—Poultry is only a side line on these farms. Enough chickens are raised to supply the table with eggs and poultry and to have a small surplus to exchange at the store for groceries and supplies. Most of the flocks are of general purpose, or American, breeds.

PART II

UNIT REQUIREMENTS OF LABOR AND MATERIALS FOR
CROPS AND LIVESTOCK

CROP REQUIREMENTS

DEFINITION AND DESCRIPTION OF REQUIREMENTS

In any study of the crop phase of farm organization it is essential to know the basic unit requirements for the production of the various crops commonly grown in the area studied.⁴ These data include hours of man labor, hours of horse labor, quantities of seed, twine, and other material required in the production of the several crops. It is also important to know the seasonal distribution of the labor and the probable days available for the various crop operations. As any study of unit requirements shows a wide variation on different farms even in the same locality where soil and climatic conditions are quite uniform, these data are presented in tables showing the range of requirements for individual farms.

In addition to the range of requirements for a single year⁵ the average for that year is shown and the average for the preceding and succeeding years. The factors causing these variations are mentioned when possible, in order that a farmer wishing data applicable to his own farm may find requirements covering conditions similar to those under which he is working. Data showing standard requirements are also given. These standard requirements represent what may be reasonably expected for cultural practices most characteristic of the area, under good management. They are lower than the average, mean, or modal requirements, and represent approximately the attainment of those farmers who are found among the upper 25 per cent in the scale of labor efficiency as measured by low labor requirements for a given operation. They are intended to serve as a standard by which the individual farmer may, by comparison with his own requirements, check the effectiveness with which he utilizes his labor in performing the various operations.

⁴ The term "unit requirement" as used in this bulletin implies unit consumption or expenditure of labor, seed, feed, and other factors of production under conditions as they exist rather than that this consumption or expenditure is a fixed physical necessity. For example, if 3 man hours and 12 horse hours per acre are listed as the labor requirement for plowing on a given farm, this simply means that this particular farmer expended this amount of labor in plowing an acre of land.

⁵ The range of requirements for 1921 is presented in unit requirement tables. The middle year of the three was selected in order that a comparison with the preceding and succeeding years might be shown. On account of the replacement of some farms in the study one year by others the next, there is much less difference in the composition of the group between two succeeding years than between 1920 and 1922. Then, too, 1921 was more nearly a normal year from the standpoint of climatic conditions. A wet, cold spring in 1920 delayed the whole season's program of work and interfered abnormally with seedbed preparation. The summer of 1922 was so hot and dry as to make that season abnormal, especially for hay and corn.

In addition to the time actually spent in motion in the field, a reasonable allowance is made for time spent in going to and from fields, adjusting machinery, making necessary minor repairs on harness and machinery in the field, and resting teams; during showers, and other losses of time necessarily incident to the operation.

LABOR REQUIREMENTS FOR SEEDBED PREPARATION

Since the operations involved in preparing the seedbed—plowing, disking, and harrowing—require practically the same amount of labor to cover an acre once regardless of the crop for which the ground is being prepared, the labor requirements are presented in a table independent of the crop tables. Both man and horse labor requirements for these three operations on the basis of one acre covered, are shown in Table V.

CAUSES FOR VARIATION IN LABOR REQUIREMENTS FOR SEEDBED PREPARATION

Size and type of implement and power unit.—The seven farms having the lowest man labor requirements per acre used gang plows largely. Two-bottom gangs and 4- or 5-horse teams were used except on Farms 10 and 13, where part or all of the plowing was done with 3-bottom gangs and tractors. Of the other fifteen farms, 16-inch sulky plows and 3-horse teams were used on all but three. Both man and horse labor requirements were lower where gang plows were used. Man labor requirements were also lower where larger teams were used. On Farm 3, with the lowest man labor requirement, most of the plowing was done with a 5-horse team. Man labor requirements for harrowing were, in general, less where 4-horse teams were used than where 3-horse teams were used, increasing as the ratio of man labor to horse labor increases.

The size of the horses also affects the rate of plowing. The number of hours of horse labor required to plow an acre on Farm 14 was nearly 50 per cent greater than on Farm 4, altho there was considerable sod plowing on the latter and only stubble plowing on Farm 14. The land on Farm 4 was plowed more deeply. The lower horse labor requirements on Farm 4, in spite of the more difficult plowing, were due in part at least to the fact that four horses, averaging 1800 pounds in weight, were used on a 14-inch two-bottom gang plow, while five horses were used on the same sized implement on Farm 14, but the horses averaged less than 1400 pounds in weight. Low labor requirements for disking on Farm 4 are likewise caused by the use of large horses.

TABLE V
MAN AND HORSE LABOR REQUIREMENTS PER ACRE, BY OPERATIONS, FOR SEEDBED
PREPARATION, 1921

Plowing			Disking			Harrowing		
Farm No.*	Hours per acre		Farm No.*	Hours per acre		Farm No.*	Hours per acre	
	Man	Horse		Man	Horse		Man	Horse
3	1.81	8.60	13	0.33	0.09§	3	0.19	0.76
10	1.94	8.18†	3	0.45	1.80	18	0.19	0.76
13	2.17	||	10	0.43	1.98	9	0.22	0.81
1	2.19	8.68	1	0.47	1.88	7	0.23	0.98
6	2.32	9.43	4	0.48	1.85	13	0.23	0.87
2	2.35	9.90	7	0.49	2.26	10	0.23	1.13
4	2.35	10.60	2	0.50	1.90	5	0.23	0.83
19	2.96	11.59	11	0.50	1.73	1	0.24	0.84
11	2.99	9.59	5	0.51	2.04	4	0.24	0.96
8	3.06	11.37	20	0.53	1.86	8	0.26	0.92
22	3.12	12.48	6	0.54	2.18	2	0.26	1.04
12	3.12	13.95	9	0.55	2.50	6	0.27	1.04
7	3.13	11.95	19	0.57	2.76	20	0.27	0.94
18	3.21	9.63‡	14	0.58	2.90	12	0.29	0.92
16	3.22	10.64	8	0.58	2.26	19	0.29	1.12
5	3.23	10.94	16	0.59	2.00	17	0.32	1.29
21	3.27	10.03	12	0.60	2.31	21	0.34	0.95
9	3.31	13.78	18	0.62	2.71	16	0.35	1.31
14	3.33	15.73	15	0.63	2.52	14	0.35	1.41
15	3.47	10.25	17	0.68	2.62	11	0.39	1.16
20	3.66	10.98	22	0.71	2.70	15	0.46	1.28
17	4.34	14.29	21	0.84	2.97	22	0.46	1.84
Averages¶			Averages¶			Averages¶		
19 farms			21 farms			21 farms		
1921	2.83	10.94	1921	0.54	2.20	1921	0.27	1.02
17 farms			19 farms			20 farms		
1920	2.66	9.73	1920	0.59	2.40	1920	0.29	1.11
18 farms			20 farms			21 farms		
1922	2.95	11.40	1922	0.52	2.23	1922	0.29	1.10
54 farm			60 farm			62 farm		
years	2.81	10.69	years	0.54	2.26	years	0.29	1.08

* Farms are listed in order of man labor requirements, beginning with the lowest.

† In addition to the horse hours, 0.14 tractor hours per acre were used for plowing.

‡ In addition to the horse hours, 0.41 tractor hours were used per acre for plowing.

§ In addition to the horse hours, 0.31 tractor hours per acre were used for diskings.

|| Instead of horse hours, 2.17 tractor hours per acre were used for plowing.

¶ Data from farms using tractors are omitted from these averages.

On the ten farms having the lowest labor requirements for harrowing, 4-section harrows cutting from 22 to 26 feet were used on all but one. Of the ten with the highest labor requirements, a 22-foot harrow was used on one, a 20-foot on another, and smaller ones on the rest. The man labor requirement for diskings on Farm 13 was low on account of the use of a tractor and tandem disk.

Size and shape of fields and distance from farmstead.—The lowest labor requirements are found on the farms having the largest fields. On Farms 1, 3, and 6, having the lowest labor requirements for plowing

with horses, the average size of the fields was 39 acres. On Farms 15, 17, and 20, with the highest labor requirements, the average was 13.5 acres. The distance of the fields from the farmstead also affects labor requirements. On Farm 5, altho the fields were large and the horses were much larger than the average, the labor requirements were high because the fields composing about one third the acreage plowed were nearly two miles from the farmstead, while on most of the farms few fields were farther than a quarter of a mile.

On Farms 1, 3, and 4, with low labor requirements for disking, the fields averaged 27.25 acres; and on Farms 17, 21, and 22, having high labor requirements, the average size of field was only 8.5 acres. Much time is lost in turning and in working the headlands, on the smaller fields.

Type of plowing.—Sod plowing requires more labor than stubble plowing. Most of the plowing included in this study is stubble plowing. The high labor requirements on Farm 17 are due in large measure to the fact that the acreage plowed included some permanent pasture with a tough bluegrass sod.

STANDARD REQUIREMENTS PER ACRE FOR SEEDBED PREPARATION⁶

The following are suggested as standards of accomplishment in seedbed preparation.

Operation	Equipment	Hrs. of labor		Acres covered in 10-hour day
		Man	Horse	
Plowing	2-bottom gang plow and 5 horses	2.0	10.0	5
	16-inch sulky plow and 3 horses	3.3	10.0	3
Disking	8-foot disk and 4 horses	0.5	2.0	20
Harrowing	22-foot harrow and 4 horses	0.2	0.8	50

These standards can easily be attained on farms having large implements, large teams, and large fields conveniently located in relation to the farmstead. The plowing requirement is for stubble plowing. It would have to be increased for sod plowing according to the toughness of the sod. The usual depth of plowing in the Windom area, 5 to 6 inches, is assumed in setting these standards.

FALL PLOWING

Approximately two-thirds of all plowing on these farms is done in the fall for the following year's crop. In presenting graphically the seasonal distribution of labor on individual crops, this fall plowing will not be shown, as it is not done in the year the crop is grown. In order, however, that its place in the seasonal labor program may be known, distribution of fall plowing labor, by days, for one farm is shown in Figure 6.

⁶ See discussion of standard requirements on pages 23 and 24.

Fall plowing is spread over a considerable period of time. It may be begun in July, as soon as small grain is stacked or threshed and continued till the ground freezes, in November. However, on these farms most of it is usually done during two distinct periods: (1) the latter part of August after stacking and shock threshing are finished and before silo filling begins; (2) the latter part of September and the early part of October after silo filling is finished and before corn husking begins.

Fig. 6. Distribution of Man Labor on Forty Acres of Fall Plowing

CORN

USUAL PRACTICES IN CORN PRODUCTION

All land for corn is plowed. Practically all the small grain and grass land is fall plowed for corn. Forty per cent of the corn acreage is spring plowed, but this land was mostly in corn the previous year and the corn was not husked in time for fall plowing. Fall plowing is much preferred and is done if time permits, as it relieves some of the rush in the spring and makes earlier planting possible. All but about 17 per cent of the corn land, whether spring plowed or fall plowed, is disked in the spring. The fall plowing is usually disked twice and the spring plowing once. Some land is disked three times, but one and a half times represents the average or usual custom.

In the three years covered by this study, 73 per cent of all corn was husked from standing stalks. Most of this was husked by hand, altho a mechanical picker was used on a small acreage. Eleven per cent was hogged-off. This latter practice is increasing rapidly. Nearly twice as much corn was hogged-off in 1922 as in 1920. One farm hogged-off 26 acres. Half of the farms have silos and 11 per cent of all corn is siloed. The other 5 per cent is cut and fed in the bundle.

All corn land is harrowed before planting. Half of it is harrowed only once, the rest is covered 2, 3, or 4 times. The average number of harrowings before planting is 1.75. From 85 to 90 per cent of all corn is checked in as hill corn. The rest is drilled in. Drilled corn is usually planted more thickly than checked corn and is used largely for silage or is planted late and cut for fodder. Four-fifths of the total acreage is harrowed at least once after planting and about 40 per cent of this

is harrowed twice. On one third of the farms blind cultivation is practiced. This practice is usually applied only to the earlier plantings and only 18 per cent of the total acreage is given blind cultivation. Commonly 3 cultivations are given after the corn is above ground. About one quarter is cultivated 4 times and a small amount 5 and 6 times. A small acreage of the planted drilled corn is cultivated only twice. Most farmers in this area plan to cultivate their checked corn 4 times, but weather conditions and the press of other work usually prevent the full accomplishment of this on the whole acreage. For the entire acreage the average number of cultivations, including blind cultivation, is 3.5.

LABOR REQUIREMENTS FOR CORN HUSKED FROM STANDING STALKS

Labor requirements for corn husked from standing stalks are presented in Tables VI and VII. The acreages of corn given in these tables are the total for the farm and include silage, fodder, and hogged-off corn as well as that husked from standing stalks. Causes for variations in the time spent on seedbed preparation have already been discussed. The number of hours for each operation in these tables is the total for that operation, whether it was performed once or repeated and does not represent a once-over figure as did those in Table V. Where the operation is repeated, the number of times is indicated in the column following the hour figures.

CAUSES FOR VARIATIONS IN LABOR REQUIREMENTS FOR CORN HUSKED FROM STANDING STALKS

Size and type of equipment and of power unit.—All corn was planted with a 2-row horse-drawn planter. The only variation in the planting operation due to equipment was the difference in the time required for drilling corn as compared with checking it. The time spent in stretching the check-rower wire increased the time required per acre for planting.

On Farm 10, which had the lowest man labor requirements per acre for one cultivation, a 2-row cultivator with 4 horses was used almost exclusively. On Farm 17 the man labor requirements were also cut down by the use of a 2-row cultivator. The 2-row machine, however, increased the horse labor requirements somewhat. On all other farms, single-row 2-horse cultivators were used.

TABLE VI

MAN LABOR REQUIREMENTS PER ACRE, BY OPERATIONS, FOR CORN HUSKED FROM STANDING STALKS, 1921

Farm No.*	Acres per farm†	Yield per acre, bu.	Plowing, hours per acre	Disking		Harrowing		Planting	Cultivating		Husking	Total
				Hours per acre	Times over	Hours per acre	Times over		Hours per acre	Times over		
10	53	34	1.98‡	0.73	1.55	0.69	2.75	0.91	2.70	2.62	5.64	12.65
3	92	38	1.81	0.52	1.28	0.47	2.49	0.60	3.70	3.16	5.82	12.92
7	61	29	3.03	0.50	1.00	0.53	2.41	0.59	3.72	3.00	4.55	12.92
18	29	40	3.25‡	1.50	2.00	0.58	2.65	0.80	4.14	2.67	4.28	14.55
2	69	31	2.54	0.41	0.70	0.88	2.93	0.71	4.74	3.00	5.85	15.13
13	55	56	2.18§	0.58‡	1.67	0.58	2.22	0.73	3.99	3.00	7.73	15.79
6	72	55	2.31	0.45	0.80	0.65	2.50	0.82	3.99	2.89	7.78	16.00
19	44	48	3.01	0.76	1.33	0.61	2.12	0.81	3.85	2.81	7.24	16.28
20	30	55	3.66	0.85	1.88	0.85	3.26	0.73	4.12	2.80	7.08	17.29
11	56	53	3.01	0.23	0.48	1.23	3.00	1.06	4.69	2.91	8.12	18.34
1	96	50	2.24	0.69	1.65	0.76	3.17	0.61	3.24	2.28	11.46	19.00
5	83	52	3.23	1.00	2.00	0.72	3.11	0.73	4.11	2.67	9.93	19.12
22	21	41	2.30	1.20	1.41	1.80	3.46	1.62	5.25	2.84	7.59	19.76
16	42	39	3.23	0.31	0.56	1.34	3.72	0.91	4.91	3.34	9.97	20.67
9	62	41	3.30	1.26	2.48	0.39	1.87	0.62	6.20	4.84	9.18	20.95
8	40	60	3.28	1.06	1.60	0.72	2.75	0.81	6.64	4.00	8.72	21.23
4	85	45	2.35	0.66	1.65	0.72	2.88	0.71	4.47	3.19	12.72	21.63
17	32	53	4.34	1.38	2.13	0.81	2.45	0.72	4.80	4.00	9.77	21.82
12	40	51	3.35	1.86	3.00	0.35	1.00	1.00	8.85	5.00	7.85	23.26
15	55	44	3.47	0.88	1.31	1.30	2.77	0.85	5.44	3.11	11.84	23.78
14	52	58	3.33	0.90	1.96	1.23	3.41	0.86	6.52	4.00	14.82	27.66
Averages												
17 farms, 1921||	57	46	2.87	0.95	1.82	0.79	2.74	0.77	4.72	3.23	8.77	18.87
18 farms, 1920||	57	38	2.70	0.92	1.54	0.94	3.02	0.84	5.33	3.60	7.96	18.69
18 farms, 1922||	66	33	3.02	0.81	1.56	0.75	2.59	0.74	5.19	3.79	6.66	17.29

* Farms are listed in order of total man labor requirements, beginning with the lowest.

† Total corn acreage on farm.

‡ Tractor used for part of this operation.

§ Tractor used for all plowing.

|| Data from farms using tractors are omitted from these averages.

TABLE VII

HORSE LABOR REQUIREMENTS PER ACRE, BY OPERATIONS, FOR CORN HUSKED FROM STANDING STALKS, 1921

Farm No.*	Acres per farm†	Yield per acre, bu.	Plowing, hours per acre	Disking		Harrowing		Planting	Cultivating		Husking	Total
				Hours per acre	Times over	Hours per acre	Times over		Hours per acre	Times over		Hours per acre
10	53	34	8.41‡	3.64	1.55	3.44	2.75	1.82	10.43	2.62	12.98	40.72
3	92	38	9.60	2.10	1.28	1.89	2.49	1.20	7.40	3.16	9.37	31.55
7	61	29	12.56	2.64	1.00	2.24	2.41	1.18	7.44	3.00	9.10	35.16
18	29	40	8.56¶	6.48	2.00	2.33	2.65	1.60	8.28	2.67	12.90	40.15
2	69	31	10.30	1.62	0.70	3.52	2.93	1.42	9.48	3.00	11.55	37.89
13	55	56	....	0.38§	1.67	2.35	2.22	1.49	7.98	3.00	15.61	27.75
6	72	55	9.29	1.79	0.80	2.48	2.56	1.61	8.12	2.89	15.14	38.43
19	44	48	11.88	3.60	1.33	2.35	2.12	1.62	7.90	2.81	14.34	41.69
20	30	55	10.98	3.38	1.88	3.06	3.26	1.46	8.23	2.80	13.38	40.49
11	56	53	9.64	0.71	0.48	3.57	3.00	2.12	9.57	2.91	14.47	40.08
1	96	50	8.85	2.77	1.65	2.44	3.17	1.22	6.48	2.28	12.25	34.01
5	83	52	10.94	4.00	2.00	2.55	3.11	1.35	8.22	2.67	13.35	40.41
22	21	41	9.20	4.48	1.41	7.20	3.46	3.24	10.51	2.84	15.18	49.81
16	42	39	10.66	0.94	0.56	4.91	3.72	1.82	9.82	3.34	19.37	47.52
9	62	41	13.92	6.18	2.48	1.57	1.87	1.14	12.58	4.84	18.20	53.69
8	40	60	13.16	4.22	1.60	2.39	2.75	1.62	13.28	4.00	16.13	50.80
4	85	45	10.60	2.56	1.65	2.88	2.88	1.42	8.93	3.19	21.67	48.06
17	32	53	14.29	5.24	2.13	3.18	2.45	1.44	11.12	4.00	19.54	54.81
12	40	51	15.43	6.90	3.00	1.23	1.00	2.00	17.70	5.00	13.49	56.75
15	55	44	10.25	3.51	1.31	3.55	2.77	1.70	10.88	3.11	11.67	41.56
14	52	58	15.73	4.51	1.96	5.05	3.41	1.72	13.04	4.00	17.65	57.70
Averages												
17 farms, 1921¶	57	46	11.20	3.91	1.82	2.88	2.74	0.14	9.53	3.23	14.07	41.73
18 farms, 1920¶	57	38	10.91	3.76	1.54	3.47	3.02	1.67	10.69	3.60	13.76	44.26
18 farms, 1922¶	66	33	11.54	3.56	1.56	2.90	2.59	1.49	10.57	3.79	11.90	42.48

* Farms are listed in order of total man labor requirements, beginning with the lowest.

† Total corn acreage on farm.

‡ In addition to the horse hours, 0.12 tractor hours per acre were used for plowing.

§ In addition to the horse hours, 2.18 tractor hours per acre were used for plowing and 0.54 tractor hours for disking.

¶ In addition to the horse hours, 0.66 tractor hours per acre were used for plowing.

|| Data from farms using tractors omitted in computing these averages.

The use of a mechanical corn picker resulted in low man labor requirements for husking on Farm 18. Some saving in horse labor occurred. Low labor requirements for husking on Farm 10 were in part due to the use of a mechanical picker on part of the acreage. Man labor is saved in husking by the use of only one man with a team. On Farms 1, 14, and 15 two men worked with one team in husking and altho the horse labor requirements per acre were low, the man labor requirements per acre were among the highest in the group.

Size and shape of fields and distance from farmstead.—Labor requirements for cultivation are lowest on large, well shaped fields. On Farms 3, 7, and 13, which used the least number of hours of man and horse labor for cultivating one acre with a 1-row cultivator, the average size of field was 26 acres and the average length 92 rods. On Farms 8, 15, and 22, with the highest labor requirements, the average size of field was 8.25 acres and the average length 52 rods. The labor requirements on Farm 15 are further increased by the distance of the fields from the farmstead. More than half the corn land was more than a mile from the farmstead.

Quality of labor.—On Farm 1, altho most of the operations were performed with less labor than on the majority of the farms, the man labor requirement per acre for husking was one of the highest. This work was done by members of the family and included woman and child labor, whereas on most farms the husking was done by experienced man labor.

Yields.—Except for husking, there was no marked relation between yield and labor requirements. In general the labor requirements for husking increased with increased yields. This tendency is especially evident from a comparison of the average requirements for the three years.

Number of times operations are performed.—The effect on labor requirements of repeating an operation is quite apparent in case of cultivating. On Farm 9 the man labor required for one cultivation was among the lowest in the group, but the large number of cultivations, 4.84, brings the total requirement for cultivating up among the highest. The same increase is apparent in a less degree in harrowing and disking.

LABOR REQUIREMENTS FOR SILAGE CORN

The labor requirements for silage corn are presented in Tables VIII and IX. Since the operations on the corn crop prior to harvesting are the same regardless of the method of harvesting, this labor is included as one item. This is taken from Tables VI and VII and includes all labor prior to husking. It has already been considered in the discussion

of those tables. The item of "filling silo" includes all labor involved in hauling the corn to the silo, filling the silo, packing the silage, and any incidental operations.

TABLE VIII
MAN LABOR REQUIREMENTS PER ACRE, BY OPERATIONS, FOR SILAGE CORN, 1921

Farm No.*	Acres per farm	Yield per acre, tons	Before cutting, hours per acre	Cutting, hours per acre	Filling silo, hours per acre	Total hours per acre
16	9	6.1	10.70	0.98	8.00	19.68
7	7	8.9	8.37	1.08	12.77	22.22
4	11	7.5	8.91	1.63	13.68	24.22
9	8	7.5	11.77	1.61	10.50	25.88
11	11	8.0	10.22	2.06	14.29	26.57
14	7	9.4	12.84	2.25	12.76	27.85
18	9	9.0	10.27	2.24	16.54	29.05
15	9	8.5	11.94	2.79	14.75	29.48
20	8	8.8	10.21	1.76	18.53	30.50
8	8	9.1	12.51	3.72	15.32	31.55
Averages						
10 farms, 1921	9	8.2	10.70	2.00	13.92	26.62
10 farms, 1920	12	4.6	10.91	1.63	9.29	21.82
12 farms, 1922	13	6.2	11.23	1.97	10.45	23.65

* Farms are listed in order of total man labor requirements beginning with the lowest.

TABLE IX
HORSE LABOR REQUIREMENTS PER ACRE, BY OPERATIONS, FOR SILAGE CORN, 1921

Farm No.*	Acres per farm	Yield per acre, tons	Before cutting, hours per acre	Cutting, hours per acre	Filling silo, hours per acre	Total hours per acre
16	9	6.1	28.15	2.53	14.00	44.68
7	7	8.9	26.06	3.24	12.31	41.61
4	11	7.5	26.39	4.89	15.79	47.07
9	8	7.5	35.49	4.83	12.50	52.82
11	11	8.0	25.61	6.18	13.67	45.46
14	7	9.4	40.05	6.75	12.76	59.56
18	9	9.0	27.25	6.08	12.17	45.50
15	9	8.5	29.89	8.37	18.25	56.51
20	8	8.8	27.11	3.52	23.00	53.63
8	8	9.1	34.67	7.06	14.44	56.17
Averages						
10 farms, 1921	9	8.2	29.67	5.39	14.90	49.96
10 farms, 1920	12	4.6	29.80	4.77	8.94	43.49
12 farms, 1922	13	6.2	30.78	5.39	12.67	48.87

* Farms are listed in order of total man labor requirements beginning with the lowest.

CAUSES FOR VARIATIONS IN LABOR REQUIREMENTS FOR SILAGE CORN

Yield.—The lowest labor requirements for silo filling were found on Farm 7, which also had the lowest yield. The effect of increased yields on increased labor requirements is to be noted in comparing the average requirements for the three years.

Size of crew and power unit.—The largest number of hours per acre for cutting were expended on Farm 8. This was because an extra team and an extra driver were used on the binder for part of the cutting.

LABOR REQUIREMENTS FOR FODDER CORN

The labor requirements for fodder corn are shown in Tables X and XI. This classification includes all corn cut and fed in the bundle whether drilled thick for fodder only, or checked for mature ears. It is largely the former. Only the harvesting operations are shown. The labor of growing the crop has been taken from Tables VI and VII as in case of silage corn.

TABLE X

MAN LABOR REQUIREMENTS PER ACRE, BY OPERATIONS, FOR FODDER CORN, 1921

Farm No.*	Acres per farm	Yield per acre, tons	Before harvest, hours per acre	Cutting, hours per acre	Shocking, hours per acre	Total hours per acre
3	22	1.5	7.10	1.58	1.94	10.62
1	17	2.1	7.54	1.63	2.38	11.55
20	1	2.3	10.21	1.76	...	11.97
13	4	3.3	8.06	1.81	3.23	13.10
6	8	2.0	8.22	1.71	3.60	13.53
5	10	1.3	9.79	1.45	4.10	15.34
17	2	2.6	12.05	1.68	1.89	15.62
21	8	1.4	11.14	1.88	2.66	15.68
11	3	1.2	10.22	2.06	4.00	16.28
9	1	4.0	11.77	1.61	3.00	16.38
22	5	0.4	12.17	2.48	1.76	16.41
8	1	4.2	12.51	3.72	3.09	19.32
12	4	4.0	15.41	2.50	7.38	25.29
Averages						
13 farms, 1921	7	1.9	9.11	1.77	2.90	13.78
7 farms, 1920	8	2.1	10.62	1.50	3.17	15.29
8 farms, 1922	8	1.7	9.78	2.03	2.50	14.31

* Farms are listed in order of total man labor requirements beginning with the lowest.

CAUSES FOR VARIATIONS IN LABOR REQUIREMENTS FOR FODDER CORN

Yield.—The higher yielding fields require more labor for harvesting. This is especially true in case of shocking.

Size of crew and power unit.—Farm 8 has high labor requirements for cutting for the reason mentioned in the silage discussion.

Distance of fields from farmstead.—On Farms 5 and 12, having the highest labor requirements for shocking, the fields shocked were from half a mile to a mile and a half from the farmstead. Rain increased the number of trips to these fields considerably, thus emphasizing this handicap.

TABLE XI
HORSE LABOR REQUIREMENTS PER ACRE, BY OPERATIONS, FOR FODDER CORN, 1921

Farm No.*	Acres per farm	Yield per acre, tons	Before harvest, hours per acre	Cutting, hours per acre	Total hours per acre
3	22	1.6	22.18	4.47	26.65
1	17	2.1	21.76	4.89	26.65
20	1	2.3	27.11	3.52	30.63
13	4	3.3	11.99	5.43	17.42
6	8	2.0	23.29	5.73	29.02
5	10	1.3	27.06	4.90	31.96
17	2	2.6	35.27	5.04	40.31
21	8	1.4	28.03	5.64	33.67
11	3	1.2	25.61	6.18	31.70
9	1	4.0	35.49	4.83	40.32
22	5	0.4	34.63	7.44	42.07
8	14	4.2	34.67	7.06	41.73
12	4	4.0	43.26	7.50	50.76
Averages					
13 farms, 1921	7	1.9	25.43	5.28	30.71
7 farms, 1920	8	2.1	29.05	4.62	33.66
8 farms, 1922	8	1.7	26.86	6.12	32.98

* Farms are listed in order of total man labor requirements beginning with the lowest.

MATERIAL REQUIREMENTS FOR CORN

The average amount of seed per acre for checked corn on all farms for the three years was 8.7 pounds. It varied from 7.2 to 10.5 pounds. Checked corn is spaced 3 feet 6 inches or 3 feet 8 inches, and three or four kernels are planted per hill. The average rate of seeding for drilled corn was 14.7 pounds with a range from 8.9 to 24.9 pounds. This wide range is due to the fact that some is planted quite thinly, so that full-sized ears will be formed, while most of it is planted thick enough that no ears will mature. The average amount of twine used per acre was 3.6 pounds. The least amount was 1.5 and the largest 6.4 pounds. The range was largely due to differences in yield. Twine requirements for drilled corn are usually much higher than for checked corn, because drilled corn is planted more thickly.

STANDARD REQUIREMENTS PER ACRE FOR CORN PRODUCTION IN SOUTHWESTERN MINNESOTA

The following standard requirements are suggested for corn production. As has been stated, they represent the accomplishment of farmers who handle their labor most efficiently as measured by their ability to perform the various operations in the shortest time. These standard requirements furnish a standard of attainment for all farmers to use as a guide. The seed requirements are based on usual seeding rates in the community; the twine requirements, on twine used for a normal crop.

Operation	Equipment	Hours of labor		Acres covered in 10-hour day
		Man	Horse	
Plowing	Gang plow and 5 horses	2.0	10.0	5.0
	Sulky plow and 3 horses	3.3	10.0	3.0
Disking	8-ft. disk and 4 horses	0.5	2.0	20.0
Harrowing	22-ft. harrow and 4 horses	0.2	0.8	50.0
Planting		0.6	1.3	15.0
Cultivating	Single-row cultivator	1.3	2.6	7.5
Husking	1 man with team	7.5	15.0	1.3
(45 bu. yield)				
Cutting	3-horse team	1.7	5.0	6.0
Filling silo		11.0	12.5	0.9
(8-ton yield)				
Shocking		2.5	...	4.0
(2-ton yield)				
Seed for checked corn				
(8 lbs.)				
Seed for drilled corn				
(silage or fodder)				
(15 lbs.)				
Twine				
(3½ lbs.)				

DISTRIBUTION OF LABOR ON CORN

In the following table are shown the dates between which the different operations on the corn crop are commonly performed and the usual days available for the operations during the period. These dates are subject to seasonal fluctuations but their general sequence is quite uniform. The days available are computed by subtracting from the total days in the period all Sundays and holidays and also on estimated number of days on which rain might interfere with the operation. This estimate is based on precipitation data for ten years, interpreted in the light of actual rain interference with the various operations during the three years of the study.

Operation	Dates	Work days available
Spring plowing	April 26 to May 25	21
Disking	May 1 to May 25	18
Harrowing	May 5 to June 1	17
Planting	May 10 to May 28	12
Cultivating	June 1 to July 10	28
Cutting	Sept. 1 to Sept. 30	22
Filling silo	Sept. 1 to Sept. 15	10
Husking	Oct. 10 to Dec. 10	47

These figures do not include the extreme ranges of dates for any operation. They cover only the period during which the operation is most commonly performed. For example, corn was planted as early as May 5 and as late as the latter part of June, but little is planted before May 10 and little later than May 28. In fact most of the corn for

grain is planted before May 28 and the latter part of the period is devoted largely to drilled corn for silage and fodder. The dates suggested are ordinarily the most satisfactory time for performing the several operations and can safely be used in planning the farm labor program.

Fig. 7. Distribution of Man Labor on Fifty-Seven Acres of Corn

Figure 7 shows the daily distribution of man labor on 57 acres of corn. Of this, 34 acres were husked standing, 11 hogged off, 11 siloed, and 1 acre cut and fed in the bundle. Five acres of the silage corn were drilled and the rest of the corn was checked. The peak labor demand occurred during silo filling in September. Most of the land was fall plowed and hence the work did not begin as early in the spring as when there is considerable spring plowing to do. The husking labor was concentrated in a somewhat shorter period than is usually the case. Otherwise the labor distribution is quite characteristic for the area.

OATS

USUAL PRACTICES IN OAT PRODUCTION

During the three years of this study, only 25 per cent of the oat land was plowed, the rest was disked into corn land. This practice has increased with the increased use of corn land for oats. In 1920, 50 per cent of the oat land was plowed, but in 1922 only 5 per cent. The plowing was practically all done in the fall. All but 3.5 per cent of the oat land was disked at least once and most of it was disked two or more times. The average for all farms was 1.75 diskings. Where an end-gate seeder is used the oats are often seeded first and the land is disked afterward. Sometimes the land is disked before seeding and again after. Often oat

land is disked after seeding when an ordinary broadcast seeder is used, but seldom when a drill is used. Only 33 per cent of the oat land was harrowed before seeding, but 80 per cent was harrowed after seeding, and 5 per cent was not harrowed at all. A little more than half was harrowed once and the rest two or more times. The average number of harrowings was 1.4.

Sixty-three per cent of the oat acreage was planted with a drill. A disk drill was usually used. Twenty-three per cent was seeded with a broadcast seeder and 14 per cent with an end-gate seeder. The oat crop was cut with a binder, and shocked. A small amount was fed in the bundle but most of it was threshed. In the last three years there has been a rapid transition from stack threshing to shock threshing. In 1920, 33.5 per cent of the oat acreage was shock threshed; in 1921, 63.5 per cent; and in 1922, 70 per cent.

LABOR REQUIREMENTS FOR OAT PRODUCTION

The labor requirements for oats are presented in Tables XII and XIII. The total hours for each operation are shown, and if an operation is repeated the number of times is indicated. As shock threshing is the common practice, the average total labor requirements are on this basis. The average for stack threshing is given so that a total can be computed.

CAUSES FOR VARIATIONS IN LABOR REQUIREMENTS FOR OATS

Size and type of equipment and power unit.—End-gate seeders were used on Farms 5, 7, and 14 and the labor requirements for seeding were much lower than on any other farm. The man labor requirement where an ordinary broadcast seeder was used was about the same as for a drill, but the horse labor requirement was only about half, as only 2 horses are used on the seeders and 4 was the usual number on a drill. On Farms 3, 9, 10, and 22, broadcast seeders were used. On Farm 16 a small 2-horse drill was used, so both man and horse labor requirements were high.

On Farms 13 and 21 only 3 horses were used on the binder while 4 were used on practically all the other farms. The horse labor requirement on these farms was about the same as on the others but the man labor requirement was higher. On Farm 4 only 3 horses were used on the binder but they were much larger horses than were used on any of the other farms, hence the horse labor requirement is one of the lowest and man labor only about the average.

TABLE XII

MAN LABOR REQUIREMENTS PER ACRE, BY OPERATIONS, FOR OATS, 1921

Farm No.*	Acres per farm	Yield per acre, bu.	Plowing		Disking		Harrowing		Hours per acre						
			Hours per acre	Times over	Hours per acre	Times over	Hours per acre	Times over	Seeding	Cutting	Shocking	Stacking	Stack threshing	Shock threshing	Total
3	81	33	...	...	0.75	1.54	0.22	1.21	0.48	0.74	0.88	...	...	2.25	5.32
2	93	28	1.25	0.59	0.40	0.81	0.44	1.98	0.54	0.74	0.62	...	...	1.79	5.78
17	41	29	...	...	0.82	1.16	0.37	1.16	0.53	0.91	0.80	...	...	2.40	5.83
1	77	34	0.14	0.07	1.17	2.30	0.26	1.00	0.51	0.80	1.12	...	...	2.44	6.44
10	32	29	0.13	0.07	1.10	2.50	0.34	2.00	0.52	0.94	0.85	...	...	2.97	6.85
6	50	41	...	...	1.02	2.00	0.26	1.00	0.48	0.91	1.32	...	...	2.89	6.88
9	45	31	0.14	0.04	1.26	2.00	0.33	1.38	0.45	0.55	1.32	...	...	3.01	7.06
7	47	32	1.53	0.46	0.75	1.54	0.28	1.00	0.20	0.84	1.31	...	...	2.17	7.08
5	81	31	...	...	1.04	2.00	0.25	1.00	0.30	0.75	1.28	2.74	0.73	...	7.09
15	32	36	...	...	1.16	2.00	0.19	0.53	0.50	0.99	1.86	...	...	2.58	7.28
4	54	45	...	...	1.16	2.00	0.15	0.72	0.61	0.88	0.97	...	...	3.54	7.31
20	25	32	...	...	1.26	2.00	0.31	1.00	0.59	0.87	1.02	2.76	0.81	...	7.62
19	24	32	0.10	0.03	1.12	2.00	0.31	1.00	0.78	1.26	0.93	2.14	0.99	...	7.63
18	41	35	1.35	0.43	0.67	1.39	0.41	2.30	0.45	0.96	1.06	...	...	2.94	7.84
14	41	26	...	...	1.46	2.00	0.39	1.31	0.24	1.00	1.91	...	...	3.96	8.96
16	20	31	0.52	0.17	1.52	2.50	0.96	3.00	1.12	0.92	0.97	2.75	0.51	...	9.27
13	27	39	2.18†	1.00	0.56†	2.00	...	...	0.47	1.01	0.86	3.23	0.98	...	9.29
11	34	37	2.07	0.70	0.31	0.60	0.56	1.70	0.54	0.79	2.08	...	...	2.99	9.34
21	8	28	1.57	0.65	0.60	1.00	0.24	1.00	0.54	1.21	0.97	2.72	1.69	...	9.54
12	58	37	1.41	0.50	0.97	1.68	0.63	2.32	0.47	0.90	1.12	2.82	1.32	...	9.64
22	15	24	0.71	0.31	1.78	2.92	0.36	1.46	0.47	1.08	1.42	2.83	1.08	...	9.73
8	53	40	1.70	0.61	1.06	2.00	0.26	1.00	0.50	0.96	1.08	3.36	1.64	...	10.56
Averages															
21 farms, 1921†	45	33	0.57	0.21	0.96	1.75	0.34	1.37	0.48	0.86	1.14	2.83	1.08	2.65	7.00§
16 farms, 1920‡	40	37	1.25	0.48	0.75	1.23	0.46	1.64	0.58	0.78	1.07	2.54	1.10	2.67	7.56§
18 farms, 1922‡	48	41	0.13	0.04	1.00	1.92	0.32	1.12	0.48	0.77	0.98	2.87	1.06	2.23	5.91§

* Farms are listed in order of total man labor requirements, beginning with the lowest.

† Plowed and disked with tractor.

‡ Farms using tractors omitted in computing these averages.

§ Total is for shock threshing. Total hours per acre in 1921 for stacked oats were 8.26.

TABLE XIII

HORSE LABOR REQUIREMENTS PER ACRE, BY OPERATIONS, FOR OATS, 1921

Farm No.*	Acres per farm	Yield per acre, bu.	Plowing		Disking		Harrowing		Hours per acre					
			Hours per acre	Times over	Hours per acre	Times over	Hours per acre	Times over	Seeding	Cutting	Stacking	Stack threshing	Shock threshing	Total
3	81	33	...	...	3.02	1.54	0.87	1.21	0.96	2.96	...	...	3.95	11.76
2	93	28	5.69	0.59	1.42	0.81	1.72	1.98	1.98	2.92	...	...	2.66	16.39
17	41	29	...	...	3.29	1.16	1.48	1.16	2.06	3.64	...	...	3.20	13.67
1	77	34	0.55	0.07	4.76	2.30	1.06	1.00	2.04	3.20	...	...	4.36	15.97
10	32	29	0.66	0.07	4.13	2.50	1.70	2.00	1.05	3.76	...	...	3.70	15.00
6	50	41	...	...	4.08	2.00	1.04	1.00	1.92	3.22	...	...	5.02	15.28
9	45	31	0.41	0.04	5.04	2.00	1.06	1.38	0.90	2.20	...	...	5.10	14.71
7	47	32	4.77	0.46	3.02	1.54	1.12	1.00	0.40	3.36	...	...	3.98	16.65
5	81	31	...	...	4.20	2.00	0.86	1.00	0.60	3.03	3.53	1.09	...	13.31
15	32	36	...	...	4.64	2.00	0.66	0.53	2.00	3.96	...	...	4.91	16.17
4	54	45	...	...	4.48	2.00	0.60	0.72	1.83	2.64	...	...	5.59	15.14
20	25	32	...	...	3.90	2.00	0.90	1.00	1.61	3.48	2.76	0.97	...	13.62
19	24	32	0.31	0.03	5.64	2.00	1.16	1.00	3.11	5.06	2.76	1.49	...	19.53
18	41	35	4.88	0.43	3.04	1.39	1.63	2.30	1.83	3.86	...	...	4.87	20.11
14	41	26	...	...	7.28	2.00	1.56	1.31	0.69	3.57	...	...	5.09	18.19
16	20	31	1.76	0.17	5.35	2.50	3.84	3.00	2.65	3.68	3.67	0.51	...	21.46
13	27	39	†	1.00	‡	2.00	...	...	1.88	3.03	3.23	1.20	...	9.34
11	34	37	6.62	0.70	1.25	0.60	1.82	1.70	2.16	3.16	...	...	4.93	19.94
21	8	28	6.26	0.65	1.81	1.00	0.73	1.00	2.18	3.63	2.90	1.93	...	19.44
12	58	37	5.96	0.50	3.90	1.68	1.93	2.32	1.88	3.60	3.62	2.39	...	23.28
22	15	24	2.85	0.31	6.95	2.92	1.46	1.46	0.94	4.32	3.78	1.08	...	21.38
8	53	40	5.59	0.61	4.06	2.00	1.04	1.00	2.00	3.68	3.75	1.95	...	22.07
Averages														
21 farms, 1921§	45	33	2.15	0.21	3.87	1.75	1.29	1.37	1.57	3.31	3.46	1.52	4.27	16.46||
16 farms, 1920§	40	37	5.03	0.48	2.96	1.23	1.67	1.64	1.81	3.08	3.04	1.10	4.98	19.53||
18 farms, 1922§	48	41	0.40	0.04	3.97	1.92	1.20	1.12	1.42	3.01	3.47	1.20	3.36	13.36||

* Farms are listed in order of total man labor requirements, beginning with the lowest.

† 2.18 tractor hours per acre were used for plowing.

‡ 0.56 tractor hours per acre were used for disking.

§ Farms using tractors omitted in computing these averages.

|| Total is for shock threshing. Total hours per acre for stacked oats in 1921, 17.17.

Size of fields and distance from farmstead.—The labor requirements for cutting were highest on Farms 15, 19, and 22, and lowest on Farms 2, 3, and 9. The average field of oats on this first group of farms was 14 acres and the total acreage per farm 24 acres. These acreages for the second group of farms were 20 and 72 respectively. One-third of the oat acreage on Farms 14 and 15 was more than a mile from the farmstead. This was reflected in high labor requirements for cutting and shocking. It also resulted in high labor requirements for threshing on Farm 14.

Quality of labor.—The high labor requirements for shocking on Farms 11 and 14 and for stacking on Farm 8 were due in part to the use of family labor. On both farms, boys were used.

Yields.—On Farms 8 and 13, having the highest labor requirements for stacking, the yield per acre was 20 per cent higher than the average for all farms where oats were stacked. The highest yield was obtained on Farm 4. The horse labor for stack threshing was highest on this farm and the man labor next to the highest.

Method of threshing.—These data show that the man labor requirements for stacking and stack threshing were about 50 per cent higher than for shock threshing. There was also a small increase in horse labor requirements.

Omission or repetition of operations.—The total labor requirements per acre were lowest on the farms where little or none of the acreage was plowed. The highest labor requirements for disking or harrowing were found on the farms where these operations were repeated the greatest number of times. Altho the man and horse labor for harrowing once on Farm 18 was the lowest in the group, as shown in Table XIII, the fact that the oat land was harrowed 2.3 times brings the total requirement above the average. The same was true on Farm 1 for disking. A low once-over requirement was brought up above the average by repeating the operation 2.3 times.

MATERIAL REQUIREMENTS FOR OATS

The average amount of oats sown per acre on all farms for the three years was 3.2 bushels; the maximum being 4.7 and the minimum 2.5 bushels. The average amount of seed sown on farms using drills was 3.1 bushels, on those using broadcast seeders 3.4 bushels, and on those using end-gate seeders 3.9 bushels. The average amount of twine used per acre was 2.3 pounds, the maximum being 3.4 and the minimum 1.2 pounds. The average amount of twine used with yields below 30 bushels per acre was 2.2 pounds; with yields from 30 to 35 bushels,

2.5 pounds; and with yields over 35 bushels, 2.6 pounds. The usual cost of threshing was 3 cents per bushel in 1921 and 1922, and 5 cents in 1920.

STANDARD REQUIREMENTS PER ACRE FOR OAT PRODUCTION IN SOUTHWESTERN MINNESOTA

Operation	Equipment	Hours of labor		Acres covered in 10-hour day
		Man	Horse	
Disking	8-ft. disk and 4 horses	0.50	2.0	20.0
Harrowing	22-ft. harrow and 4 horses	0.20	0.8	50.0
Seeding	10-ft. drill and 4 horses	0.50	2.0	20.0
Cutting	8-ft. binder and 4 horses	0.75	3.0	13.3
Shocking		1.00		10.0
Shock threshing		2.50	4.0	4.0
Seed, (3 bu.)				
Twine, (2.3 lbs.)				

These requirements cover the usual operations in oat culture in this area. If it is desirable to plow for oats, the standard plowing requirements may be obtained from Table V. If the crop is to be stacked the shock threshing can be replaced with 2.75 man hours and 3.25 horse hours for stacking and 1 man hour and 1.25 horse hours for threshing.

DISTRIBUTION OF LABOR ON OATS

The following table shows the dates between which the different operations on the oat crop are commonly performed and the usual days available for the operation during the period.

Operation	Dates	Work days available
Spring plowing	April 5 to April 22	14
Disking	April 10 to April 25	10
Harrowing	April 12 to April 28	13
Seeding	April 12 to April 25	10
Cutting and shocking	July 18 to July 26	7
Stacking	Aug. 2 to Aug. 15	10
Stack threshing	Aug. 25 to Sept. 30	27
Shock threshing	Aug. 1 to Aug. 15	11

Work on the oat crop starts as soon in the spring as the ground is thawed and dry enough to work. It is the first crop sown, hence the time of seedbed preparation and seeding operations is determined largely by weather conditions. In a late spring the seedbed preparation is rushed and the number of harrowings and diskings is reduced in order that the work on the corn crop may not be delayed too long. As for corn, the dates suggested may be safely used in planning the labor program for the farm.

Figure 8 shows the man labor distribution by days on 45 acres of oats. All the labor on the crop is confined to 13 days of seedbed preparation and seeding in April, 6 days of cutting and shocking in July, and 2 days of shock threshing early in August. This is a representative labor distribution for the crop.

Fig. 8. Distribution of Man Labor on Forty-Five Acres of Oats

BARLEY

USUAL PRACTICES IN BARLEY PRODUCTION

One-half the land for barley on these farms is plowed in the spring. In fact barley is often grown on spring plowing because the plowing was completed too late for oats. The land not plowed is disked, usually at least twice. All barley land is harrowed at least once before seeding and usually once after. The plowed land is harrowed twice before seeding. On all farms included in this study, barley was sown with a drill. It was either shock threshed or stack threshed according to the practice prevailing on the farm. This practice has already been discussed for the oat crop.

LABOR REQUIREMENTS FOR BARLEY PRODUCTION

The labor requirements for barley production are presented in Tables XIV and XV. The total hours as given in the yearly averages are computed on the basis of shock threshing. The number of farms growing barley in 1921 was too small to bring out many of the causes for variations in labor requirements by operations. In general, the same factors which caused variations in labor requirements for oats obtain for barley.

TABLE XIV
MAN LABOR REQUIREMENTS PER ACRE, BY OPERATIONS, FOR BARLEY, 1921

Farm No.*	Acres per farm	Yield per acre, bu.	Plowing		Disking		Harrowing		Hours per acre						Total
			Hours per acre	Times over	Hours per acre	Times over	Hours per acre	Times over	Seeding	Cutting	Shocking	Stacking	Stack threshing	Shock threshing	
21	8	16	...	...	0.60	1.00	0.20	1.00	0.59	1.44	0.78	1.83	0.91	...	6.35
2	30	21	1.37	0.60	0.88	2.00	0.48	2.00	0.44	1.01	0.84	...	...	2.39	7.41
6	20	34	0.37	0.14	1.18	1.96	0.42	1.18	0.66	1.05	1.66	...	...	2.86	8.20
1	15	34	1.91	1.00	...	...	0.72	3.00	0.51	0.82	1.64	...	...	3.34	8.94
Averages															
4 farms, 1921		28	1.06	0.49	0.75	1.47	0.49	1.87	0.53	1.03	1.22	1.83	0.91	2.75	7.83†
6 farms, 1920		14	0.97	0.47	0.60	0.93	0.60	2.00	0.49	0.62	0.88	2.45	0.77	2.77	6.93†
5 farms, 1922		31	1.40	0.57	0.46	0.96	0.54	1.74	0.50	0.66	1.12	2.97	1.02	2.24	6.92†

* Farms are listed in order of total man labor requirements, beginning with the lowest.

† Total is for shock threshing. Total hours per acre for stack threshed barley in 1921 were 7.82.

TABLE XV
HORSE LABOR REQUIREMENTS PER ACRE, BY OPERATIONS, FOR BARLEY, 1921

Farm No.*	Acres per farm	Yield per acre, bu.	Plowing		Disking		Harrowing		Hours per acre						
			Hours per acre	Times over	Hours per acre	Times over	Hours per acre	Times over	Seeding	Cutting	Shocking	Stacking	Stack threshing	Shock threshing	Total
21	8	16	...	...	2.31	1.00	0.60	1.00	1.18	5.76	...	1.83	1.04	...	12.72
2	30	23	5.50	0.60	3.52	2.00	1.92	2.00	1.55	4.04	...	...	...	3.91	20.44
6	20	34	1.83	0.14	4.74	1.96	1.70	1.18	2.45	4.20	...	...	...	4.09	19.01
1	15	34	7.64	1.00	...	...	2.88	3.00	2.04	3.28	...	...	...	6.28	22.12
Averages															
4 farms,															
1921		28	4.33	0.49	3.00	1.47	1.89	1.87	1.86	4.11	...	1.83	1.04	4.51	19.70†
6 farms,															
1920		14	3.71	0.47	2.40	0.93	2.32	2.00	1.62	2.53	...	2.01	0.56	4.70	17.28†
5 farms,															
1922		31	5.73	0.57	1.85	0.96	2.09	1.74	1.71	2.66	...	3.51	1.51	3.93	17.97†

* Farms are listed in order of total man labor requirements, beginning with the lowest.

† Total is for shock threshing. Total hours per acre for stack threshed barley in 1921 were 18.06.

MATERIAL REQUIREMENTS FOR BARLEY

The average rate of seeding barley on these farms was 2 bushels per acre. The range was from 1.6 bushels to 2.4 bushels. The average amount of twine used per acre was two pounds and the range 1.6 to 3.7 pounds. The usual threshing rate was 4 cents per bushel in 1921 and 1922 and 6 cents in 1920. The threshing rate for barley is usually 1 cent higher per bushel than the rate for oats.

STANDARD REQUIREMENTS PER ACRE FOR BARLEY PRODUCTION IN SOUTHWESTERN MINNESOTA

Operation	Equipment	Hours of labor		Acres covered in 10-hour day
		Man	Horse	
Plowing	Gang plow and 5 horses	2.00	10.0	5.0
Disking	8 ft. disk and 4 horses	0.50	2.0	20.0
Harrowing	22 ft. harrow and 4 horses	0.20	0.8	50.0
Seeding	10 ft. drill and 4 horses	0.50	2.0	20.0
Cutting	8 ft. binder and 4 horses	0.75	3.0	13.3
Shocking		1.00		10.0
Shock threshing		2.50	4.0	4.0
Seed, (2 bu.)				
Twine, (2 lbs.)				

If this crop was stacked the shock threshing hours given should be replaced with 2.75 man hours and 3.25 horse hours for stacking, and 1 man hour and 1.25 horse hours for stack threshing.

DISTRIBUTION OF LABOR ON BARLEY

The following table shows the dates between which the different operations on the barley crop are commonly performed and the days usually available for the operation during the period.

Operation	Dates	Work days available
Spring plowing	April 20 to April 28	7
Disking	April 10 to April 29	16
Harrowing	April 18 to May 1	11
Seeding	April 21 to April 30	7
Cutting and shocking	July 15 to July 22	7
Stacking	Aug. 1 to 10	7
Stack threshing	Aug. 25 to Sept. 30	22
Shock threshing	Aug. 1 to Aug. 15	11

On account of the shorter time required to mature the crop, barley can be sown later than oats with an equal chance of getting a good crop. The seedbed preparation and the seeding for barley are usually fitted in between those for oats and for corn. Barley ordinarily ripens a few days earlier than oats.

Figure 9 shows the labor distribution by days on a farm having 15 acres of barley. The land was all spring plowed. It was harrowed twice before seeding and once after. This crop was shock threshed. This barley was seeded five days later than the oats on the same farm and cut two days earlier.

Fig. 9. Distribution of Man Labor on Fifteen Acres of Barley

RYE

COMMON PRACTICES IN RYE PRODUCTION

Rye differs from the other grain crops grown in the Windom area in that it is seeded in the fall. All ground for rye is plowed. Only a small part of it is disked. All is harrowed at least once and some of it twice before planting, and most of it is harrowed again after seeding. All was sown with a drill. Rye usually ripens a week earlier than oats and several days earlier than barley. It is either shock threshed or stack threshed according to the practice on the farm.

LABOR REQUIREMENTS FOR RYE PRODUCTION

The labor requirements for rye production are presented in Tables XVI and XVII. These data cover the crop sown in 1921 and harvested in 1922. All other crop requirement data cover the crop planted and harvested in 1921. As very little rye was grown in either 1920 or 1921 no data covering these years are included.

CAUSES FOR VARIATIONS IN LABOR REQUIREMENTS FOR RYE

Quality of labor.—The high man labor requirements for harvesting and stacking on Farm 2 were due to the use of family labor. Much of this work was done by boys. There was more family labor than could be utilized on the farm and no attempt was made to economize in its use.

Yields.—The high requirements for harvesting and threshing on Farm 18 were due to the high yield. This unusual yield was secured on an old lake bed that has been drained and plowed for the first time.

TABLE XVI
MAN LABOR REQUIREMENTS PER ACRE, BY OPERATIONS, FOR RYE, 1921 AND 1922

Farm No.*	Acres per farm	Yield per acre, bu.	Plowing		Disking		Harrowing		Hours per acre						
			Hours per acre	Times over	Hours per acre	Times over	Hours per acre	Times over	Seeding	Cutting	Shocking	Stacking	Stack threshing	Shock threshing	Total
9	29	15	1.69	1.00	...	...	0.53	1.30	0.48	0.63	0.87	...	...	1.91	6.11
10	29	11	1.77†	1.00	...	...	0.75	2.63	0.58	0.81	0.60	...	...	1.97	6.48
24	35	20	1.83†	1.00	1.08	2.00	0.58	2.00	0.37	0.57	0.60	...	...	1.57	6.60
23	20	22	2.32	1.00	...	...	0.60	2.00	0.53	0.84	0.84	2.12	1.38	...	8.63
21	11	12	1.89	1.00	0.45	0.59	0.54	1.15	0.99	0.90	1.26	2.53	1.62	...	10.18
6	6	26	1.94	1.00	...	...	0.40	2.00	0.64	1.28	1.44	2.88	1.60	...	10.18
8	15	20	4.04	1.00	0.66	1.00	0.39	2.00	0.66	0.82	0.99	2.43	1.05	...	11.04
18	10	44	2.76	1.00	...	...	0.59	3.00	0.39	1.28	1.58	...	...	5.06	11.66
2	15	11	2.51	1.00	...	...	0.99	3.00	1.32	1.25	2.22	4.17	0.72	...	13.18
Averages															
All farms	19	18	2.39‡	1.00	0.31	0.54	0.61	2.08	0.60	0.82	0.98	2.78	1.22	2.12	7.83§

* Farms are listed in order of man labor requirements, beginning with the lowest.

† Plowed with tractor.

‡ Only acreage plowed with horses included in this average.

§ Computed on basis of plowing with horses.

TABLE XVII

HORSE LABOR REQUIREMENTS PER ACRE, BY OPERATIONS, FOR RYE, 1921 AND 1922

Farm No.*	Acres per farm	Yield per acre, bu.	Plowing		Disking		Harrowing		Hours per acre					Total
			Hours per acre	Times over	Hours per acre	Times over	Hours per acre	Times over	Seeding	Cutting	Stacking	Stack threshing	Shock threshing	
9	29	15	8.42	1.00	...	...	2.11	1.30	0.92	2.52	...	...	3.34	17.31
10	29	11	†	1.00	...	...	2.99	2.63	2.33	3.16	...	...	3.34	11.82
24	35	20	‡	1.00	5.00	2.00	2.20	2.00	0.74	1.83	...	...	3.14	12.91
23	20	22	9.74	1.00	...	...	2.32	2.00	1.61	3.37	2.17	2.28	...	21.49
21	11	12	5.68	1.00	1.35	0.59	1.62	1.16	2.98	3.61	3.43	0.72	...	19.39
6	6	26	7.77	1.00	...	...	1.60	2.00	2.56	5.13	3.85	2.24	...	23.15
8	15	20	12.03	1.00	2.63	1.00	1.38	2.00	2.17	3.29	1.97	0.84	...	24.31
18	10	44	11.45	1.00	...	...	2.37	3.00	1.58	5.13	...	...	8.69	29.22
2	15	11	8.28	1.00	...	...	3.67	3.00	3.95	4.98	3.90	0.57	...	25.35
Averages														
All farms		18	9.15§	1.00	1.35	0.54	2.34	2.08	1.81	3.19	2.87	1.31	3.81	21.65||

* Farms are listed in order of man labor requirements, beginning with the lowest.

† 1.77 tractor hours per acre for plowing.

‡ 1.83 tractor hours per acre for plowing.

§ Only acreage plowed with horses included in this average.

|| Computed on basis of plowing with horses.

MATERIAL REQUIREMENTS PER ACRE FOR RYE

The average rate of seeding rye on these farms was 1.6 bushels per acre, the maximum being 2.3 and the minimum 1.4 bushels. The average twine requirement per acre was 1.7 pounds and the range from 1 pound to 4 pounds per acre. Because of the small acreage of rye grown in the vicinity, the threshing rate has not become standardized as have the rates for oats and barley. The average rate in 1922 was 6.5 cents per bushel and the range from 5 to 8 cents.

STANDARD REQUIREMENTS PER ACRE FOR RYE PRODUCTION IN SOUTHWESTERN MINNESOTA

Operations	Equipment	Hours of labor		Acres covered in 10-hour day
		Man	Horse	
Plowing	Gang plow and 5 horses	2.00	10.0	5.0
Harrowing	22-ft. harrow and 4 horses	0.20	0.8	50.0
Seeding	10-ft. drill and 4 horses	0.50	2.0	20.0
Cutting	8-ft. binder and 4 horses	0.75	3.0	13.3
Shocking		1.00		
Shock threshing		2.25	3.5	4.5
Seed, (1.63 bu.)				
Twine, (1.75 lbs.)				

These requirements can be adjusted for stack threshing by substituting for the shock threshing hours 2.75 man hours and 3.25 horse hours for stacking and 1 man hour and 1.25 horse hours for threshing.

DISTRIBUTION OF LABOR ON RYE

The following table shows the dates between which the different operations on rye are commonly performed and the number of days available for the operation during the period.

Operation	Dates	Work days available
Plowing	Aug. 20 to Sept. 20	25
Harrowing	Sept. 14 to Sept. 30	13
Seeding	Sept. 15 to Sept. 28	11
Cutting and shocking	July 10 to July 18	7
Stacking	July 28 to Aug. 10	10
Stack threshing	Aug. 25 to Sept. 30	27
Shock threshing	Aug. 1 to Aug. 15	11

Figure 10 shows the distribution of man labor on a field of 29 acres of rye. This crop was shock threshed. A much longer time is available for the seedbed preparation for rye than for spring-sown grain crops. The seeding may also be spread over a longer period. The range of seeding dates on these farms was from September 8 to October 10. The earlier seedings are less likely to winter kill and most farmers plan

to get their rye in by September 25. Rye is cut early enough to avoid competition with the spring-grown grains, but may conflict seriously with haying and the last cultivation of corn.

Fig. 10. Distribution of Man Labor on Twenty-Nine Acres of Rye

FLAX

USUAL PRACTICES IN FLAX PRODUCTION

Land is always plowed for flax, usually in the spring. As flax is usually grown on sod land it is ordinarily disked at least twice and often three times. It is harrowed once before seeding and sometimes again after seeding. Flax is usually cut with a binder, altho in 1920 one farmer in this study cut his with a mower, raked it, and threshed it from the windrow. Shock threshing is the usual practice.

LABOR AND MATERIAL REQUIREMENTS FOR FLAX PRODUCTION

As only two farms each year grew flax and the acreage per farm was only 12 acres, there are not enough data for a significant range of labor requirements. The average amount of seed sown during the three years was 32 pounds and the average amount of twine used was 2.1 pounds. The average yield was 9.5 bushels. By adapting data from "Standard Requirements for Seedbed Preparation" already given, and from "Standard Requirements for Oat Production," outlined in the discussion of that crop, the following requirements for flax have been worked up on the basis of the usual practices.

Operation	Equipment	Hours of labor		Acres covered in 10-hour day
		Man	Horse	
Plowing*	Sulky plow and 3 horses	4.00	12.0	2.5
Disking	8 ft. disk and 4 horses	0.50	2.0	20.0
Harrowing	22 ft. harrow and 4 horses	0.30	0.8	50.0
Seeding	10 ft. drill and 4 horses	0.50	2.0	20.0
Cutting		0.75	3.0	13.3
Shocking		1.00	...	10.0
Shock threshing		2.50	4.0	4.0
Seed, (2 pks.)				
Twine, (2.25 lbs.)				

* Data for sulky plows are given, as a sulky is usually used for sod plowing. They have been increased to allow for the fact that sod plowing is slower than stubble plowing.

DISTRIBUTION OF LABOR ON FLAX

There is a much wider range in time of seeding flax than of any of the other spring-sown grain crops. The flax plant is tender and can not safely be sown as early as oats or barley, but as it is not subject to rust as are the other grains and is less affected by hot weather, it can be sown much later in the spring than any other grain crop. The seeding time on these farms varied from May 14 to June 15. Harvest varied from July 26 to September 5. This elasticity in time of seeding and harvest makes it possible to fit the crop in at a time when it will interfere least with the labor demands of other crops.

TAME HAY

USUAL PRACTICES IN TAME HAY PRODUCTION

Tame hay is always seeded with small grain, usually oats, as a nurse crop. As the seed is either mixed with the grain in the drill box or sown with a grass seeding attachment to the drill, there is practically no extra labor involved in seeding the crop. Sixty per cent of the tame grass seeded during the three years of this study was a mixture of timothy and red or alsike clover, the rest was clear clover. The practice of seeding clear clover is increasing rapidly. In 1920 less than a third of the grass seeding was clear clover, but in 1922 two thirds of the acreage was sown clear. In the mixture, the first year's crop is largely clover but the following year timothy predominates and increases from year to year till the field is plowed up. Clear clover seeding is usually cut only one year and then plowed up. It is the usual practice in the Windom area to cut only one crop of tame hay a year and then pasture the field. A small acreage is cut for seed.

Most of the hay is raked, altho some is picked up directly from the swath with a hay loader. A small amount is tedded before raking and some is cocked by hand. Most of the tame hay is hauled into the barn, but any in excess of the mow space or from fields distant from the barn, is stacked in the field. Some of the hay stacked is pitched on a wagon or loaded with a loader and pitched on the stack by hand. Usually, however, a sweep rake and swinging stacker or a bucking pole is used.

LABOR REQUIREMENTS FOR TAME HAY PRODUCTION

The labor requirements for tame hay are shown in Tables XVIII and XIX. The operation of hauling and stacking includes both hauling to the barn and stacking in the field. As part of the hay from so many fields was put in the barn and the rest stacked, it was impossible to separate the requirements for these operations.

TABLE XVIII
MAN LABOR REQUIREMENTS PER ACRE, BY OPERATIONS, FOR TAME HAY, 1921

Farm No.*	Acres per farm	Yield per acre, tons	Hours per acre			
			Mowing	Raking	Hauling and stacking	Total
7	21	1.0	0.92	0.10	2.12	3.14
11	17	1.6	1.10	0.53	3.15	4.78
12	11	1.7	1.25	0.18	4.05	5.48
3	17	1.1	0.66	0.66	4.19	5.51
1	34	1.4	0.86	0.84	4.01	5.71
6	11	1.5	1.19	0.62	4.14	5.95
10	24	1.1	1.09	0.38	4.60	6.07
2	23	1.4	1.16	...	5.32	6.48
4	40	1.8	1.93	0.60	4.29	6.82
13	15	1.8	0.75	...	6.41	7.16
22	11	1.8	1.88	0.76	4.58	7.22
9	19	1.7	0.91	0.39	6.21	7.51
8	35	1.5	1.45	0.47	6.82	8.74
16	10	2.4	3.67	0.41	9.08	13.16
Averages						
14 farms, 1921	21	1.5	1.26	0.52	4.84	6.62
13 farms, 1920	19	1.0	1.11	0.45	3.76	5.32
14 farms, 1922	20	0.9	0.95	0.51	2.95	4.39

* Farms are listed in order of total man labor requirements, beginning with the lowest.

TABLE XIX
HORSE LABOR REQUIREMENTS PER ACRE, BY OPERATIONS, FOR TAME HAY, 1921

Farm No.*	Acres per farm	Yield per acre, tons	Hours per acre			
			Mowing	Raking	Hauling and stacking	Total
11	17	1.6	2.20	1.06	2.49	5.75
7	21	1.0	1.84	0.20	4.24	6.28
9	19	1.7	1.82	0.41	5.09	7.32
1	34	1.4	1.72	1.64	4.22	7.58
3	17	1.1	1.32	1.32	5.25	7.89
8	35	1.5	2.84	0.94	4.34	8.12
12	11	1.7	2.50	0.36	5.52	8.38
6	11	1.5	2.38	1.14	5.35	8.87
2	23	1.4	2.32	...	7.03	9.35
13	15	1.8	1.50	...	7.91	9.41
10	24	1.1	2.18	0.76	6.73	9.67
4	40	1.8	3.86	1.20	6.62	11.58
22	11	1.8	3.76	1.52	10.14	15.42
16	10	2.4	7.34	0.82	12.24	20.40
Averages						
14 farms, 1921	21	1.5	2.50	0.99	5.80	9.29
13 farms, 1920	19	1.0	2.23	0.91	5.04	8.18
14 farms, 1922	20	0.9	1.89	1.00	3.77	6.66

* Farms are listed in order of total horse labor requirements, beginning with the lowest.

CAUSES FOR VARIATIONS IN LABOR REQUIREMENTS FOR TAME HAY

Yield.—The principal cause for variations in labor required for mowing, hauling, and stacking was the difference in yield. The average hours of man labor for mowing for the farms having less than an average yield was 1.05 hours, for farms having more than an average yield 1.64 hours. The highest labor requirement for mowing occurred on Farm 16. The grass was so heavy in places that it stood up after it was cut off and the man driving the mower had to get off and pitch it aside with a fork in order to see where to drive. The highest labor requirements for hauling and stacking were on the farms having the highest yields, Farms 13, 16, and 22.

Method of handling.—The man and horse labor requirements for raking were figured on the basis of the entire acreage of tame hay whether it was raked or not. Data were not available on the percentages of acreage raked and not raked. Consequently some of the variations are due to variations in the percentage of total acreage raked. On Farm 2 it was bucked out of the swath and on Farm 13 it was taken out with a hay loader. On Farms 7 and 12 part of it was taken out of the swath. On all other farms it was all raked before hauling or stacking. On some farms the hay was only raked into windows, but on Farms 1 and 22, with the highest labor requirements for raking, it was also bunched with a rake. Hauling hay to the barn usually requires more labor than stacking it in the field. On Farm 12 all tame hay was stacked in the field. On Farm 9 it was all hauled to the barn. The yields were the same on both farms but the labor requirements for stacking were 4.05 man hours and 5.52 horse hours as compared with 6.21 man hours and 5.09 horse hours for hauling into the barn. The hay in the latter case was put into the mow with slings.

GRASS SEED REQUIREMENTS

The average amount of clear clover seed sown per acre was 10.2 pounds. If it was mixed with timothy the average amount of clover per acre was 6.1 pounds and of timothy 5.3 pounds. The clear clover seeding varied from 9.3 to 17 pounds per acre and the mixed timothy and clover from 8.3 to 14.6 pounds. The best stands of grass were obtained where at least 10 pounds of clover or from 12 to 14 pounds of mixed timothy and clover were sown per acre. Red clover was the variety commonly used, altho small amounts of alsike were included in some of the mixtures.

STANDARD REQUIREMENTS PER ACRE FOR TAME HAY PRODUCTION IN SOUTHWESTERN MINNESOTA

Operation	Equipment	Hours of labor		Acres covered in 10-hour day
		Man	Horse	
Mowing, (1.5 tons)	5-ft. mower and 2 horses	1.0	2.0	10.0
Raking, (1.5 tons)	10-ft. rake and 2 horses	0.5	1.0	20.0
Hauling and stacking, (1.5 tons)		4.5	5.5	2.2
Seed				
Clover, (10 lbs.)				
Mixed, timothy, (6 lbs.); clover, (8 lbs.)				

DISTRIBUTION OF LABOR ON TAME HAY

Tame hay is usually cut between July 1 and July 15. Ordinarily at least ten work days of this period would be available for haying operations. The time of cutting tame hay varies with the season, in 1922 some was cut as early as June 20, and in 1920 the bulk of the tame hay work was not completed until July 25. For a given season, however, the work seldom extends over more than two weeks. Tame hay must be cut quite promptly after it is ready in order to insure good quality

Fig. 11. Distribution of Man Labor on Twenty-Three Acres of Tame Hay

Figure 11 shows the distribution of man labor on 23 acres of tame hay on a Windom farm in 1922. Except that the cutting is earlier than usual, this distribution is quite characteristic for farms in the area. The tame hay crop is characterized by heavy labor demands for a short time with no possibility of shifting them much one way or the other without sacrificing the quality or yield of hay.

WILD HAY

USUAL PRACTICES IN WILD HAY PRODUCTION

Wild hay is handled in much the same way as is tame hay. It is usually cut later in the season than tame hay when the weather is likely to be more favorable; and as it is less easily damaged by rain less care is exercised in handling it. It is never tedded and seldom cocked, and

is usually stacked in the field. Either a sweep rake and stacker or a bucking pole is used. Unless the first crop is cut early and the precipitation is quite heavy, a second crop is seldom cut.

LABOR REQUIREMENTS FOR WILD HAY PRODUCTION

The labor requirements for wild hay are shown in Tables XX and XXI. The stacking requirement includes a small amount for hauling to the barn. As parts of the same field were handled each way it was impossible to separate the labor for these two operations.

TABLE XX

MAN LABOR REQUIREMENTS PER ACRE, BY OPERATIONS, FOR WILD HAY, 1921

Farm No.*	Acres per farm	Yield per acre, tons	Hours per acre			
			Mowing	Raking	Hauling and stacking	Total
7	11	1.0	0.76	0.19	2.00	2.95
2	12	1.9	0.56	...	2.98	3.54
10	5	1.0	1.36	0.42	3.32	5.10
9	5	1.1	0.90	0.57	3.88	5.35
12	13	1.9	1.44	0.23	3.86	5.53
20	23	1.8	1.42	0.56	3.72	5.70
17	14	1.4	1.64	0.83	3.42	5.89
13	3	1.0	1.15	0.77	4.98	6.90
15	15	1.6	1.06	1.36	4.70	7.12
6	2	1.1	1.67	0.83	5.56	8.06
14	12	1.7	1.72	0.16	8.99	10.87
21	27	1.0	2.63	0.26	8.55	11.44
Averages						
12 farms, 1921	11.83	1.4	1.52	0.52	5.03	7.07
11 farms, 1920	18.12	1.1	1.29	0.57	3.54	5.40
9 farms, 1922	12.96	0.9	1.08	0.47	2.96	4.51

* Farms are listed in order of total man labor requirements, beginning with the lowest.

TABLE XXI

HORSE LABOR REQUIREMENTS PER ACRE, BY OPERATIONS, FOR WILD HAY, 1921

Farm No.*	Acres per farm	Yield per acre, tons	Hours per acre			
			Mowing	Raking	Hauling and stacking	Total
7	11	1.0	1.52	0.38	4.00	5.90
2	12	1.9	1.12	...	5.32	6.44
9	5	1.1	1.80	1.14	3.79	6.73
15	16	1.6	2.12	2.72	2.18	7.02
12	13	1.9	2.87	0.45	5.14	8.46
20	23	1.8	2.85	1.12	4.86	8.83
17	14	1.4	3.28	1.66	4.56	9.50
10	5	1.0	2.72	0.84	6.64	10.20
6	2	1.1	3.34	1.66	5.56	10.56
13	3	1.0	2.30	1.54	6.90	10.74
14	12	1.7	3.27	0.32	12.10	15.69
21	27	1.0	4.68	0.51	14.58	19.77
Averages						
12 farms, 1921	11.83	1.4	2.91	1.04	7.11	11.06
11 farms, 1920	18.12	1.1	2.58	1.11	5.08	8.77
9 farms, 1922	12.96	0.9	2.16	0.90	4.42	7.48

* Farms are listed in order of total horse labor requirements, beginning with the lowest.

CAUSES FOR VARIATIONS IN LABOR REQUIREMENTS FOR WILD HAY

Size of fields.—The high labor requirements on Farms 6 and 13 were due to the small fields. The requirement for each operation was higher than for the corresponding operation on tame hay on the same farms, even tho the yield of tame hay was much higher.

Distance of fields from farmstead.—The labor requirements on Farm 21 were high because the wild hay was on rented land eight miles from the farmstead. The high requirements, especially for hauling, on Farm 14 were due to hauling all hay to the barn from a field three-fourths of a mile distant.

Method of handling.—The labor requirements for raking on Farms 7, 12, 14, and 21 were low because only parts of the fields were raked. The hay on the rest was picked up directly from the swath with a hay buck. The difference between the hauling and stacking requirements on Farms 7 and 10 was due to the fact that all hay on Farm 7 was stacked in the field with a sweep rake and stacker while on Farm 10 it was all pitched onto a wagon and hauled to the barn.

Yield.—The higher labor requirement for stacking on Farm 2 as compared with Farm 7 was due to the higher yield. All other conditions on these two farms were comparable. The average labor requirements for the three years also reflect the effect of increased yield in increasing labor requirements.

STANDARD REQUIREMENTS PER ACRE FOR WILD HAY PRODUCTION IN SOUTHWESTERN MINNESOTA

The farmers who put up their wild hay with the least labor rake it into windrows, pick it up with a sweep rake, and stack it with a swinging stacker. Assuming these practices and a yield of 1.25 tons per acre, the following are suggested as standard labor requirements for the crop.

Operation	Equipment	Hours of labor		Acres covered in 10-hour day
		Man	Horse	
Mowing	5-ft. mower and 2 horses	1.0	2.0	10.0
Raking	10-ft. rake and 2 horses	0.5	1.0	20.0
Stacking	Sweep rake and swinging stacker	3.0	4.5	3.3

DISTRIBUTION OF LABOR ON WILD HAY

Wild hay as a crop is very elastic in its labor demands. The period at which it is ready to cut varies widely. A wide variety of grasses, from Kentucky bluegrass to coarse marsh grasses and sedges, is included. These mature at different times. Some fields are on high, well drained land which can be cut at any time. Others are on low, wet land that is only dry enough for mowing in late summer. Then, too, the wild grass does not deteriorate so rapidly in palatability or feeding value

after it is once ready to cut as do the tame grasses. For this reason the making of wild hay is extended over a considerable time and can be shifted to avoid conflict with the labor demands of other crops to a considerable extent. On these farms wild hay was cut as early as June 24 and as late as September 29. Most of it was cut between July 10 and August 30. When it is cut earlier than July 10 it is usually with the purpose of getting a second crop.

Fig. 12. Distribution of Man Labor on Fourteen Acres of Wild Hay

Figure 12 shows the distribution of man labor by days on a 14-acre field of wild hay. It illustrates the method of fitting in the work between other operations. The work was started on July 5, after the last cultivation of corn, and extended till oat harvest on July 14. Two days, July 21 and 22, between oat harvest and shock threshing were spent putting up wild hay, and in August, after shock threshing was over, the work on the crop was completed. It is the usual practice to fit the wild hay labor between the operations on other enterprises whose labor demands are less elastic.

ALFALFA

USUAL PRACTICES IN ALFALFA PRODUCTION

Alfalfa in the Windom area is practically always seeded with small grain, usually oats, as a nurse crop. The seed is mixed with the grain and little extra labor is involved. Prepared cultures are sometimes used for inoculating the soil, but more often soil from an old alfalfa field is used. In many cases a good stand is obtained with no artificial inoculation. The practices in putting up alfalfa hay are practically the same as for tame hay. All alfalfa on these farms is hauled directly to the barn, none is stacked in the field. Except for a few small fields used as hog pasture, a first crop is cut on all fields. A second crop is cut on three quarters of the acreage and a third crop on at least one half. When a second or third crop is not cut the field is usually pastured. Occasionally a small amount is cut for seed.

LABOR REQUIREMENTS FOR ALFALFA PRODUCTION

The labor requirements for alfalfa are presented in Tables XXII and XXIII. The principal factor causing variations in the requirements for this crop was yield. This is well illustrated in the first cutting.

The labor requirements increased directly with the yield except on Farm 14, where the labor was disproportionately high because of the use of family labor. The fact that the requirements for the second cutting were lower than for the first, further illustrates this point. If alfalfa is cocked before hauling, the hauling requirements are lessened but the total labor required for the crop is increased.

TABLE XXII
MAN LABOR REQUIREMENTS PER ACRE, BY OPERATIONS, FOR ALFALFA, 1921

Farm No.*	Acres per farm	Yield per acre, tons	Hours per acre				Total
			Mowing	Raking	Cocking	Hauling	
First cutting							
15	7.6	0.7	1.05	0.79	0.26	2.24	4.34
10	5.0	0.8	1.10	0.30	...	3.14	4.54
21	6.8	0.5	1.17	0.59	1.46	1.46	4.68
1	5.1	1.2	1.96	0.79	...	4.32	7.07
11	8.0	1.5	1.07	0.75	...	5.40	7.22
14	2.8	1.1	1.08	0.54	...	5.73	7.35
16	2.9	1.7	1.38	1.03	...	5.86	8.27
6	5.7	2.1	1.58	0.26	3.77	4.21	9.82
Averages							
8 farms, 1921	5.5	1.2	1.28	0.63	1.66	3.75	7.32
4 farms, 1920	5.2	1.4	1.10	0.57	2.07	3.30	7.04
9 farms, 1922	5.1	1.4	1.04	0.64	...	4.06	5.74
Second cutting							
10	5.0	0.3	0.75	0.55	...	0.60	1.90
15	7.6	1.0	1.05	0.66	...	1.84	3.55
14	2.9	1.1	0.72	0.72	...	2.87	4.30
6	5.7	1.2	0.88	0.44	...	3.16	4.48
21	6.8	0.6	1.61	0.66	...	2.64	4.91
16	2.9	1.0	1.03	...	...	4.14	5.17
11	4.4	1.4	1.15	0.46	...	4.13	5.74
Averages							
7 farms, 1921	5.0	0.9	1.07	0.58	1.93	2.58	6.16
2 farms, 1920	4.1	†	0.91	0.42	...	1.70	3.30
7 farms, 1922	4.9	0.9	0.80	0.57	...	2.60	3.97
Third cutting							
21	6.8	0.4	1.46	0.59	...	1.61	3.66
6	5.7	0.7	0.79	0.53	...	2.46	3.78
11	4.4	0.8	1.15	0.46	...	2.29	3.90
16	2.9	0.4	1.03	0.69	...	2.76	4.48
15	7.6	0.8	1.25	1.05	...	2.63	4.93
Averages							
5 farms, 1921	5.5	0.6	1.17	0.69	1.48	2.30	5.64
1 farm, 1920	2.2	†	1.35	0.90	...	1.80	4.05
3 farms, 1922	6.5	0.5	0.63	0.33	...	1.42	2.38

* Farms are listed in order of total man labor requirements, beginning with the lowest.
† Yield included in first cutting.

TABLE XXIII

HORSE LABOR REQUIREMENTS PER ACRE, BY OPERATIONS, FOR ALFALFA, 1921

Farm No.*	Acres per farm	Yield per acre, tons	Hours per acre			
			Mowing	Raking	Hauling	Total
First cutting						
15	7.6	0.7	2.10	1.58	2.11	5.79
10	5.0	0.8	2.20	0.60	3.19	5.99
21	6.8	0.5	2.34	1.18	2.64	6.16
1	5.1	1.2	3.92	1.58	4.32	9.82
11	8.0	1.5	2.14	1.50	3.77	7.41
14	2.8	1.1	2.16	1.08	5.73	8.97
16	2.9	1.7	2.76	2.06	11.72	16.54
6	5.7	2.1	3.16	0.52	4.56	8.24
Averages						
8 farms, 1921	5.5	1.2	2.55	1.25	4.06	7.86
4 farms, 1920	5.2	1.4	2.20	1.15	3.78	7.13
9 farms, 1922	5.1	1.4	2.08	1.16	4.19	7.43
Second cutting						
10	5.0	0.3	1.49	1.10	1.19	3.78
15	7.6	1.0	2.10	1.32	2.37	5.79
14	2.8	1.1	1.43	1.43	2.87	5.73
6	5.7	1.2	1.76	0.88	3.16	5.80
21	6.8	0.6	3.22	1.32	4.10	8.64
16	2.9	1.0	2.06	...	4.14	6.20
11	4.4	1.4	2.30	0.92	6.42	9.64
Averages						
7 farms, 1921	5.0	0.9	2.14	1.15	3.35	6.64
2 farms, 1920	4.1	†	1.82	0.85	2.43	5.10
7 farms, 1922	4.9	0.9	1.54	1.04	2.78	5.36
Third cutting						
21	6.8	0.4	2.92	1.18	1.76	5.86
6	5.7	0.7	1.58	1.06	3.51	6.15
11	4.4	0.8	2.30	0.92	7.29	5.51
16	2.9	0.4	2.06	1.38	5.52	8.96
15	7.6	0.8	2.50	2.10	3.16	7.76
Averages						
5 farms, 1921	5.5	0.6	2.34	1.39	2.99	6.72
1 farm, 1920	2.2	†	2.70	1.80	3.61	8.11
3 farms, 1922	6.5	0.5	1.27	0.66	1.32	3.25

* Farms are listed in order of total man labor requirements, beginning with the lowest.

† Yield included in first cutting.

SEED REQUIREMENTS FOR ALFALFA

The average rate of seeding alfalfa was 12.5 pounds per acre. This rate varied from 9 to 15 pounds per acre on different farms. Twelve pounds was the most common rate and proved sufficient in most cases to secure a satisfactory stand.

STANDARD REQUIREMENTS PER ACRE FOR ALFALFA PRODUCTION IN SOUTHWESTERN MINNESOTA

The following standard requirements for alfalfa are suggested for three cuttings with a total yield of three tons.

Operation	Equipment	Hours of labor		Acres covered in 10-hour day
		Man	Horse	
First cutting				
Mowing	5-ft. mower and 2 horses	1.25	2.50	8.00
Raking	10-ft. rake and 2 horses	0.50	1.00	20.00
Hauling		4.50	4.50	2.25
Second cutting				
Mowing		1.00	2.00	10.00
Raking		1.50	1.00	20.00
Hauling		3.00	3.00	3.30
Third cutting				
Mowing		1.00	2.00	10.00
Raking		0.50	1.00	20.00
Hauling		2.50	3.00	4.00
Seed, (12 lbs.)				

DISTRIBUTION OF LABOR ON ALFALFA

There is considerable seasonal fluctuation in the dates of cutting alfalfa. In 1922 some was cut on June 5 and in 1920 some was cut for the first time on June 26. The second cutting varied from July 9 to July 31 and the third from August 20 to September 27. The most common dates of the cuttings and the days usually available during the period are as follows:

First cutting	June 13 to June 22	7 days available
Second cutting	July 15 to July 21	5 days available
Third cutting	Sept. 1 to Sept. 10	6 days available

Fig. 13. Distribution of Man Labor on Six Acres of Alfalfa (3 Cuttings)

Figure 13 shows the labor distribution by days on a field of six acres of alfalfa cut three times. The first cutting of alfalfa conflicts with corn cultivation, the second with small grain harvest, and the third with silo filling, stack threshing, and fall plowing. Like tame hay, the crop is characterized by high labor requirements for short periods of time with little chance of shifting these periods materially. Once alfalfa is ready to cut it can not be allowed to stand without loss of feeding value for that crop and a lessened yield for the next. After it is cut it must be cured and hauled to the barn as promptly as possible to avoid loss of leaves.

USE OF UNIT REQUIREMENT AND LABOR DISTRIBUTION DATA
IN PLANNING A CROP SYSTEM

In the presentation of labor requirements by operations for the several crops, a wide range in requirements for each operation has been apparent. The principal causes for these variations have been noted. Often there are several factors affecting the requirement for a given operation on a particular farm. For example, the labor requirements for husking corn on Farm 15 were high, because two men worked with one team and the fields were small and distant from the farmstead. In other instances the factors causing variations may be exerted in opposite directions and offset each other. For this reason it is impossible to evaluate accurately the effect of each factor in raising or lowering labor requirements. However, it is apparent that low labor requirements are generally associated with large implements, large teams, experienced, able-bodied laborers, balanced power and equipment units, and large fields conveniently located with reference to the farmstead. A farmer using these standard requirements in computing the probable labor demand of any cropping system, should include these factors in his organization or increase the requirements in proportion to his inability to do so.

The suggested dates for the performance of the various crop operations are usually the most satisfactory and can safely be used in planning the labor program, altho seasonal variations will make occasional adjustments necessary for particular years. The number of work days available for each operation is computed with a fair allowance for weather interference.

In planning a system of cropping for a farm, these tables of unusual dates and days available for the various operations will indicate when different crops will require labor and what competition between crops will occur. By computing the total labor requirements for the acreages of crops planned and comparing it with the work days available, the farmer may determine whether his labor supply is sufficient to meet the demands at all times with a reasonable margin of safety, or whether he must either change his cropping plan or hire additional labor for the heavy demands occurring at certain seasons.

LIVESTOCK REQUIREMENTS

DEFINITION AND DESCRIPTION OF LIVESTOCK REQUIREMENTS

The unit requirements for livestock include hours of man and horse labor and pounds of feeds of the various kinds. In addition to the requirements that can be measured in terms of physical units, there are others, as medicine and veterinary services, that can only be measured in terms of money value. Altho these occur quite irregularly they have been included in the tables of requirements because the farmer must in the long run make provision for them. So far as possible the product of each class of stock is indicated in terms of physical units. Where joint products are produced the quantity of each is listed. In case of mature animals, as horses or cows, the requirements are listed on a per head basis. Swine requirements are based on one hundred pounds of pork produced.

For other classes of stock the animal unit basis is used, as they do not have a single physical product, and they vary in age and weight so widely that a per head requirement would not be significant.⁷

The roughage requirements for livestock do not include straw. Usually several classes of stock eat from the same stack at will. Often they trample more under foot, to be later hauled out as manure, than they actually eat. These practices made it difficult to get a complete and accurate record of straw consumed by each class of stock. For the same reason no charge has been made for straw used for bedding.

The range of requirements is presented for 1921, also averages for 1920. Livestock data for 1922 were not completed in time to be included in this study.

As in case of crops, the reasons for the variations in requirements are mentioned so far as possible. Standard requirements are presented which represent the accomplishment of farmers who by their skill in feeding and handling their livestock attain the lowest requirements per unit of product. In computing this requirement a standard of production is set which, while higher than the average, is easily within the reach of any farmer who follows the better practices in feeding and handling stock that are mentioned as factors in lowering feed and labor requirements.

⁷ An "animal unit" as defined by the committee on terminology of the American Farm Management Association, now the American Farm Economic Association (see Record of Proceedings of Eighth Annual Meeting, December 1917, page 192), represents on average mature horse or cow, or the equivalent in other livestock, based upon the amount of feed eaten and manure produced. In this study the following numbers of other livestock will be considered equivalent to a mature horse or cow:

2 colts

2 young cattle

5 mature hogs

10 pigs

7 mature sheep

14 lambs

100 chickens

WORK HORSES

FEED AND LABOR REQUIREMENTS FOR WORK HORSES

The feed and labor requirements for work horses are presented in Table XXIV. The range of requirements for 1921 is shown, together with averages for both 1920 and 1921. All horses are included in this table, whether brood mares raising colts or geldings used exclusively for work. Labor on horses includes time spent in feeding, watering, currying, harnessing, and caring for them. It also includes time spent cleaning and bedding the horse barn. It does not include indirect labor on horses, such as grinding feed or hauling hay or straw for them. In addition to feed and labor the amount of miscellaneous cash expense per horse is shown. This includes shoeing, medicine, and veterinary attention. Since it is impossible to reduce this to a physical unit basis, it is shown as a cash amount. The number of hours worked by a horse is also given.

CAUSES FOR VARIATIONS IN FEED REQUIREMENTS FOR HORSES

Amount of work performed by horses.—The largest number of hours of work per horse was performed on Farm 15, which has the highest feed requirements of any farm except No. 4. The latter has much larger horses and raised colts in addition to working the horses. The lightest grain feeding was practiced on Farm 22, where horses were worked the fewest hours.

Kinds of feed.—The extensive use of pasture saves hay or grain or both, as is shown by Farms 7, 19, and 22, using most pasture. The hay requirements are low on all three and the grain quite low on 7 and 22. The grain feed is usually heavier when it is largely corn, and the roughage feed is heavier when it is largely wild hay.

Price of feeds.—The heavier feeding of both hay and grain in 1921 as compared with 1920 is partly due to the fact that the price of feeds had decreased so much that they were used less economically.

CAUSES OF VARIATION IN MAN LABOR ON HORSES

Number of horses per farm.—In general, the more horses per farm the less labor per horse. In several operations, as feeding, the time spent per horse does not increase as the number of horses increases. It does not take twice as long to feed 8 horses on Farm 1 as to feed the 4 on Farm 13.

Use of pasture.—On Farms 7, 19, and 22, where the greatest use is made of pasture for horses, the chore labor on horses is least. The labor of feeding and currying the horses as well as cleaning and bedding the barn is saved when the horses are on pasture.

TABLE XXIV
UNIT REQUIREMENTS PER YEAR FOR A WORK HORSE, 1921

Farm No.*	No. of horses per farm	Corn, lbs.	Small grain, lbs.	Tame hay, lbs.	Wild hay, lbs.	Pasture, days	Total grain, lbs.	Total roughage, lbs.	Man labor, hours	Shoeing, vet. services, medicine, dollars	Total hours worked
22	7.0	946	42	....	4564	148	988	4564	45	...	433
7	8.0	....	1743	798	2695	195	1743	3493	25	...	541
20	4.8	626	1808	....	3817	....	2433	3817	98	0.44	547
13	4.0	....	2457	1753	2823	115	2457	4576	81	...	628
12	7.4	841	1972	1435	3353	33	2813	4788	82	...	691
17	4.8	2155	763	....	5351	73	2918	5351	93	1.25	701
10	6.0	1294	948	3370	2145	111	2242	5515	47	...	732
19	5.0	2004	1500	966	3141	151	3505	4127	65	1.30	737
3	7.0	2389	1800	5233	....	....	4189	5233	89	1.43	780
16	5.1	908	2240	3818	....	113	3148	3818	78	...	792
6	7.0	2512	682	2695	2734	101	3194	5429	62	1.07	792
18	5.0	1118	1841	....	7233	19	2959	7233	72	...	793
11	5.0	339	3309	5809	1600	37	3648	7409	85	...	823
5	6.6	2956	433	....	5970	88	3389	5970	83	0.21	831
9	5.9	1687	2435	2387	4007	86	4122	6394	46	...	834
2	8.8	2820	909	2301	3360	71	3729	5661	69	2.32	858
21	2.8	1523	2072	1958	6401	....	3595	8359	82	3.38	885
1	8.0	1056	2243	6970	....	90	3299	6970	51	...	896
4	7.0	3113	2690	3715	5616	24	5803	9331	235	0.43	910
8	6.0	2432	2787	4440	....	....	5219	4440	72	...	1003
14	5.3	2839	1009	749	7008	60	3848	7757	82	1.05	1069
15	3.4	3927	1513	....	7582	15	5440	7582	123	0.59	1238
Averages											
130 horses, 1921		1708	1646	2350	3376	74	3354	5726	79	0.57	780
132 horses, 1920		1397	1774	2725	2266	60	3171	4977	78	0.71	824

* Farms are listed in order of hours worked beginning with the lowest.

Amount of work done by horses.—High labor requirements are found on Farm 15 where the horses worked the largest number of hours.

Care of purebred horses and of growing colts.—The work horses on Farm 4 included 4 purebred mares from which 3 colts were raised. The extra labor involved in breeding the mares, attending them at foaling time, and caring for the colts until weaning time is included in the total labor requirement. This purebred stock was given much more attention than most grade stock receives. The time spent in fitting them and showing them at the county fair further increased the labor charged against them.

SHOEING, VETERINARY SERVICES, AND MEDICINE

The miscellaneous cash costs were highest on Farm 21, as a team was used daily for milk deliveries and was kept shod all year. All other items over \$1 per horse, consist largely of shoeing, except on Farm 17. This item covers veterinary service. The difference between 1920 and 1921 represents largely a difference in price levels.

STANDARD REQUIREMENTS FOR HORSES

The following standard requirements are suggested for a 1500-pound horse working 1000 hours a year:

Grain, pounds	4000
Roughage, pounds	6000
Pasture, days	45
Man labor, hours.....	80
Cash costs, cents.....	60

DISTRIBUTION OF MAN LABOR ON HORSES

Fig. 14. Distribution of Man Labor, by Weeks, on Work Horses

Figure 14 shows the distribution of man labor expended on horses on a farm having an average of 6.6 horses for the year. The labor runs fairly uniformly during most of the year. The peak requirements come during the rush of putting in the corn crop and cultivating it. From July to the close of the year the use of pasture cuts down the chore hours. In the fall and through the winter the horses run in stalk fields. This pasturing of stalk fields is common in the area and reduces the chores on horses during the fall and winter.

TABLE XXV
UNIT REQUIREMENTS PER ANIMAL UNIT PER YEAR FOR COLTS, 1921

Farm No.*	No. of horses per farm	Corn, lbs.	Oats, lbs.	Tame hay and alfalfa, lbs.	Wild hay and fodder, lbs.	Pasture, animal unit days	Total grain, lbs.	Total roughage, lbs.	Hours of labor		Vet. services and medicine, dollars
									Man	Horse	
6	0.4	1660	1195	6050	....	....	2855	6050	...	...	....
10	0.7	1417	....	1012	817	89	1417	1829	...	...	....
18	1.4	833	1628	....	4433	64	2461	4433	47	...	....
12	2.0	680	972	606	1955	77	1652	2561	...	...	....
15	2.8	1497	749	....	3738	146	2246	3738	1	...	....
19	3.0	173	100	747	1055	184	273	1802	...	...	....
9	3.1	1000	1244	....	3631	322	2244	3631	5	...	....
7	4.0	....	....	38	147	223	....	185	...	...	0.67
22	4.0	294	....	....	3195	165	294	3195	...	...	....
3	4.0	586	....	....	567	207	586	567	1	1.0	....
2	4.4	997	341	821	957	310	1338	1778	...	...	....
14	8.9	148	....	....	486	272	148	486	8	9.5	....
4	14.2	816	1155	780	577	43	1971	1357	1	...	....
Averages											
53 head, 1921	4.1	598	527	354	1248	173	1125	1602	3	2.0	0.07
48 head, 1920	3.4	608	318	1129	730	216	927	1625	17	3.0	0.14

* Farms are listed in order of number of head per farm, beginning with the lowest.

COLTS

DESCRIPTION OF ENTERPRISE

The unit requirements for colts are presented in Table XXV. The colt enterprise included yearlings, two-year olds, and even three-year old unbroken horses. On account of this variability in age and because the feed and labor for the different ages could not be separated, the requirements have been computed on the animal unit basis.⁸

FEED REQUIREMENT FOR COLTS

The wide variations in feed requirements for colts represent largely differences in practice. Usually more grain is fed to colts under one year than to older animals. Colts were born during the year on Farms 4, 6, 10, 15, and 18. These farms show high grain feeding requirements. Usually less grain is fed when a large amount of pasture is utilized. Farm 9 is an exception to this, as grain was fed while the colts were on pasture. On Farm 7 there were 4 yearling colts that received no grain and very little roughage. They ran in the pasture and stalk fields part of the year and received a ration of oat straw the rest of the time. They made little growth during the year. On Farms 3 and 14 liberal feeding of straw was practiced and on most of the farms straw formed part of the ration for colts. No record was kept of the amount of straw fed.

LABOR REQUIREMENTS FOR COLTS

Very little labor is required for colts. All labor on colts until they were weaned is included with that on work horses. After weaning, the colts spend most of their time in the pasture or stalk fields and require little care. The time spent daily on colts was usually so small that it was not reported. Farm 18 reported the largest amount of labor expended on colts, largely caring for a fall colt. Spring colts are turned out on pasture soon after birth but fall colts require stabling and more care.

STANDARD REQUIREMENTS FOR COLTS

On account of the variety of practices in raising colts on these farms, it is impossible to work out significant standards.

DAIRY COWS

DESCRIPTION OF ENTERPRISE

There were seven herds in 1921 in which all the cows were milked by hand throughout their period of lactation and for which a record of the entire milk and butterfat production for the year is therefore available. These dairy herds are bred to freshen during the late fall and winter. Forty-two per cent of the calves in 1921 were born during

⁸ See footnote 7, page 62.

October, November, and December, and 46 per cent from January to April, inclusive. The disposition of the calves is considered under the discussion of young dairy stock. The product of these cows is marketed as cream in nearly every case. The milk is separated on the farm and fed to calves and hogs. The cream is sold to the local creamery or to shipping stations. If sweet cream is sold it must be delivered at least three times a week in summer and twice a week in winter. One farmer bottled his whole milk and maintained a milk route in Windom. On another farm the cream was churned and the butter was sold in town. The general method of caring for and handling these cows is indicated in the discussion of causes for variations in feed, labor, and production.

The amounts of feed and labor and the production per cow for these herds is presented in Table XXVI. On Farms 15, 17, and 21 the herds consisted of grade and purebred Holsteins and Jerseys. The other four herds were almost entirely grade Shorthorns. The labor includes not only the regular chore hours spent in milking, feeding, cleaning the barn, and bedding the cows, but also marketing milk and any special work that is done at irregular times, as caring for a sick cow, buying cows, or testing for tuberculosis. The production record is based on butterfat actually utilized. It includes butterfat marketed; that contained in milk, cream and butter used in the house; and that in whole milk fed to calves.

CAUSES FOR VARIATIONS IN FEED REQUIREMENTS FOR DAIRY COWS

The amount of feed required by a dairy herd is determined by the farmer who feeds them. It is varied according to his judgment and to the supply of feed available. In general the greater the amount of pasture used the less the amount of grain and hay fed. Silage reduces the amount of dry roughage fed. In general the cows were fed according to production, the heaviest producers receiving the most feed. More than four times as much grain was fed per cow in 1921 as in 1920. This was largely owing to the low price of feeds in 1921 as compared with the price of dairy products. Grain had declined in price so much more, proportionately, than had butterfat, that the dairy cow offered a relatively better market for it than she had the previous year. Part of this large difference is, however, due to a change in the herds included in the study. Only four of the same herds were included both years. The grain feed for these herds was doubled in 1921 with a resulting increase of 30 per cent in butterfat production. The three herds added in 1921 were fed more than seven times as much grain per cow as the average of the herds they displaced, and produced 60 per cent more butterfat.

TABLE XXVI
UNIT REQUIREMENTS PER YEAR FOR A DAIRY COW, 1921

Farm No.*	No. of cows per farm	Corn, lbs.	Small grain, lbs.	Oil-meal, lbs.	Tame hay, lbs.	Wild hay, lbs.	Alfalfa, lbs.	Corn fodder, lbs.	Corn silage, lbs.	Pasture, days	Total grain, lbs.	Total dry roughage, lbs.	Hours of labor		Vet. services and medicine, dollars	Milk production, lbs.	Butterfat production, lbs.
													Man	Horse			
1	13.9	1133	46	....	1061	....	....	1684	....	229	1179	2745	118	2	0.12	3198	124
8	10.4	181	169	....	199	....	....	256	5495	264	350	455	122	25	...	3270	131
9	9.1	407	....	....	1424	543	....	659	2440	229	407	2626	147	3	0.63	3539	132
6	11.2	650	1302	....	433	134	2720	923	....	201	1952	4210	123	....	1.73	5321	208
17	5.7	422	2260	....	....	1729	....	2776	....	211	2682	4505	213	16	...	4651	217
15	8.1	1210	918	50	....	367	1456	....	9821	182	2178	1823	272	2	0.72	7570	260
21	8.6	2776	2916	233	624	832	2061	2684	....	171	5925	6201	459	35	1.37	7726	290
Averages																	
67 cows, 1921		963	932	36	596	397	892	1217	2365	215	1932	3102	194	11	0.66	4841	186
90 cows, 1920		283	194	1	1247	452	148	709	1561	199	478	2318	150	10	0.14	3293	132

* Farms are listed in order of butterfat production, beginning with the lowest.

CAUSES FOR VARIATIONS IN LABOR REQUIREMENTS FOR DAIRY COWS

Size of herd.—In general, the labor per cow decreased as the size of the herd increased. Milking is the only operation for which labor varies directly with the number of cows.

Use of pasture.—On Farms 1 and 8, where the largest use was made of pasture, the man labor requirements were lowest. These herds received very little feed while on pasture. Farm 9 reported as many pasture days per cow as Farm 1, but the cows were fed grain and hay while on pasture, thus increasing labor requirements.

Summer feeding.—On Farms 15 and 17 the cows were fed either grain or silage all but one month of the year, and on Farm 21 every month. On the farms with lower man labor requirements little, if any, feed was supplied in addition to pasture during six months of the year.

Method of marketing.—The high man and horse labor requirements for Farm 21 were due to the fact that all milk was bottled and delivered in Windom as whole milk. Other farms sold cream, which was delivered only two or three times a week. Farms 8 and 17 used horses largely in hauling cream and the horse labor requirements were higher than on farms where cream was delivered with an automobile.

Stabling cows in winter.—On Farms 15 and 21 the cows were stabled practically every day in winter. On Farm 17 the cows were stabled most of the winter and on Farm 9 part of the time. On the other farms they were turned out in the yard except in the most severe weather.

CAUSES FOR VARIATIONS IN PRODUCTION OF BUTTERFAT

Amount and kinds of feed.—The four highest producing herds were much more heavily fed than the low producing herds. The grain ration for the low producers was largely corn while the high producers received considerable small grain and in two cases oilmeal. Three of the four highest producing herds received alfalfa hay.

Care and handling.—As has already been noted, the three highest producing herds were stabled practically all winter. These herds and that on Farm 6 were in pasture a shorter time than the others. Since the extension of the pasture season beyond about 200 days involves the use of cornstalk pastures, which are really of little value for milk production, it is to be expected that the long pasture season will decrease rather than increase milk production. On Farms 6, 15, 17, and 21 the cows were given some extra feed during the summer while on pasture. This was especially important, as the rainfall in May and June was much below normal in 1921 and pastures were quite short.⁹ The skill of the farmer on Farm 15 in combining feeds and handling the herd was apparently an important factor in the high production.

⁹ See Fig. 2, page 11.

Individuality of cows.—The higher production of the herds composed of cows of the generally recognized dairy breeds is undoubtedly due to their inherited capacity for feed consumption and to their utilization of a relatively larger amount of feed for production and less for bodily maintenance.

The herd on Farm 15 was of excellent dairy type and breeding. The individual productive capacity, coupled with a skillful feeding and handling on the part of the farmer, as already mentioned, undoubtedly accounts in large measure for the higher production in proportion to the feed received than in the herds on Farms 17 and 21.

VETERINARY SERVICE AND MEDICINE

The cash expense for veterinary service and for medicine varies quite widely. Most of it is incurred for veterinary services. The high expense on Farms 6 and 21 is due to the testing of all cows for tuberculosis.

STANDARD REQUIREMENTS FOR DAIRY COWS

The following are suggested as standard requirements for a cow of dairy breeding producing 200 pounds of butterfat per year in a herd of at least ten cows given the care and attention essential to successful dairying.

Grain, lbs.	1400
Hay, alfalfa, or clover, lbs.....	2000
Silage, lbs. ¹⁰	6000
Pasture, days	180
Man labor, hours.....	150
Horse labor, hours.....	10
Cash costs (veterinary care and medicine), cents.....	35

DISTRIBUTION OF LABOR ON DAIRY COWS

Figure 15 shows the distribution of man labor by weeks on a dairy herd averaging 8 cows for the year. The shaded portion of each bar represents the regular daily work, as milking, separating the milk, feeding and bedding the cows, cleaning the barn, etc.; the clear portion, time spent marketing cream, extra work, as caring for a sick cow, and any work done only at irregular intervals. These cows were stabled every day during cold weather. From the latter part of March until they went on pasture they were turned out in the yard during the day and stabled at night. They were in the pasture until November, when they were turned into the stalk fields. Beginning the first week in December they were confined to the yard and by the last of the month were kept

¹⁰ If no silage were available an additional 2000 pounds of hay would be required and possibly some additional grain.

in the barn all the time. This labor distribution is typical of the better dairy herds where the cows are stabled in winter and given the care and attention necessary for high production.

Fig. 15. Distribution of Man Labor, by Weeks, on Dairy Cows

YOUNG DAIRY CATTLE

DESCRIPTION OF ENTERPRISE

"Young dairy cattle" includes not only heifers being raised for sale or use in the herd or bulls raised for sale as breeding stock, but also calves for veal, and both heifers and steers to be sold as stockers or feeders or to be fed on the farm.

There are fewer young dairy cattle on farms where Holsteins and Jerseys are kept, as the male calves are nearly all sold for veal and only the heifers are raised. Where Shorthorn cows are milked, few veal calves are sold. The male calves are castrated and raised for sale as yearling or two-year-old steers. The large number of young cattle on Farm 1 is due to the fact that all calves are raised and retained in the herd until two or three years old. The calves of at least three years are on hand all the time.

The usual practice in handling calves in these dairy herds is to wean them a few days after birth, feed them on whole milk for a short time, and then gradually replace this with skim milk. Pasture and roughage are extensively used with the young stock. Liberal grain feeding is practiced in case of only the older animals, especially steers that are being fattened.

The unit requirements for these young dairy cattle are presented in Table XXVII. As this class includes all ages and weights of cattle from veal calves to heavy two- and even three-year-old steers, unit

requirements are based on the animal unit.¹¹ No attempt has been made to compute a physical product for this class of cattle.

VARIATIONS IN FEED REQUIREMENTS FOR YOUNG DAIRY CATTLE

As for dairy cows, the feed for the young cattle is varied according to a farmer's judgment. The large variation in the type of cattle included in this enterprise caused a wide diversity in the labor and feed expended on them. The heaviest feeding was practiced on Farm 15, where young cattle were grade or purebred Holsteins that the owner was attempting to grow to as large size as possible. The heavy feeding on Farm 1 was due to the fact that 22 two- and three-year-old steers on a heavy fattening ration were included in the enterprise. Except in this case the large use of pasture was associated with low grain and roughage requirements.

CAUSES FOR VARIATIONS IN LABOR REQUIREMENTS

Use of pasture.—On Farms 6, 15, and 21, which had the highest man labor requirements, the least use was made of pasture, as more labor is required to care for stock in the barn or yard.

Feeding grain to calves and yearlings.—On Farms 6, 15, and 21, which had the highest man labor requirements, more grain per animal unit was fed than on any others except Farm 1. On these farms the grain was fed largely to calves and yearlings in the barn. This involved much more labor than was required on Farm 1, where most of the grain was fed outdoors in bulk quantities to a carload of fattening cattle.

Size of herd.—The saving of labor as herds increase in size is somewhat obscured by the other variables affecting labor. However, on Farms 1, 8, and 9 conditions were fairly comparable and the labor per animal unit decreased as the size of herd increased.

Care of dairy heifers.—On Farm 15 the young cattle consisted largely of purebred or grade heifers. These were not turned on pasture as young as were the animals on most farms. They were stabled at night for at least six months of the year, were kept in the barn both day and night during severe cold weather, and received much more individual care and attention than did the grade stock of beef breeding.

VETERINARY SERVICES AND MEDICINE

Very little is spent for veterinary services or medicine for young cattle. The high cost on Farm 6 is due to testing for tuberculosis.

¹¹ See footnote 7, page 62.

TABLE XXVII
UNIT REQUIREMENTS PER ANIMAL UNIT PER YEAR FOR YOUNG DAIRY STOCK, 1921

Farm No.*	No. of head	Corn, lbs.	Small grain, lbs.	Tame hay and alfalfa, lbs.	Wild hay and fodder, lbs.	Silage, lbs.	Skim-milk, lbs.	Whole milk, lbs.	Pasture, animal unit days	Total grain, lbs.	Total dry roughage, lbs.	Hours of labor		Vet. services and medicine, dollars
												Man	Horse	
21	6	955	861	1319	1038	....	....	357	99	1816	2357	33	..	....
15	11	766	2083	2616	471	6268	2212	470	76	2849	3087	63	1.6	0.12
17	14	54	751	....	2598	....	....	....	194	805	2598	23	1.9	....
8	17	268	371	700	634	6278	1651	252	153	639	1334	26	2.4	....
9	21	66	358	....	369	5034	1847	215	178	424	369	15	1.4	....
6	24	1798	574	1101	1153	....	1996	348	151	2372	2254	36	1.3	1.46
1	50	2900	129	1530	1063	....	489	186	185	3029	2593	12	0.3	....
Averages														
142 head, 1921	20	1477	506	1067	1026	1957	1148	237	163	1983	2093	24	1.1	0.26
201 head, 1920	20	335	225	1545	927	1502	1044	159	198	561	2472	19	2.7	0.14

* Farms are listed in order of number of head per farm, beginning with the lowest.

STANDARD REQUIREMENTS FOR YOUNG DAIRY CATTLE

On account of the small number of herds included in this study and the high variability both in type of cattle and in feeding and handling methods, it is impossible to set standard requirements for this class of cattle that will have any significance.

DISTRIBUTION OF MAN LABOR ON YOUNG DAIRY CATTLE

Fig. 16. Distribution of Man Labor, by Weeks, on Young Dairy Cattle

Figure 16 indicates the distribution of man labor by weeks on 14 young dairy cattle. The high labor peak in February is due to the fact that all the calves were born during this month; the decrease in labor the latter part of April, to the fact that the yearlings were turned on pasture at that time. The young calves were turned on pasture the first of June and received no additional feed or care until the last of August. From then until the close of the year they were in pasture or stalk fields but received additional feed. At no time during the year did they require as much as six hours of labor a week. Most of this occurred during the slack season and is consequently of little importance in planning the labor program for the farm.

MIXED CATTLE

DESCRIPTION OF ENTERPRISE

The mixed cattle enterprise on these farms contains an element of diversity that makes it flexible and capable of adjustment to changing price conditions. When the price of butterfat is high in comparison with beef prices, all the cows can be milked and the calves either sold for veal or raised on skimmilk. Should the price of butterfat drop below that of beef, relatively, these same cows may be allowed to nurse their calves and their entire product may be marketed as beef. During the years of this study, butterfat was relatively high in price and more cows were being milked than would ordinarily be the case. About a third of these mixed herds were cows, the rest were calves, yearlings, and two-year-olds. From 15 to 20 per cent of all calves were sold as veal. The rest were raised to be retained in the breeding herd or sold as stockers, feeders, or fat cattle.

On one farm the calves were fed as baby beef and sold when about eighteen months old. There was considerable range in the time of year that the calves were dropped. They were fairly evenly distributed from November to May, inclusive. Few calves were born in the summer and early fall. As has already been noted, there was a wide range between farms in the proportion of cows milked by hand and those allowed to nurse their calves. Some cows nursed their calves throughout their lactation period, while others were allowed to nurse the calves only a part of the time and many not at all. The general plan of handling these cattle other than in the way of milking, differs little from that of the dairy herds of Shorthorn breeding. The product of the cows milked is marketed as cream.

The unit requirements for the mixed cattle enterprise are shown in Table XXVIII. As the age and size of the animals composing these herds varied so widely, the requirements are computed on an animal unit basis.¹² Under "Value of Stock" are included all sales of breeding, feeding, and fat stock as well as any increase in cattle on hand. Fluctuations due to changing price levels, in opening and closing inventories, have been eliminated. The dairy products include all cream sold, all dairy products used in the house, and skimmilk fed to swine and poultry. The lower value of dairy products in 1921 as compared to 1920 is largely due to lower prices received. At least as much was produced in 1921 in comparison with beef as in 1920. The reason the price deflation did not affect the value of the stock produced is that little stock was sold in 1920 until after prices had fallen. The two years are on very nearly the same price basis for stock but not for dairy products.

FEED REQUIREMENTS FOR MIXED CATTLE

The variability of the enterprise as well as the difference in systems of management on different farms, produced a wide range in feed requirements. Liberal silage feeding is usually associated with low grain or dry roughage requirements. On Farms 4 and 20, having the highest value product per farm, the heaviest feeding was practiced. The higher feed requirements on Farm 20 are due to the fact that dairy production was emphasized relatively more than on Farm 4. On both these farms grade Shorthorn cows of the milking strain were kept and the calves were raised for beef, fed on the farm, and sold as fat cattle.

¹² See footnote 7, page 62.

TABLE XXVIII
UNIT REQUIREMENTS PER ANIMAL UNIT PER YEAR FOR MIXED CATTLE ENTERPRISE, 1921

Farm No.*	No. of head	Corn, lbs.	Small grain, lbs.	Tame hay and alfalfa, lbs.	Wild hay, lbs.	Fodder, lbs.	Silage, lbs.	Pasture, animal unit days	Total grain, lbs.	Total dry roughage, lbs.	Hours of labor		Vet. services and medicine, dollars	Value of product	
											Man	Horse		Stock, dollars	Dairy products, dollars
2	81	1887	106	1243	1083	....	....	275	1993	2325	38	23	0.34	15.40	5.09
22	15	....	16	....	3299	404	....	225	16	3703	69	7.6	....	10.09	13.01
12	34	399	117	818	1296	1318	....	163	516	3432	54	0.8	....	8.76	16.52
7	38	375	131	206	920	210	2795	240	506	1147	32	2.8	....	21.84	7.33
14	23	539	68	328	61	185	6520	188	607	575	90	6.0	....	13.88	16.17
10	16	449	459	1446	96	....	....	226	908	1542	81	2.8	0.05	7.41	23.09
13	25	191	826	1702	198	1315	....	160	1017	3215	83	1.1	1.32	16.72	14.51
19	17	1069	538	516	1049	779	....	248	1607	2345	81	2.9	0.15	8.51	29.36
3	31	572	120	488	....	1230	....	213	693	1718	59	0.5	0.12	26.80	13.16
18	23	358	81	....	1044	....	5959	196	439	1044	74	4.3	0.35	25.82	15.16
5	27	427	116	....	1226	1167	....	253	544	2393	76	4.1	....	16.22	25.91
11	30	662	447	1750	....	272	6549	148	1108	2022	105	2.5	0.12	13.79	28.93
16	23	198	67	1887	....	355	7119	236	265	2247	114	1.9	....	8.75	36.06
20	26	2065	454	....	2969	785	3221	151	2518	3754	105	1.9	0.16	20.25	35.21
4	89	1424	891	1748	34	57	2176	198	2315	1838	74	2.2	....	35.64	21.49
Averages															
498 head, 1921	33	897	350	971	753	455	2178	210	1249	2178	72	2.6	0.17	19.37	19.02
321 head, 1920	29	431	176	1312	757	673	2489	188	608	2743	63	4.6	0.21	19.90	27.12

* Farms are listed in order of total value of product, beginning with the lowest.

CAUSES FOR VARIATIONS IN LABOR REQUIREMENTS FOR MIXED CATTLE

Amount of dairy production.—On all farms on which more than the usual amount of dairy products was produced, the man labor per animal unit was correspondingly high. Man labor, on the other hand, did not increase so definitely with increased value of stock product.

Size of herd.—In general the man labor per animal decreased as the size of the herd increased.

Shelter and care.—On Farms 11, 16, and 20, having the highest man labor requirements, all cattle were put in the barn, at least at night, all winter and were fed largely in the barn. On most farms part of the young cattle, especially feeding cattle, were fed in the yard and had only an open shed for shelter.

VETERINARY SERVICES AND MEDICINE

Very little is spent for veterinary services or medicine for mixed cattle. The large cost reported on Farm 13 was incurred in testing the herd for tuberculosis.

STANDARD REQUIREMENTS FOR MIXED CATTLE

The diversity of type of individuals composing these mixed cattle herds as well as of methods of handling them and of products produced, makes it impossible to set up significant standards for them.

Fig. 17. Distribution of Man Labor, by Weeks, on Mixed Cattle

DISTRIBUTION OF LABOR ON MIXED CATTLE

Figure 17 shows the distribution of man labor by weeks on 30 head of mixed cattle. This number included 13 cows, 10 of which were milked at least part of the time. They were turned out on pasture the

last of April. Some were taken off pasture early in November, but the rest had the run of the stalk fields till the latter part of December. The large amount of special labor in April was spent marketing cattle.

SWINE

DESCRIPTION OF ENTERPRISE

Swine are maintained on most of these farms for pork production. On several, however, a purebred breeding herd is maintained and a large number of animals are sold for breeding purposes. Spring farrowing is the common practice. Fall litters are produced on only about 25 per cent of the farms. Gilts are used largely for breeding on the pork producing farms, but aged sows predominate in the purebred herds.

Pigs are farrowed about March 1 for breeding purposes, but the litters to be fed for pork are not farrowed until April or May. The average weight at which hogs were marketed for pork in 1921 was 233 pounds. This varied on different farms from 188 to 292 pounds. If aged breeding animals are eliminated, the average weight at which pigs farrowed in the spring and fed directly for pork were sold, was about 200 pounds. Nineteen per cent of hogs sold for pork were marketed in December, 21 per cent in January, and 12 per cent in February. The other 48 per cent were distributed through the rest of the year.

Corn is the principal feed for hogs. The small grain used is almost exclusively oats. On a few farms a small amount of mill feeds or tankage is fed, but skimmilk is the principal protein concentrate on most of these farms. The pasture includes rape, alfalfa, clover, timothy, and bluegrass.

The feed and labor requirements for pork production are presented in Table XXIX. The pounds of pork produced represent the net gain in weight of all hogs on the farm during the year. The weights of hogs sold for either market or breeding purposes, of hogs butchered for farm consumption, and of hogs on hand at the end of the year, are added together and from their sum is subtracted the weights of hogs on hand at the beginning of the year and any purchased during the year. The remainder is the net weight of pork produced. No allowance is made for hogs that die during the year, hence this figure is net, in that it covers death risk. The feed is shown on the basis of the requirement for the production of 100 pounds net gain in weight. It includes feed for the breeding herd that produces the pig fed for market.

TABLE XXIX

UNIT REQUIREMENTS FOR PRODUCTION OF 100 POUNDS OF PORK, 1921

Farm No.*	Corn, lbs.	Small grain, lbs.	Mill feeds, lbs.	Total grain, lbs.	Tank-age, lbs.	Skim-milk, lbs.	Pasture, animal unit days†	Hours of labor		Vet. services and medicine, dollars	Pork produced, lbs.
								Man	Horse		
8	458	53	....	511	....	355	1.8	9.2	1.6	...	2,330
18	508	81	....	589	....	118	9.1	4.4	0.9	...	3,515
2	304	7	3	314	4.0	143	6.0	3.7	1.1	...	3,745
21	474	145	8	627	....	8	9.7	4.6	..	...	4,795
20	354	48	....	402	1.4	363	4.9	3.6	0.3	0.39	7,112
1	489	28	....	517	....	262	1.9	3.4	0.4	0.26	7,662
22	449	67	2	518	0.2	46	5.0	4.6	0.9	...	8,160
14	382	53	....	435	....	33	6.6	3.6	0.3	0.32	9,498
12	585	6	....	591	2.0	57	..	4.1	0.6	...	10,222
7	336	6	....	342	....	80	6.1	1.4	0.9	...	10,647
17	367	117	....	484	....	133	..	3.9	0.6	0.11	11,575
15	278	66	....	344	....	229	3.5	2.7	0.6	0.40	13,327
11	439	94	....	533	....	101	3.0	4.0	0.6	0.47	13,347
9	396	....	....	396	1.4	43	7.3	2.8	0.5	0.11	14,202
4	541	5	....	546	....	166	3.7	0.5	0.4	0.01	15,630
16	426	39	....	465	....	226	4.8	3.4	0.2	...	16,335
10	453	55	....	508	....	65	3.9	2.3	0.3	0.28	18,045
19	334	47	2	383	5.0	40	8.7	2.9	0.4	...	20,111
6	475	108	....	583	1.2	119	3.5	3.2	0.1	0.62	20,442
5	574	44	....	618	1.0	99	0.5	3.4	0.1	0.12	20,718
3	372	43	3	418	0.9	12	3.0	3.8	0.5	0.30	22,315
13	449	64	26	539	6.3	12	7.5	3.6	0.2	0.47	36,132
Averages											
289,865 lbs., 1921	432	53	4	489	4.0	98	4.5	3.2	0.4	0.23	13,176
148,753 lbs., 1920	461	27	7	495	2.0	98	5.1	3.9	0.9	0.23	9,917

* Farms are listed in order of total pork production per farm, beginning with the lowest.

† These figures must be multiplied by the number of head composing an animal unit to get actual days of pasture. For example the average for 1921, 4.5 animal unit pasture days, would be the equivalent of 22.5 pasture days for one mature hog, or 45 pasture days for a pig under six months of age.

CAUSES FOR VARIATIONS IN FEED REQUIREMENTS FOR HOGS

Size of litter.—There were more than 7 pigs per litter on Farm 15, which had one of the lowest grain requirements for hogs. On Farm 21, having the highest requirements, there were only 3 pigs per litter. Since the feed for breeding stock is charged against the hogs actually marketed, the larger the litters the smaller will be the charge against each hog.

Weight of breeding stock.—On Farms 6 and 13 the high feed requirements are in part due to the fact that the brood sows were largely aged sows weighing from 400 to 500 pounds. On most farms gilts weighing only about half this amount were used. On Farm 2, with the lowest feed requirement, no feed for breeding stock is included, as no pigs were farrowed. All hogs fed that were not on hand at the beginning of the year were purchased.

Kind of pasture.—On Farms 5 and 21, having the highest feed requirements, bluegrass pasture was used. Alfalfa pasture was used on Farm 15, and clover on Farm 9; both have low feed requirements.

Use of protein supplement.—On Farm 20 grain was saved by a liberal feeding of skim milk, and on Farm 19 by the use of tankage.

Allowing hogs to run after feeding cattle.—Part of the hogs on Farms 2 and 7 ran with cattle that were on feed and salvaged some of the grain wasted by the cattle. It was impossible to get any record of the amount of grain thus obtained by the hogs, but it was a factor in reducing the amount of grain to be fed directly to the hogs.

Death losses.—High feed requirements on Farm 5 are in part due to the heavy death losses. Sixteen pigs were lost after weaning and 3 mature hogs died during the year.

CAUSES FOR VARIATIONS IN LABOR REQUIREMENTS FOR HOGS

Size of herd.—The labor required to produce 100 pounds of pork is greatest on the farms producing the least. The average for the eleven farms producing the least pork was 3.8 man hours and 0.6 horse hour. For the eleven farms producing the most pork, the labor requirement was 3 man hours and 0.4 horse hour. It takes very little longer to feed 60 hogs than to feed 30.

Feeding conveniences.—On Farm 4, having the lowest requirements for hogs, the principal feeds were corn and skim milk. The feeding floor was adjacent to the corn crib and quite close to the separator room, hence very little time was required for feeding. Water was piped to automatic waterers in the hog lots. Much of the year the feeding hogs ran with the feeding cattle and there was no charge against them for cleaning or bedding the shed.

Hogging-off corn.—The harvesting of corn by hogs not only saves labor on the corn crop but lessens the labor cost of caring for the hogs. On Farms 10 and 15 large acreages of corn were hogged off. On Farm 4, with the lowest labor requirements, the corn received by the hogs was harvested by them in the field.

Raising purebred breeding stock.—On Farm 13, altho the largest amount of pork was produced, convenient facilities for feeding were available and 1000 bushels of corn were hogged down, the labor requirements are higher than the average. All hogs were purebreds and a large number were sold for breeding purposes. A bred-sow sale was held which added considerably to the labor requirements. As animals sold for breeding purposes are often marketed singly, this adds to the labor. The horse labor is not so high in proportion as the man labor because a truck was used for hauling hogs.

VETERINARY SERVICES AND MEDICINE

On all farms where the item of veterinary services and medicine is more than 20 cents per 100 pounds, it consists largely of the cost of cholera serum and vaccination. The high costs for these items on Farms 6, 11, and 13 are due to the use of combined serum and virus treatment. The other items of cash expense are disinfectants and hog powder.

STANDARD REQUIREMENTS PER 100 POUNDS FOR PORK PRODUCTION

Grain, pounds	4.25
Skim milk, pounds	150
or	
Tankage, pounds	15
Pasture—clover, alfalfa, or rape (animal unit days).....	7
Labor, Man hours	3.5
Horse hours	0.5

Good sized litters and low death losses are necessary to the accomplishment of these requirements. Unless at least 6 pigs per sow are raised to maturity, the grain requirement may prove somewhat low.

DISTRIBUTION OF LABOR ON HOGS

Figure 18 shows the weekly distribution of labor on hogs on a farm producing 16,000 pounds of pork in a year. The labor requirement is fairly uniform during most of the year. Less labor is required when the hogs are on pasture or in the corn field than when fed in a dry lot. The occasional high peaks, such as occurred during the latter part of November and the middle of December, are due to marketing hogs,

vaccinating for cholera, or similar extra operations not occurring regularly. Labor increases as farrowing time approaches and the peak is reached during or just after farrowing. The pigs on this farm were farrowed in April and the first ten days of May. This is also a period of high labor requirements for crops and the swine enterprise competes with them in its demand for labor. This competition, however, is not important, as the total amount of labor on swine is comparatively small and the competition may be avoided altogether by earlier farrowing. This labor distribution on hogs is quite representative for the area.

Fig. 18. Distribution of Man Labor, by Weeks, on Swine

SHEEP

DESCRIPTION OF ENTERPRISE

As has been stated, sheep are a minor enterprise on most of these farms and receive little feed or care. They are pastured in the farmstead, along roads and lanes, in grain fields after harvest, or wherever there is grass or weeds that they will consume. They serve a useful purpose in cleaning weeds out of the fields and farmsteads. On only a few farms are the flocks large enough to require much feed in addition to what they pick up. Most of the lambs, except those retained for breeding purposes, are marketed in September and October. They are sold directly from grass and receive no grain.

The unit requirements for sheep are presented in Table XXX. As the enterprise includes all ages and weights of sheep from young lambs to aged ewes, the requirements have been computed on an animal unit basis.¹³

FEED REQUIREMENTS FOR SHEEP

The feed requirements for sheep vary widely because of the varying amounts of feed that the sheep salvage about the farm and farmstead of which it is impossible to keep any record. If silage is fed, usually little other roughage is used. On most farms grain is fed only from one to three months before and during lambing, but on Farm 13 the ewes were fed a liberal grain ration for six months, beginning in December.

¹³ See footnote 7, page 62.

TABLE XXX
UNIT REQUIREMENTS PER ANIMAL UNIT PER YEAR FOR SHEEP, 1921

Farm No.*	No. of head	Corn, lbs.	Small grain, lbs.	Tame hay and alfalfa, lbs.	Wild hay and fodder, lbs.	Silage, lbs.	Pasture, animal unit days	Total grain, lbs.	Total dry roughage, lbs.	Hours of labor		Production	
										Man	Horse	Wool, lbs.	Mutton, lbs.
10	6	....	....	....	....	....	289	....	....	21	..	56	338
15	12	....	....	549	....	3437	209	....	549	33	4.9	43	299
6	16	....	252	528	609	....	160	252	1137	22	4.6	51	325
17	22	73	243	....	287	....	139	316	287	13	6.7	31	395
14	23	219	....	....	....	1435	161	219	....	41	2.1	61	141
13	29	....	1603	355	....	....	247	1603	355	30	..	52	345
7	30	....	166	20	....	219	212	166	20	10	3.3	53	387
18	43	59	159	....	....	5804	226	218	....	29	2.5	48	89
Averages													
182 sheep, 1921	23	52	360	142	90	1861	203	412	232	25	2.8	49	264
391 sheep, 1920	43	124	164	1099	347	871	201	288	1446	29	4.5	50	352

* Farms are listed in order of number of sheep per farm, beginning with the lowest.

LABOR REQUIREMENTS FOR SHEEP

Very little labor is expended on sheep except at lambing time. The rest of the year they receive attention irregularly as they need it. The tendency for labor per unit to decrease as the size of the enterprise increased, noticed in case of other classes of stock, does not obtain with sheep. It is offset by the fact that the larger flocks can not shift for themselves, as do the small ones, but must have some attention from the farmer.

PRODUCTION OF MUTTON AND WOOL

The production of mutton and wool per animal unit was fairly uniform for the different farms. The low wool production reported on Farm 17 is due to the fact that 48 mature sheep that were on the farm at the beginning of the year were sold just before shearing time. They are included in computing animal units, as their feed is included with that for the rest of the flock. This fact reduces the wool per animal unit, so that it can not be compared with the wool production of other flocks. The low mutton production on Farm 18 is due to the loss of half of all the lambs born, most of them after they were several months old. On Farm 14 the loss of two mature ewes and several lambs accounts for the low mutton production.

STANDARD REQUIREMENTS FOR SHEEP PRODUCTION

As with other minor enterprises, especially where a joint product is involved, it is difficult to set up standard requirements for sheep. The labor will vary according to the size of the flock and the method of handling it. The feed actually fed will be determined in part by the amount of otherwise waste products they can salvage. A reasonable production of mutton and wool to be expected under representative farm conditions in this area, if no unusual losses occur, would be 50 pounds of wool and 350 pounds of mutton per animal unit.

DISTRIBUTION OF MAN LABOR ON SHEEP

Fig. 19. Distribution of Man Labor, by Weeks, on Sheep

Figure 19 shows the weekly distribution of man labor on sheep on a farm having 11 breeding ewes. Nineteen lambs were raised, and sold in September and October. The peak load of labor came during lambing time in March and April. The lambs also received some extra care

just before they were sold. The large amount of special labor in March was spent in preparing pens for the ewes about to lamb. The peak in May consisted of shearing sheep, and in September and October of marketing lambs. At no time during the year do sheep require sufficient labor to interfere seriously with any other enterprise.

POULTRY

FEED AND LABOR REQUIREMENTS FOR POULTRY

The unit requirements for 100 mature chickens are presented in Table XXXI. Pullets and cockerels grown and sold during the year are not included in the number of poultry on the farm, but their feed is included with that of the breeding flock that produced them. The physical product is listed in terms of both eggs and poultry. On all but one farm both were produced but in widely varying proportions.

The feed requirements listed include only the feed actually fed. In addition to this they foraged about the farmstead and adjoining fields for a considerable part of their living. Most of the feed they picked up would otherwise have been wasted. The labor on poultry was performed largely by women and children but this has been reduced to a man labor equivalent in computing the labor requirements.

VARIATIONS IN FEED REQUIREMENTS FOR POULTRY

The feed requirements for poultry vary according to the methods of conducting the enterprise and the conditions on individual farms. On some farms there is considerable waste grain and other products that are picked up, while on others there is little such available and they are fed marketable feeds. Usually considerably more grain is fed where a large number are produced for meat. The grain requirement follows poultry production more closely than it does egg production. Little chicks can not forage for as large a proportion of their feed as can laying hens. The heavier feeding in 1920 as compared to 1921 was largely due to the difference in the number of pounds produced.

CAUSES FOR VARIATIONS IN LABOR REQUIREMENTS FOR POULTRY

Use of incubators and brooders.—More labor is required if incubators and brooders are used than if the chicks are hatched and raised with hens. Farms 4, 15, and 18 used incubators and brooders and labor requirements were higher than on Farms 8, 14, and 20, where a larger number of chickens were raised but hens were used.

TABLE XXXI
UNIT REQUIREMENTS PER YEAR FOR 100 CHICKENS, 1921

Farm No.*	No. of chickens	Corn, lbs.	Oats, lbs.	Other small grain, lbs.	Mill-feeds, lbs.	Total grain, lbs.	Skim-milk, lbs.	Hours of labor		Medicine and disinfectant, dollars	No. of eggs laid	Poultry produced, lbs.
								Man	Horse			
17	55	2760	2620	545	....	5925	....	495	5.5	...	6578	529
10	62	4013	1411	....	....	5424	574	371	3.2	4.73	5248	471
19	70	1251	2493	....	....	3744	1157	252	13.6	1.71	3983	421
2	80	709	1296	1128	....	3133	....	232	7.5	0.31	3549	152
12	90	1726	648	....	....	2374	....	206	6.7	4.56	4609	196
18	91	2203	1472	....	....	3675	1179	321	10.4	4.71	6716	†
8	97	4370	708	55	....	5133	....	169	35.1	...	1839	779
22	100	1643	1728	....	....	3371	372	151	...	2.76	6418	110
13	110	3359	1231	....	....	4590	....	133	10.0	...	3856	150
9	125	1544	1389	....	....	2933	309	187	1.6	...	4428	293
6	125	1164	1673	....	80	2317	791	161	9.6	2.55	6638	27
14	150	2076	319	....	....	5395	1583	134	5.3	...	4449	575
5	160	1792	808	68	....	2668	....	234	14.7	0.31	5880	186
4	167	2751	490	....	....	3241	....	382	7.2	1.08	3966	474
1	170	1422	616	128	....	2166	....	240	6.8	...	3949	350
11	170	1020	1121	290	147	2578	1234	170	1.8	1.16	4282	312
15	214	1632	249	....	280	3161	2865	293	14.5	...	5907	377
3	246	1673	1061	....	31	2765	616	192	4.1	3.25	3905	496
20	264	1088	1992	1136	161	4377	725	124	...	0.85	6659	568
16	278	983	2440	112	288	3823	1198	223	1.1	1.29	5115	187
Averages												
2824 chickens, 1921	141	1820	1301	191	80	3392	756	219	7.0	1.32	4950	344
1778 chickens, 1920	99	2248	1568	373	54	4243	304	267	16.6	1.71	5210	447

* Farms are listed in order of number of chickens per farm, beginning with the lowest.

† Most of the chickens hatched died during the year. Only enough lived to maintain the breeding flock.

Size of flock.—More man labor per 100 hens is expended on the smaller flocks, in most cases. The smallest flock and the highest labor requirements were found on Farm 17. There are, however, exceptions to this, as on Farm 4. Here an unusually large amount of poultry was raised and incubators and brooders were used.

MEDICINE AND DISINFECTANTS

On the majority of the farms there was considerable trouble with various poultry diseases. It was necessary to disinfect poultry houses frequently and medicine was resorted to in many cases.

STANDARD REQUIREMENTS FOR POULTRY

On account of the varying conditions under which poultry are kept and their minor place in the farm organization, it is difficult to work out standard requirements that might be generally applicable. However, the results secured with the higher producing flocks indicate that under representative farm conditions as they exist in the area, a flock of from 100 to 150 or 200 chickens producing 6000 eggs and 475 pounds of meat annually per 100 birds, could be maintained with the following unit requirements per 100 chickens.

Labor, Man hours.....	225
Horse hours	10
Grain, ¹⁴ pounds	4000
Medicine and disinfectants.....	\$1.50

DISTRIBUTION OF MAN LABOR ON POULTRY

Fig. 20. Distribution of Man Labor, by Weeks, on Poultry

Figure 20 shows the weekly distribution of man labor on a flock of 160 chickens. The peak labor load comes in April, when most of the chicks were hatched. The large amounts of special labor in May and June were spent cleaning and disinfecting the poultry house. As poultry require comparatively little labor and this is performed by women or children, it interferes little if at all with the major enterprises.

¹⁴ Skimmilk might be substituted for part of the grain at the rate of 6 pounds of milk for every pound of grain replaced.

MISCELLANEOUS LABOR REQUIREMENTS AND THEIR RELATION TO CROP AND LIVESTOCK LABOR

CLASSIFICATION AND DESCRIPTION OF MISCELLANEOUS LABOR

The labor requirements presented in the preceding sections of Part II included only the regular work on crops and the different classes of livestock. In addition to this regular labor on crops and livestock, a large amount of work of miscellaneous or maintenance character must be performed. This labor is divided into manure hauling, miscellaneous crop and livestock labor, and maintenance labor.

MANURE HAULING

An average of 10 per cent of the crop acreage of the farms studied is manured each year at the rate of 10 loads per acre. One-third of the hauling is done during March and April. Ten per cent is done in each of the three months, January, February, and August. Practically none is hauled during June and very little in July and October. The rest of this work is scattered throughout the remainder of the year. The labor spent hauling manure is shown in Table XXXII.

Manure hauling is a task that can be shifted about in the labor program considerably. On some farms all manure is hauled directly from the barn to the field during most of the year. As 73 per cent of the manure is applied to land that is to be planted to corn, the large amount of hauling in the spring represents the hauling out of the winter's accumulation as soon as it thaws out in order that it may be plowed under before the corn crop is planted. Eighteen per cent of the manure hauled is applied to land to be seeded to small grain and 9 per cent to hay and pasture land. This hauling is fairly well distributed throughout the year.

MISCELLANEOUS CROP LABOR

The labor requirements for crops as shown in preceding tables include only direct field work involved in producing these crops. They do not include labor expended in cleaning or treating seed, purchase of seed or materials required, cleaning grain, or shelling corn for market, or any marketing work. The amount of this labor varied on different farms from 1 to 14 per cent of the total direct labor on crops. The average amount was 7 per cent of the man labor and 3.5 per cent of the horse labor. The amount of this "other labor" on crops on each farm in 1921 is shown in Tables XXXIII and XXXIV.

TABLE XXXII

MANURE, HAULING, 1921

Farm No.*	Crop acres per farm	Animal units per farm	Hours of labor		Loads hauled	Acres covered	Hours of labor per acre		Loads per acre	Percentage of crop acres covered
			Man	Horse			Man	Horse		
5	195	37	78	220	75	8	9.75	27.50	9.4	4.1
10	123	30	107	278	106	6	17.84	46.33	17.7	4.9
3	191	45	134	255	130	10	13.40	25.50	13.0	5.2
19	69	29	58	167	47	4	14.50	41.75	11.8	5.8
18	74	31	58	155	60	5	11.60	31.00	12.0	6.8
17	102	29	123	247	95	8	15.38	30.88	11.9	7.8
8	128	28	161	213	109	10	16.10	21.30	10.9	7.8
12	122	40	114	242	100	10	11.40	24.20	10.0	8.2
1	226	55	268	365	222	19	14.11	19.21	11.6	8.4
7	145	45	76	204	79	13	5.85	15.69	6.1	9.0
14	109	35	188	336	129	11	17.09	30.55	11.7	10.1
2	238	61	190	377	220	24	7.92	15.71	9.2	10.1
15	110	27	154	262	143	12	12.83	21.83	12.0	10.9
16	89	35	84	162	86	10	8.40	16.20	8.6	11.2
21	71	18	90	184	75	8	11.25	23.00	9.4	11.3
6	160	45	142	265	171	19	7.47	13.95	9.0	11.9
4	240	82	412	876	325	30	13.73	39.20	10.8	12.5
20	78	30	188	238	144	10	18.80	23.80	14.4	12.8
11	112	34	209	311	171	16	13.06	19.44	10.7	14.3
9	132	35	122	368	118	20	6.10	18.40	5.9	15.2
22	52	26	64	130	61	8	8.00	16.25	7.6	15.4
13	99	52	198	393	253	28	7.07	14.04	9.0	28.3
Average per farm	130	39	146	284	133	13	11.14	21.63	10.2	10.0

* Farms are listed in order of percentage of crop acreage manured, beginning with the lowest.

MISCELLANEOUS LIVESTOCK LABOR

The livestock labor presented heretofore includes only the regular daily chore work of feeding, bedding, and milking cows, cleaning barns, and regular care of stock, and also such special work as caring for sick animals, buying and selling stock, and any other direct work on stock performed at irregular intervals.

In addition to this, considerable time is spent on each farm hauling and grinding feed, hauling bedding, and other operations which indirectly maintain the livestock and which usually serve several classes of stock jointly. The amount of this labor may range from 1 per cent of the direct man labor to 14 per cent. The average amount on the farms studied was 6.5 per cent of the total direct man labor. On most farms the horse labor of this type exceeded the total direct horse labor on livestock and the average amount was 40 per cent greater than the average amount of direct horse labor. The amount of this labor as well as the total hours on livestock on each farm in 1921 is shown in Tables XXXIII and XXXIV.

MAINTENANCE LABOR

In addition to the direct and indirect labor required in the conduct of the crop and livestock enterprises, a considerable amount of maintenance or general upkeep work is essential to the operation of the farm, but is not directly chargeable to any enterprise or group of enterprises. Furthermore, this is often unnecessary when choice of enterprises is the objective, since the amount of this work is usually affected only slightly by the choice between the different crops or kinds of livestock. However, it must be considered in any attempt to forecast the labor program for a year. The amount of this labor on each farm is shown in Tables XXXIII and XXXIV. The maintenance labor is divided into five classes and the total indicated as miscellaneous labor.

The relative amount of this maintenance work varies widely among different farms and different years. In 1921 the range was from 2.5 to 21.5 per cent of all man labor on the farm and from 2 to 16 per cent of the total horse labor. There was much less of this type of labor in 1921 and in 1920. The much larger amount of real estate work in 1920 as compared to 1921 is due to building construction and tiling. On account of the low prices of farm products prevailing in 1921, practically all construction work was postponed until the farmer would be better able to finance it. This type of work can be shifted at the farmer's convenience. In planning the labor supply for a farm or in planning an organization that will best utilize the available supply of labor, due allowance must be made for manure hauling, indirect labor on crops and livestock, and various kinds of maintenance labor in addition to the direct labor already considered in the discussion of labor requirements for the individual crop and livestock enterprises.

TABLE XXXIII
DISTRIBUTION OF TOTAL MAN LABOR BY FARMS, 1921

Farm No.*	Crop acres per farm	Animal units per farm	Real estate, hrs.†	Ma- chinery, hrs.‡	General expenses, hrs.§	House- hold, hrs. ||	Garden, potatoes and orchard, hrs.¶	Total main- tenance, hrs.	Livestock		Crops		Total labor on farm, hrs.	Percentage maintenance labor of total labor
									Chores, hrs.	Other, hrs.	Field, hrs.	Other, hrs.		
7	145	45	66	49	37	43	7	202	1181	50	1387	64	2,884	7.0
22	52	26	115	81	92	266	144	698	1528	67	850	80	3,223	21.6
19	69	29	120	85	81	101	64	451	2059	298	945	138	3,891	11.6
17	102	29	40	36	46	69	26	217	2609	136	1034	54	4,050	5.3
18	74	31	258	157	116	189	28	748	2211	91	1102	116	4,268	17.3
10	123	30	203	321	171	305	120	1120	1902	92	1295	59	4,468	25.1
20	78	30	162	32	13	93	48	348	3138	149	1139	82	4,856	7.2
9	132	35	182	161	28	122	154	647	2402	55	1858	116	5,078	12.7
16	89	35	187	20	58	62	22	349	3655	124	1305	31	5,464	6.4
8	128	28	177	83	109	292	75	736	2299	192	2090	257	5,574	13.2
12	122	40	157	172	160	226	66	781	2471	336	1880	155	5,623	13.9
13	99	52	231	83	115	232	89	750	3488	144	1261	56	5,699	13.1
3	191	45	70	34	45	130	72	351	3195	205	1847	220	5,818	6.0
6	160	45	137	112	45	38	70	402	3137	208	2066	189	6,002	6.7
21	71	18	338	76	38	...	13	465	4505	172	893	15	6,050	7.7
14	109	35	114	147	95	259	202	817	2744	32	2318	210	6,121	13.3
5	195	37	133	151	9	118	85	496	3178	174	2128	165	6,141	8.1
2	238	61	143	50	29	175	6	403	2723	346	2480	202	6,154	8.2
11	112	54	486	205	129	139	57	1016	3563	195	1941	111	6,826	14.9
15	110	27	317	129	109	259	39	853	4002	211	1832	67	6,965	12.2
1	226	55	239	259	132	107	157	894	3035	347	2861	302	7,439	12.0
4	240	82	161	113	45	126	138	583	7847	298	2360	67	11,155	5.2
Averages														
22 farms, 1921	130	39	183	116	77	152	76	604	3040	178	1676	125	5,623	10.8
21 farms, 1920	130	37	436	133	119	163	73	924	2528	190	1896	118	5,656	16.3

* Farms are listed in order of total hours of man labor on the farm, beginning with the lowest.

† Real estate labor consists of repair and upkeep of buildings, fences, drains, water systems, lighting plants, etc., as well as making new improvements.

‡ Under machinery labor is included the time spent repairing machinery, purchasing machinery, or purchasing materials for repair work.

§ General expense labor consists of trimming trees, mowing yards and lawns, office work in connection with the farm business, looking for laborers to hire, work on public or farm roads, attending farmers organization meetings, and other tasks which can not be allocated even indirectly to any individual enterprise.

|| Household labor includes the time spent in cutting and hauling wood, purchasing household supplies, hauling coal, and similar tasks ordinarily performed by men on the farm. It does not include any of the routine household tasks even tho they may be performed by the farmer or his hired help.

¶ Under garden, potatoes, and orchard is included the time spent in raising food for consumption on the farm.

TABLE XXXIV
DISTRIBUTION OF TOTAL HORSE LABOR BY FARMS, 1921

Farm No.*	Crop acres per farm	Animal units per farm	Real estate, hrs.†	Machinery, hrs.‡	General expenses, hrs.§	Household, hrs.¶	Garden, potatoes and orchard, hrs.¶	Total maintenance, hrs.	Livestock		Crops		Total labor on farm, hrs.	Percentage maintenance labor of total labor
									Chores, hrs.	Other, hrs.	Field, hrs.	Other, hrs.		
7	145	45	79	28	34	18	15	174	145	84	3336	76	3815	4.5
22	52	26	61	26	123	152	59	421	152	124	1917	34	2648	15.9
19	69	29	52	19	113	41	30	255	139	476	2574	72	3516	7.2
17	102	29	26	16	35	76	36	189	198	271	2405	62	3125	6.0
18	74	31	266	42	62	64	47	481	128	142	2758	139	3648	13.2
10	123	30	78	26	32	79	101	316	110	149	3534	70	4179	7.5
20	78	30	125	...	11	24	34	194	100	188	2084	81	2647	7.3
9	132	35	77	17	2	80	20	196	116	90	4416	122	4940	4.0
16	89	35	34	4	22	17	12	89	71	214	2836	32	3242	2.8
8	128	28	94	16	105	283	23	521	353	111	3869	217	5065	10.3
12	122	40	147	49	48	43	29	316	90	177	4145	123	5051	6.3
13	99	52	73	...	17	19	36	145	100	222	2077	...	2544	5.7
3	191	45	35	7	2	63	46	153	159	320	4245	337	5214	2.9
6	160	45	29	11	...	27	45	112	156	292	4614	190	5364	2.1
21	71	18	124	22	48	...	5	199	321	317	1682	12	2531	7.9
14	109	35	30	12	25	114	127	308	209	64	4572	278	5431	5.7
5	195	37	74	25	...	49	51	199	125	326	4657	197	5504	3.6
2	238	61	110	22	...	6	9	147	152	661	6188	331	7479	2.0
11	112	34	205	13	19	28	18	283	144	57	3576	22	4082	6.9
15	110	27	152	31	22	80	29	314	149	132	328	4	3886	8.1
1	226	55	170	16	58	41	66	351	85	298	5455	380	6569	5.3
4	240	82	105	16	34	70	30	255	214	523	5267	24	6283	4.1
Averages														
22 farms, 1921	130	39	97	19	37	62	39	254	155	247	3613	127	4396	5.8
21 farms, 1920	130	37	196	29	81	106	34	446	215	272	3937	136	4982	8.9

* Farms are listed in order of total hours of man labor on the farm, beginning with the lowest.

† Real estate labor consists of repair and upkeep of buildings, fences, drains, water systems, lighting plants, etc., as well as making new improvements.

‡ Under machinery labor is included the time spent repairing machinery, purchasing machinery, or purchasing materials for repair work.

§ General expense labor consists of trimming trees, mowing yards and lawns, office work in connection with the farm business, looking for laborers to hire, work on public or farm roads, attending farmers organization meetings, and other tasks which can not be allocated even indirectly to any individual enterprise.

¶ Household labor includes the time spent in cutting and hauling wood, purchasing household supplies, hauling coal, and similar tasks ordinarily performed by men on the farm. It does not include any of the routine household tasks even tho they may be performed by the farmer or his hired help.

¶ Under garden, potatoes, and orchard is included the time spent in raising food for consumption on the farm.

PLACE OF CROP, LIVESTOCK, AND MISCELLANEOUS LABOR IN LABOR PROGRAM OF FARM

A representative distribution of labor for each of the important crops and kinds of livestock has already been shown. In order to avoid an undesirable piling up of labor requirements, the farmer must have a knowledge of the way in which these requirements are distributed. The usual dates for performing the various operations characteristic of the major crops grown in the Windom area, are shown in Figure 21. These dates may vary from year to year, but their general sequence remains substantially the same.

Fig. 21. Usual Period for the Performance of Field Crop Operations in Cottonwood and Jackson Counties

At certain periods during the growing season several crops compete for the farmer's time. Small grain seeding conflicts with plowing for corn, alfalfa and tame hay with corn cultivation, and stack threshing and rye seeding with silo filling and corn cutting. At other times, as during corn cultivation in June or corn husking and fall plowing, only one crop provides employment for labor. Small grains conflict in their labor requirements but compete with corn very little. The different kinds of hay conflict little with each other but compete with either small grains or corn. The cropping plan for a farm must be so adjusted as to reduce these conflicts to a minimum and yet provide as regular and continuous a succession of crop work throughout the season as is possible.

While the labor on crops is seasonal and comes only at certain fairly definite periods during the year, the livestock labor is distributed throughout the year. The different classes of livestock require labor simultaneously throughout the year, but this competition for labor is not so important in some classes of stock as the competition for feed, pasture, and building equipment.

Fig. 22. Distribution of Man Labor on Livestock, by Weeks, on a 160-Acre Farm

Fig. 23. Distribution of Man Labor, by Weeks, on a 160-Acre Farm

The distribution of man labor on livestock by weeks on a farm maintaining 34 animal units is presented in Figure 22.¹⁵ The "all stock" labor corresponds to the "other" livestock labor in Table XXXIII, and includes such work as hauling feed, grinding feed, and hauling bedding. The different classes of stock vary somewhat in their seasonal demands for labor; cattle requiring considerably less attention during the crop season and horses requiring more. Most of the "all stock" labor may be shifted into the winter months when there is the least work on crops. The regular chore labor of feeding and caring for livestock must be done every day regardless of the urgency of crop or other work.

In planning the labor program of the farm it is necessary to combine the crop and livestock enterprises in such a way that the sum of the labor expended on them, increased by the necessary miscellaneous labor, will be so distributed throughout the year as to make the fullest utilization of the available labor supply. Figures 23 and 24 show the distribution by weeks of all labor on a 160-acre farm in the Windom area.¹⁶

These charts show that altho the labor requirements for each crop are characterized by peak demands at certain periods, the whole cropping plan is so adjusted that the peaks of different crops never coincide. During the second and third weeks in June there is a peak in the total man labor caused by the coincidence of high labor demands of three different crops. The lower livestock labor requirements during the summer are more than offset by the larger amount of crop labor. The result is higher total labor requirements during the crop season.

The distribution of horse labor is much less uniform than that of man labor. Man labor is usually so scarce in this region as to be the limiting factor in the farm organization. The labor plan is adjusted to the supply of man labor rather than to that of horse labor. Sufficient horses are kept for the peak demands. Even with the best labor distribution that can be planned, horses will work at less than their maximum capacity during most of the year.

DAY-TO-DAY MANAGEMENT OF LABOR

In addition to planning an adjustment of crop and livestock enterprises that will result in a desirable seasonal distribution of labor, a farmer must work out from day to day the details of his labor plan in order to reduce to a minimum the interference with the crop or livestock work of a seasonal character that must be done during fairly definite periods. Certain tasks, as feeding and caring for livestock, must be performed every day without fail. There is no shifting or

¹⁵ See footnote 7, page 62.

¹⁶ This is the same farm for which the distribution of livestock labor is presented in Fig. 22.

Fig. 24. Distribution of Horse Labor, by Weeks, on a 160-Acre Farm.

avoiding of this type of work and it can be definitely planned for in advance. Other types of work are almost as difficult to shift for which the exact dates can not be known in advance. Seedbed preparation and seeding of oats in the spring are in this class. In some years this field work can be started in March, in other years not until the latter part of April. The farmer can predict only a few days in advance when his fields will be in condition to work, but once they are ready any delay in beginning work will not only result in increased competition for his time later on, between oats and corn, but will be attended with risk of reduced yields. Each day the farmer must decide what are the most important tasks to be done on that day.

As conditions interfere with the performance of these, attention must be turned to others that are most urgent in view of the changed conditions. A classification according to fixity of time of the various kinds of work performed on these Windom farms is presented in Table XXXV.

TABLE XXXV

CLASSIFICATION OF FARM OPERATIONS FROM THE STANDPOINT OF FIXITY OF TIME

WORK THAT MUST BE DONE AT A DEFINITE TIME	WORK THAT MAY VARY WITHIN SEASONAL LIMITS	WORK THAT CAN BE DONE AT ANY TIME THROUGH- OUT THE YEAR
Spring plowing	Fall plowing	General repair work on harness and machinery
Seedbed preparation	Hauling manure	Building repairs
Seeding	Putting up wild hay	Marketing non-perishable products
Cultivating	Stack threshing	Cutting and hauling wood
Cutting, shocking, and stack- ing small grain	Husking corn	Breaking colts
Shock threshing	Hauling feed, bedding, and supplies	
Putting up alfalfa and tame hay	Shelling corn	
Cutting corn and filling silo	Marketing livestock	
Regular care of livestock	Grinding feed	
Attending livestock sales	Culling poultry	
Repair and upkeep of equip- ment so far as necessary to continue fixed time operations	Ringing pigs	
Repair of fences when stock break out	Trimming horses' hoofs	
Emergency building repairs	Shearing sheep	
Marketing perishable or seasonal products	Dehorning cattle	
Returning exchange labor	Pruning trees	
	Cleaning up farmstead	
	Ditching and tiling	
	Hauling gravel	
	Road maintenance	
	Fencing	
	Putting up ice	

In the day-to-day management of labor the work listed in the first column takes precedence. Next in order comes the work listed in the second column, which is fitted in during its appropriate season after the more pressing tasks have been attended to. The third class of tasks may be done at any time of the year that labor is not demanded for these other classes of work.

The farmer who most carefully fits together these three classes of work in accordance with their time fixity will find fewer and less serious peaks in his labor demand and will distribute this demand most uniformly throughout the year.

Rain is one of the most serious interferences with any labor plan. A day's or even a week's labor program may be completely upset by a sudden shower. Table XXXVI is a list of tasks at which the farmer can busy himself while it is raining; and another at which he can find employment after the rain stops falling but before the ground is dry enough to work. The farmer who keeps in mind this classification of tasks or, still better, keeps a list of such tasks on his own farm, will be best prepared to adjust his labor plans to weather conditions.

TABLE XXXVI
CLASSIFICATION OF FARM OPERATIONS FROM STANDPOINT OF EFFECT OF RAIN
AND SOIL CONDITIONS

WORK THAT CAN BE DONE WHILE IT IS RAINING	WORK THAT CAN NOT BE DONE WHILE RAIN IS FALLING BUT CAN BE DONE WHILE GROUND IS WET	WORK REQUIRING DRY GROUND AND LAND DRY ENOUGH TO WORK
Repairing equipment	Cutting hay or grain	All tillage operations
Grinding sickles	Hauling manure	Seeding
Indoor repair and alterations on buildings	Shelling corn	Haying operations except mowing
Shoeing horses and trimming hoofs	Cleaning, grading, and treating seed	Shocking, stacking, and threshing grain
Cleaning calf pens and hog pens	Mowing lawn and cutting weeds	
Culling poultry	Hauling hay, straw, feed, and supplies	
Cleaning box-stalls	Marketing crops and live- stock products	
Grinding feed	Butchering	
	Dehorning cattle	
	Breaking colts	
	Sorting hogs and cattle	
	Shearing sheep	
	Fencing	
	Repairing buildings	
	Pruning trees	
	Cleaning up farmstead	
	Hauling gravel	
	Storing machinery	
	Draining and tiling	
	Cutting and hauling wood	

A third classification of labor which will serve as a guide in working out the labor program for a farm is presented in Table XXXVII.

This sorting of tasks is chiefly valuable in deciding which to choose when a choice is possible within the classes listed in Tables XXXV and XXXVI. For example, in the second column in Table

XXXVI there is a choice of cleaning up the farmstead, hauling gravel, or cutting firewood, when the ground is too wet for field work. If all were of equal importance the farmer should haul gravel, because this must be done before the ground freezes. After the ground is frozen and before the first snow comes he has a choice between the remaining two tasks. Cleaning the farmstead should be given precedence, as it must be done before the ground is covered with snow, while he can cut wood at any time during the winter.

TABLE XXXVII
CLASSIFICATION OF FARM OPERATIONS FROM STANDPOINT OF EFFECT OF FROZEN
GROUND AND SNOW

WORK THAT CAN NOT BE DONE WHILE GROUND IS FROZEN	WORK THAT CAN BE DONE WHILE GROUND IS FROZEN BUT FREE OF SNOW	WORK THAT CAN BE DONE WHILE GROUND IS COVERED WITH SNOW
All tillage, seeding, and harvesting operations except corn husking Setting fence posts Draining and tiling Road maintenance Hauling gravel Outdoor concrete construction Painting buildings	Husking corn Storing machinery Cleaning up farmstead Picking up dead wood in grove and windbreak Cutting brush	Hauling manure Marketing crops and livestock and livestock products Shelling corn Cleaning, testing, and grading seeds Hauling seed, feed, and supplies Grinding feed Attending sales and livestock breeders' meetings Breaking colts Culling chickens Farm Bureau business Cutting and hauling firewood Repairing equipment Indoor repairs and alterations on buildings Butchering Pruning trees Putting up ice

The actual day-to-day adjustment of fixed and shifting labor on a 260-acre farm is shown in Figure 25.

In "shifting labor" is included all work listed in Columns 2 and 3 in Table XXXV, except fall plowing, putting up wild hay, stack threshing, and corn husking. These operations are included in fixed labor. One-half of the shifting labor is performed between December 1 and April 15, when there is the least fixed work. The only large amount of shifting labor performed during the busy crop season was during a period of wet weather in May and again between corn cultivation and oat harvest in July. Practically all of this was performed between fixed operations or when these fixed operations were delayed by adverse weather. This represents an

excellent adjustment of these two classes of labor from the standpoint of securing a uniform distribution of total labor throughout the year.

Fig. 25. Day-to-Day Adjustment of Fixed and Shifting Labor on a 260-Acre Farm

EXCHANGE LABOR

In spite of a most careful adjustment of enterprises and a careful day-to-day planning of work, certain operations, as threshing and silo filling, demand, for periods of two or three days, several times the regular supply of labor available on the farm. To hire this extra labor would be expensive and ordinarily it is not available.

The customary way of providing the large supply of labor demanded for these operations in the Windom area is for neighbors to exchange labor with each other. The way this worked out on one farm is illustrated in Figure 26. Two hundred and eight hours of labor were required for oat threshing in less than two days. The regular labor on the farm could be expanded to 45 hours per day, but not more than 30 hours of this was available for threshing. The rest was furnished by the neighbors. At silo-filling time even less regular labor was available, but 140 man hours were required in one day. Exchange help was received to supply this demand and also in smaller amounts to assist in haying. During the busiest four days, 368 hours of exchange help was received; during the other five days, 31 hours. These 399 hours were repaid by 401 hours of work spread over forty days.

This handling of peak loads by exchange work merely distributes the peaks over a longer period of this time. This farmer distributed the extra requirement for eight days over forty days and thus avoided hiring extra labor.

Fig. 26. Exchange Labor on 260-Acre Farm

SUMMARY

In Part II have been presented the basic data on the amounts and distribution of the various items of input for the important crop and livestock enterprises of the farms studied.

It has been shown that man labor, horse labor, and materials for different enterprises vary from farm to farm, and wherever possible the reasons for these variations have been pointed out. Consideration has also been given to the proper correlation of the different classes of work on the farm. The importance of adjusting the work that can be shifted so that it will interfere as little as possible with that of a seasonal character can not be given too much emphasis. This analysis makes it possible for a farmer in this area or for other farmers working under similar conditions to study methods of conducting the important enterprises on their farms in order to find out how to improve their methods so as to use their resources most effectively.

PART III

PRINCIPLES OF CHOICE AND ADJUSTMENT OF CROP AND LIVESTOCK ENTERPRISES AND ILLUSTRATIONS OF THE APPLICATION OF THESE PRINCIPLES

PRINCIPLES OF CHOICE AND ADJUSTMENT OF ENTERPRISES

FACTORS AFFECTING CHOICE AND ADJUSTMENT OF ENTERPRISE

Basic data such as are presented in Part II may be used in planning a well balanced farm organization scheme, with a view to securing maximum returns from farming. When used in this way they must of necessity be combined with data on normal yields and normal price trends or probable future prices. The farmer is continually confronted with the problem of apportioning his resources among the different lines of production. He must decide how many acres of the different crops to grow and the number and kinds of livestock to keep. His objective in organizing his business should be to keep his enterprises so adjusted to the conditions of the market as to yield maximum results. This adjustment can not be made once for all time. As the expenses of production or the prices of products change, readjustments must be made to meet the new conditions.

In the area covered in this discussion, all the land is included in rather definitely defined farm units, consequently the necessary procedure is the adjustment of enterprises to conditions on particular farms and to general price conditions, rather than of farms adapted to definite types of organization. Decisions on individual farms must be made in view of these conditions. In general, farmers are attempting to secure the most profitable utilization of the resources at their command. These resources are real estate (owned or rented), machinery, other equipment, work stock, other livestock, the operator's labor and managerial ability, any regular hired labor employed, and such family labor as is available for farm work.

In determining the combination and proportion of farm enterprises the following characteristics of the problem are important:

1. Production on farms varies in its demands upon the resources of the farmer.
2. The succession of a large number of different operations from season to season necessitates frequent labor adjustments.
3. Certain non-marketable resources must be utilized when and where available.
4. The use of intermediate products is a complicating factor.

1. *Production on farms varies in its demands upon the resources of the farmer.*—The different crops require different amounts of man and horse labor, land, and managerial ability for a given volume of product. For example, on 18 farms in 1921 an average of 19 hours of man labor and 42 of horse labor per acre was used in the production of corn, and an average of 7 hours of man labor and 16 of horse labor in the production of oats. Likewise, the different kinds of livestock require varying amounts and qualities of labor, feed, shelter, and other requirements.

There are also wide variations in the time when these various requisites are demanded by the different kinds of crops and livestock, and in their duration. Most crops require attention only at certain definite seasons of the year and these seasons are different for the various crops. For example, the seedbed preparation and seeding of oats are ordinarily completed several days before those of corn. Late in July after the corn cultivation is completed comes the oat harvest. Thus the labor, horses, and machinery of the farmer are usually employed more economically in a diversified farming system than in a single-crop system, even if the crop needing attention at one time gives a lower return than that requiring attention at another time.

On some crops the labor is used in more or less regular amounts over a long productive period. In some cases, notably with the small grain crops, the work comes in two or three short periods of seedbed preparation, planting, harvesting, and threshing. Crops which require attention at the same time of the year may be regarded as *competing crops*. The spring grains—oats, barley, and spring wheat—are examples of competing crops in this area. They require about the same amount of man labor, horse labor, and tools at approximately the same time.

One enterprise is *complementary* to another when it makes a definite contribution to it. Crops and livestock are frequently mutually complementary, the crops furnishing feed for the livestock and the livestock in turn furnishing fertility for the crops. Complementary relations are evident between legumes and other crops included in a rotation. Legumes help to build up the soil for the production of the other crops in the rotation, and frequently receive protection from the small grain when it is used as a nurse crop.

Supplementary enterprises are frequently brought in to reduce the burden of expense of the major enterprises. The supplementary enterprise may reduce the idle time, idle land, and idle machinery left over after the major enterprises have been properly conducted. The object is always to get the fullest utilization of the requisites of production, and since such an enterprise utilizes supplies of labor and non-marketable feeds which would otherwise be wasted, it may give a relatively low return and still be profitably included in the farm organization.

The demands of different crops and different kinds of livestock frequently conflict in certain respects while they are complementary or supplementary in others. Corn and alfalfa compete for labor during corn cultivation in June and frequently again at silo-filling time. However, the silage and alfalfa are supplementary as dairy feeds and this may more than compensate for the conflicting demands for labor. These conflicting, complementary, and supplementary relationships of enterprises can not be exactly measured. However, their importance in obtaining the most profitable utilization of the resources of a particular farm is obvious.

2. *Succession of a large number of different operations from season to season necessitates frequent labor adjustments.*—The operations on a general farm, unlike those of a factory, are not standardized and can not be reduced to routine. The succession of a large number of different operations from season to season renders any general plan of division of labor, specialization by tasks, standardization of operations, etc., practically impossible. These different operations require different conditions of soil, weather, and climate. Thus, it is possible to perform certain operations when weather or other conditions are unfavorable for the performance of others. In this way are eliminated a part of the difficulties due to encountering constantly the exigencies of weather in farm work. For example, a heavy rain in June may stop corn cultivation for a time. Meanwhile the work of mowing hay may proceed with very little interference. This characteristic must be kept in mind both in the organization and in the day-to-day management of resources.

3. *Non-marketable resources must be utilized when and where available.*—In the conduct of their business, the farmers in Cottonwood and Jackson counties find themselves in possession of certain non-marketable feeds, non-tillable pasture, and idle time of man and horses. These are worth just what the operator can make them add to the value of the product of the farm by proper utilization. A noteworthy example of this is found in the labor supply on many of these farms. When the crop labor constitutes the major part of the farm work, there is generally a surplus of labor during the winter months when little crop work can be done. Unless an enterprise is introduced that will provide productive employment during these months, this labor will be wasted. Such labor may get a lower return than that spent on the major enterprises, but nevertheless the total returns of the farm will be increased by making the best use of it possible.

Similarly, on many of these farms there are supplies of corn stover, skim milk, straw, wild hay, or other feeds that are frequently non-marketable which must be used on the farm in connection with other feeds or allowed to go to waste. The existence of a large amount of

non-tillable pasture may justify the keeping of livestock which gives a relatively low return, but which affords the best market for this particular resource.

4. *Use of intermediate products is a complicating factor.*—In the system of general stock and grain farming common to this region, intermediate products appear at various stages in the production process. This requires decisions on the matter of using these intermediate products in further production or marketing them directly. Thus a producer of hogs who grows his own feed must decide whether the corn, oats, and other feeds are to be sold on the market or through the hogs. The milk or butterfat producer must make similar decisions. The conduct of these livestock enterprises constitutes a method of marketing the products of other enterprises.

Such decisions are rendered more difficult by reason of the effect of the fertility by-product from marketing these feeds through livestock. Since the value of this fertility added to the soil depends upon the increase in value of the future product of the soil, it is impossible accurately to evaluate this by-product. Wherever livestock constitutes an important part of the farming business, due consideration must be given to the matter of producing such feeds as can be produced more economically than they can be purchased.

STATEMENT OF PRINCIPLES OF CHOICE

Any or all of these characteristics of farm organization problems may be found on certain farms. The problems are frequently complex and can not be solved by a simple formula.

Having in mind these characteristics of the problems on his particular farm the operator should choose such enterprises and in such proportions as can be combined into a well rounded organization that will give him the best return for his supply of labor, land, equipment, and managerial ability.

This is usually accomplished by choosing the one or more major enterprises that will add most to the net returns and then supplementing the organization with such other enterprises as will give a fuller utilization of the factors and procure a return sufficient to reward the operator for the additional effort put forth.

ILLUSTRATION OF METHOD OF USING THE TYPE OF DATA PRESENTED IN PART II IN THE APPLICATION OF PRIN- CIPLES OF CHOICE AND ADJUSTMENT OF ENTERPRISES

GENERAL PLAN OF APPLICATION

The following illustrations are intended to show how these data may be used in reaching a solution of these problems on two of the farms from which the data were collected. It is assumed that these farmers are attempting to obtain the highest returns for the labor, land, livestock, work stock, machinery, managerial ability, and other resources under their control.

A description of the resources of these farmers and an analysis of their present organization, is given. The labor and material requirements are adapted from the data in Part II. The returns from the present organization are estimated on the basis of ordinary yields and relative prices of the different products. Comparisons are made between the results obtained from the present organization and the probable results from proposed organizations.

In making these comparisons between organizations, it is also necessary to determine the difference in costs of extra hired labor and of seed, twine, and other materials which do not constitute a part of the regular resources. This analysis is based on the theory that in making a choice of enterprises only the costs and returns that will be affected by the choice need be considered.¹⁷ Thus adjustments in the cropping system or the kinds of livestock kept may usually be considered without regard to the question of overhead expenses, land rent, or other charges which are not altered by the choice. The effect of the choice upon the maintenance of soil fertility and the general long-time plan of farming which can not be radically altered from year to year, must of course be kept in mind when making these choices. At the same time this general plan should provide an element of flexibility that will facilitate the making of desirable adjustments as conditions change.

ILLUSTRATION NO. 1

INVENTORY OF RESOURCES AND PRESENT PRODUCTIVE ORGANIZATION

The following is a description of the resources and productive organization as they existed in 1922 on one of the farms for which data are presented in Part II. Normal rather than actual crop yields are used in order to avoid the effect of seasonal variations upon the total amount of crops available for feed and sale. The actual livestock production is presented.

¹⁷ For further elaboration of this point, the reader is referred to "The Objectives in Agricultural Cost Accounting" by Dr. H. C. Taylor, *Journal of Farm Economics*, Vol. V, No. 2, April, 1923.

Real estate and crops	Acres	Yield	Total production
Corn for grain.....	39.0	45 bu.	1755 bu.
Corn for fodder.....	9.0	2 tons	18 tons
Oats	50.0	42 bu.	2100 bu.
Barley	11.0	25 bu.	300 bu.
Rye	6.0	18 bu.	108 bu.
Clover and timothy.....	12.0	1.5 tons	18 tons
Alfalfa hay	5.7	3.5 tons	20 tons
Wild hay	1.8	1.0 tons	1.8 tons
Total crop area.....	134.5		
Pasture	43.0		
Farmstead	7.0		
Total farm area.....	184.5		

The buildings are sufficient to take care of 12 cows, 25 young cattle, the work stock, 12 sheep, and 18 brood sows and their pigs.

Productive Livestock:

Kind and Number	Production
12 cows	2400 lbs. butterfat
24 young dairy and miscellaneous cattle.....	8000 lbs. beef
18 brood sows	20,000 lbs. pork
12 sheep	100 lbs. wool
	650 lbs. mutton

Labor Supply

Man Labor

The labor of the operator for the entire year.

A hired man employed from March to August, inclusive.

The operator's wife, who assisted with the care of dairy utensils.

Horse Labor

Six horses throughout the year.

Machinery and Equipment:

- The farm is fully equipped with the machinery needed in the production of small grain, corn, and hay crops.

The distribution of labor on this farm, by weeks, for 1922 is shown in Figure 27. The supply of labor available for use on the different enterprises is shown by the broken line on the chart. Strictly speaking, the supply of regular labor is rather flexible because of speeding up or lengthening of the working day during periods of heavy demand for labor. This speeding up is usually followed by a corresponding decline in the amount of work done during the following period. The supply, as shown in the chart, was estimated by assuming that the usual full day's work performed by the regular laborers on this farm could be maintained throughout the season. All labor other than that done by the operator and his wife must be hired.

The first important peak of man labor was during April and early May. The preparation and seeding of the oats and barley crops were

largely responsible for this peak. After this there was a surplus of labor throughout the rest of the time that the hired man was kept. In October, November, and early December corn husking is responsible for a piling up of labor. Much of this is ordinarily handled by special labor. As this is paid for on the basis of bushels husked, the actual time required is not so important to the operator.

Fig. 27. Available Supply of Man and Horse Labor and Distribution, by Weeks, of Total Labor Expended on a 185-Acre Farm (Present Organization)

The distribution of horse labor on this farm by weeks as well as the available supply is shown in Figure 27. Horses are not a limiting factor in the organization of the farms of this area.

YIELDS AND RELATIVE PRICES USED IN MAKING CALCULATIONS FOR THE FUTURE

In making plans for the future, calculations must be based upon the probable yields of the different products and the prices which may be obtained when the products are ready for sale. The yields presented above are the estimated normal yields for this farm. In making calculations, the best current information available concerning the probable

prices of different products should be used. The following local market prices for crops and livestock products prevailing in the locality in 1922 for the same grade of product are used.

	Cents		Cents
Corn, per bu.	50	Pork, per lb.	8
Oats, per bu.	30	Beef, per lb.	5
Barley, per bu.	40	Wool, per lb.	30
Rye, per bu.	70	Mutton, per lb.	10
Butterfat, per bu.	45		

UNIT REQUIREMENTS OF LABOR, MATERIALS, AND FEEDS IN PRODUCTION OF CROPS AND LIVESTOCK

Reasonable requirements for crop production on this farm, based upon the amount of labor used for different operations in 1920, 1921, and 1922, and a comparison of these amounts with standards as set forth in Part II, are shown in Tables XXXVIII and XXXIX. These are based on the actual requirements for three years and may be considered as normal requirements for the conditions obtaining as to size of implements and teams used, size of fields, and other variable factors.

Feed and labor requirements for livestock production, obtained in a similar manner, are shown in Table XL.

TABLE XXXVIII
NORMAL LABOR REQUIREMENTS PER ACRE OF CROPS

Operations	Man hours	Horse hours	Operations	Man hours	Horse hours
Seedbed preparation			Wild hay		
Plowing	2.50	10.00	Mowing	1.67	3.34
Disking	0.56	2.24	Raking	0.83	1.66
Harrowing	0.28	1.12	Hauling and stacking	4.00	5.56
Corn			Alfalfa		
Plowing	2.50	10.00	First cutting		
Disking (1.5 times) ..	0.84	3.36	Mowing	1.20	2.40
Harrowing (2.5 times)	0.68	2.72	Raking	0.50	1.00
Planting	0.81	1.62	Hauling	5.00	6.00
Cultivating (3 times) ..	4.00	8.00			
Husking	7.25	14.00	Second cutting		
Fodder corn			Mowing	0.88	1.76
Cutting	1.71	5.13	Raking	0.50	1.00
Shocking	4.00	....	Hauling	3.00	4.00
Oats			Third cutting		
Disking (2 times) ...	1.12	4.48	Mowing	0.70	1.40
Harrowing (1.1 times)	0.28	1.12	Raking	0.40	0.80
Seeding	0.52	2.08	Hauling	2.00	2.50
Cutting	0.82	3.28			
Shocking	1.10	....	Clover and timothy hay		
Threshing	3.00	5.00	Mowing	1.25	2.50
Barley			Raking	0.50	1.00
Plowing	2.50	10.00	Hauling	2.25	5.50
Harrowing (2 times) ..	0.56	2.24			
Seeding	0.52	2.08			
Cutting	0.82	3.28			
Shocking	1.10	....			
Threshing	3.00	5.00			

TABLE XXXIX
MATERIAL REQUIREMENTS OF CROPS

Crop	Seed, per acre	Twine, per acre	Threshing or husking, per bushel
Corn	10 lbs.	5.5 lbs.	0.06
Oats	3.2 bu.	3.4 lbs.	0.03
Barley	2.3 bu.	3.4 lbs.	0.03
Clover and Timothy	8 lbs. 6 lbs.	.. ..	
Alfalfa	12 lbs.	..	

TABLE XL
FEED AND LABOR REQUIREMENTS FOR LIVESTOCK

	Corn, lbs.	Oats, lbs.	Skim- milk, lbs.	Whole milk, lbs.	Tame hay, lbs.	Alfalfa, lbs.	Corn fodder, lbs.	Wild hay, lbs.	Vet. services and medicine, dollars	Hours of labor	
										Man	Horse
Horses (per horse).....	1680	1600	....	....	5000	....	....	600	1.00	60	..
Cows (per cow).....	800	1200	....	....	500	2500	1000	....	0.80	130	5.0
Miscellaneous cattle, 0-1 yr...	150	400	1400	180	750	250	200	....	0.60	12	1.0
Miscellaneous cattle, 1-2 yr...	500	400	....	....	1200	500	1200	....	0.60	12	1.0
Pork (per 100 lbs.).....	400	90	125	....	....	....	....	....	0.20	3	0.2
Sheep .....	....	40	....	....	40	40	250	....	...	3	0.5

The amounts of grain and hay required for beef and butterfat production are higher than the standards set up in Part II, partly because there was no silo on the farm. The one- and two-year-old miscellaneous cattle get a larger amount of grain than on most farms in the area.

RETURNS FROM PRESENT ORGANIZATION

	Acres	Yield per acre	Total yield	Amount required for feed	Salable surplus	Amount purchased
Corn for grain, bu.....	39.0	45	1755	1954	...	200
Corn fodder, tons.....	9.0	2	18	18	...	...
Oats, bu.	50.0	42	2100	1190	910	...
Barley, bu.	12.0	25	300.	300	...	...
Rye, bu.	6.0	18	108	...	108	...
Alfalfa, tons	5.7	3.5	20	20	...	...
Clover and timothy, tons...	12.0	1.5	18	31	...	13
Wild hay, tons.....	1.8	1.0	1.8	1.8	...	...

Sales: Crops

Oats, 910 bu. at \$0.30 per bu.....	\$273
Rye, 108 bu. at \$0.60 per bu.....	65

Total crop sales..... \$338

Livestock Products:

Pork, 20,000 lbs. at \$0.08 per lb.....	\$1600
Beef, 8000 lbs. at \$0.05 per lb.....	400
Butterfat, 2400 lbs. at \$0.45 per lb.....	1080
Wool, 100 lbs. at \$0.30 per lb.....	30
Mutton, 650 lbs. at \$0.10 per lb.....	65

Total livestock sales \$3175

Total crop and livestock sales..... \$3513

COST OF EXTRA MATERIALS AND THRESHING FOR THIS ORGANIZATION

	Seed	Twine	Threshing or husking	Total
Corn	\$13	\$6	\$105	\$124
Oats	48	20	63	131
Barley	11	5	9	25
Rye	6	1	6	13
Clover and timothy.....	13	...	...	13
Alfalfa	6	...	...	6
Total	\$97	\$32	\$183	\$312

Veterinary Services and Medicine:

Swine	\$40
Cows	10
Miscellaneous cattle	15
Horses	6
	<hr/>
	\$71
Total materials for crops and livestock.....	\$383
Corn purchased for feed.....	100
Hay purchased for feed.....	130
	<hr/>
Total extra costs	\$613
Total returns to organization after deducting extra material costs....	\$2900

WEAKNESSES OF THE PRESENT ORGANIZATION AND SUGGESTIONS FOR REORGANIZATION

Altho this organization is one of the better types found among the farms studied, certain weaknesses are apparent. A definite rotation of crops including legumes for hay and for maintenance of soil fertility has not been developed. This seems desirable from the standpoint of long-time profits and of producing sufficient hay on the farm for the livestock kept. The small grain acreage is out of proportion to the corn acreage from the standpoint of production of feed for livestock and balanced rotation of crops.

The acreages of corn and tame hay can be increased without hiring any additional labor or increasing the number of work stock. The amount of pork produced was low in proportion to the amount of skim-milk available for use. More pork could be produced without increasing the number of brood sows by raising fall litters, as was done one year on this farm, but this would necessitate the production or purchase of more corn.

In order to show how changes in organization would affect the returns, changes in the cropping system are suggested in Reorganization Plan No. 1.

REORGANIZATION PLAN NO. 1

EFFECT ON RETURNS OF CHANGE IN CROPPING PLAN

This reorganized cropping plan involves a reduction in oat production of 8 acres and the elimination of the 11 acres of barley and 6 of rye. Seventeen additional acres of corn and 8 of clover and timothy are grown. This provides more feed for livestock. The net returns from salable crops are slightly reduced, but the reduction in extra material costs more than balances this decrease. The effect of these changes on the returns from the farm as compared with the present organization is outlined below.

	Acres	Yield per acre	Total yield	Amount required for feed	Salable surplus	Amount purchased
Corn for grain, bu.....	56	45	2520	1954	565	...
Corn fodder, tons.....	9	2	18	18	...	...
Oats, bu.	42	42	1764	1640	120	...
Clover and timothy, tons...	20	1.5	30	31	...	1
Alfalfa, tons	5.7	3.5	20	20	...	...
Wild hay, tons	1.8	1.0	1.8	1.8	...	...

Sales: Crops

Corn, 565 bu. at \$0.50 per bu.....	\$283
Oats, 120 bu. at \$0.30 per bu.....	36

 \$319

Livestock products (same as present organization).....	3175
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Total livestock and crops.....	\$3494
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COSTS OF SEED, TWINE, AND OTHER MATERIALS

	Seed	Twine	Threshing or husking	Total
Corn	\$17	\$6	\$151	\$174
Oats	40	17	53	110
Clover and timothy.....	21	...	...	21
Alfalfa	6	...	...	6
Total	\$84	\$23	\$204	\$311

Veterinary Services, Medicine, etc. (same as present organization).....	\$71
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 \$382

Hay purchased for feed.....	10
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Total extra material costs.....	\$392
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Total returns to organization after deducting extra material costs.....	\$3102
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Net increase over present plan of operation.....	\$202
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This plan of operating the farm requires 4500 hours of regular crop and livestock chore labor, and 900 hours of miscellaneous crop and livestock labor and maintenance labor. The distribution of this regular crop and livestock labor was estimated by using the data on requirements by operations in Tables XXXVIII and XL, and the usual dates of performance given in Part II. The probable distribution of this regular labor on crops and livestock is shown in Figure 28. In actual practice it is of course very common for the program to be shifted slightly, but the sequence of the work on the different crops usually remains in about the same relative position from year to year. Thus, as a late season delays the seeding of oats, it will also delay the corn work and most of

the entire program will usually come later in the same relative position with respect to the other work.

Figure 28 also shows the available supply of labor. Approximately sixteen hundred hours of available time are well distributed throughout the year for the performance of the miscellaneous crop and livestock work incident to this organization. As brought out in Part II, it is good management on the part of the farmer to fit this type of work in when the weather or other conditions are unfavorable for the performance of work of a seasonal character. The proper day-to-day management of resources is quite essential if any organization plan is to be efficiently

Fig. 28. Available Supply of Man Labor and Distribution, by Weeks, of Man Labor on Crops and Livestock on a 185-Acre Farm (Proposed Organization)

carried out. With all the time available in this case, there is very little possibility of any extra labor being necessary to conduct this organization. This plan requires no additional labor except that for which provision has been made in the increased cash allowance for corn husking. The labor is more uniformly distributed throughout the year and the probable necessity of hiring extra labor in the spring is reduced. There is a wider margin of safety between the provision of feeds and the requirements for livestock. No change in resources is involved.

EFFECT OF CHANGE IN PRICES OF BEEF AND BUTTERFAT ON CHOICE BETWEEN THESE ENTERPRISES

Frequently the influence of changes in the relative prices of different products suggests a shift in the emphasis on the different lines of production. This may be illustrated by assuming changes in the prices of beef and butterfat from those given on page 112. By reducing the number of young cattle to 20, this farmer could keep two more cows on practically the same amount of feed. The cows would require more labor but not any more than is already available from the regular supply. The results of this change would be as follows:

Butterfat, 400 lbs. more, at \$0.45 per lb.....	\$180
Beef, 2000 lbs. less, at \$0.05 per lb.....	100
Added returns from the choice of butterfat production.....	80

Assuming the price of beef to be 7 cents per pound and the price of butterfat only 30 cents, the result would be as follows:

Beef, 2000 lbs. less, at \$0.07 per lb.....	\$140
Butterfat, 400 lbs. more, at \$0.30 per lb.....	120
Added returns from the choice of beef production.....	20

In one case the farmer could obtain an increase of \$80 if he considered that sufficient to repay him for the additional 212 hours of labor involved. In the other case he would actually reduce his returns by expanding the dairy at the expense of the beef enterprise. The nature of the cattle enterprise on most of the farms in this area is such as to allow taking advantage of the changes in the relative prices of beef and butterfat.

REORGANIZATION PLAN NO. 2

EFFECT OF INCREASING SIZE OF BUSINESS ON THE RETURNS

It is obvious from a comparison of the weekly distribution of labor and the available supply of labor, as shown in Figures 27 and 28, that with the exception of the corn husking period there is considerable room for expansion without necessitating the hiring of any additional labor. In order to have a better balanced organization and to obtain a fuller utilization of his resources, this farmer rented 30 acres of additional land during one year of this study. This land was used for grain

production and two-fifths of the yield was paid as rent. The possibilities of obtaining a fuller utilization of the man and horse labor and of providing feed for the expansion of the hog enterprise are shown below.

In these estimates are the same requirements for the different enterprises as for the previous smaller organization. As a matter of fact this is not what usually happens under actual farm conditions. The extent to which expansion means greater or less efficiency in the conduct of the different enterprises depends upon the ability of the operator to manage additional units. There was no significant change in the rate of performing the various crop operations on this farm as a result of expansion.

The thirty additional acres of land are distributed as follows under this second reorganization plan: corn, 14 acres; oats, 8 acres; clover and timothy, 5 acres; pasture, 2 acres; and corn fodder, 1 acre. There is no change in livestock except the increase of pork production to 30,000 pounds by raising fall litters from part of the brood sows. The same feed requirements per hundred pounds for pork production have been assumed. The following outline indicates the returns from this reorganization.

	Acres	Yield per acre	Total yield	Amount required for feed	Amount for rent	Salable surplus
Corn for grain, bu.....	70	45	3150	2650	324	175
Corn fodder, tons.....	10	2	20	All	...	...
Oats, bu.	50	42	2100	1900	200	...
Clover and timothy, tons...	25	1.5	37.5	All	...	...
Wild hay, tons.....	1.8	1.0	1.8	All	...	...
Alfalfa, tons	5.7	3.5	20	All	...	...
Total	162.5					
Pasture	45.0					
Farmstead	7.0					
Total	214.5					

Sales: Crops

Corn, 175 bu. at \$.50 per bu..... \$88

Livestock

Pork, 30,000 lbs. at \$.08 per lb..... \$2400

Beef, 8000 lbs. at \$.05 per lb..... 400

Butterfat, 2400 lbs. at \$.45 per lb..... 1080

Wool, 100 lbs. at \$.30 per lb..... 30

Mutton, 650 lbs. at \$.10 per lb..... 65

Total livestock \$3975

Total crops and stock..... \$4063

COSTS OF EXTRA MATERIALS

	Seed	Twine	Threshing or husking	Total
Corn	\$22	\$7	\$189	\$218
Oats	48	20	63	131
Clover and timothy.....	27	....	....	27
Alfalfa	6	....	....	6
Totals	\$103	\$27	\$252	\$382

Veterinary Services and Medicine:

Hogs	\$60
Cows	10
Miscellaneous cattle	15
Horses	6
Total	\$91
Total extra costs.....	\$473
Total returns to organization after deducting extra material costs....	\$3590
Net increase over present plan of operation.....	\$690

This expansion of the business involves no change in resources but requires approximately 750 additional hours of man labor. Of this, 225 is corn husking, which has been covered in a cash allowance for husking, so the net increase is only 525 hours.

On account of the better seasonal distribution of labor, this could ordinarily be handled by the present supply of labor by a slight increase in length of the working day at certain periods. Only in case of a piling up of different kinds of work as the result of an unfavorable season or other unforeseen emergency, would it be necessary to hire extra labor. A careful day-to-day management of the labor program would help materially in avoiding the necessity of hiring extra labor at any time. This plan greatly reduces the possibility of shortage of feed for the livestock and at the same time gives a net increase in returns of nearly \$700 over the present plan of operation.

ILLUSTRATION NO. 2

INVENTORY OF RESOURCES AND PRESENT PRODUCTION ORGANIZATION

The following is a description of the resources and productive organization in 1922 of another of the farms studied. This is one of the largest farms in the group and is operated almost altogether by family labor. Normal rather than actual crop yields are used.

The buildings are equipped for keeping 20 cows and their calves, 8 horses, and 15 hogs for breeding purposes and their pigs.

REAL ESTATE AND CROPS

	Acres	Yield	Total production
Corn for grain, bu.....	85	40	3400
Corn fodder, tons.....	11	2	22
Oats, bu.	77	38	2926
Barley, bu.	15	25	375
Timothy and clover, tons.....	34	1 3/4	59
Alfalfa, tons	5	3	15
Total crop area	227		
Pasture	81		
Farmstead and lanes.....	9		
Total farm area.....	317		

Productive Livestock:

Kind and Number

Production

14 cows and their calves.....	1750 lbs. butterfat
36 head one- and two-year-old cattle.....	15,000 lbs. beef
10 breed sows	7500 lbs. pork

Labor Supply:

Man Labor

The operator for the entire year.

A 19-year old son for the entire year.

A 14-year old son for chores in winter, and full time from May to August, inclusive.

The operator's wife assists with dairy chores during the crop season.

Horse Labor

Eight horses for the entire year.

Machinery

The farm is fully equipped with machinery for the production of corn, hay, and small grain.

The weekly distribution of man labor for this organization and the supply of labor available for use are shown in Figure 29. The demand

Fig. 29. Available Supply of Man Labor and Distribution, by Weeks, of Total Man Labor Expended on a 317-Acre Farm (Present Organization)

for labor exceeded the supply at three different times during the year. In early June the cultivation of corn was responsible for a slight peak requiring three days of extra hired labor. In July ten days of extra labor were necessary for harvesting oats and barley. Again in November extra hired labor was used for corn husking. However, a part of this work might have been done by the regular labor supply if it had been allowed to wait until later in the season. A relatively high yield of corn was partly responsible for the peak of labor in October and November.

PRICES USED IN MAKING CALCULATIONS FOR THE FUTURE

The following are 1922 prices of the crops and livestock products on this farm. These will be used in calculating returns from proposed plans for reorganization.

Corn, per bu.	\$0.50	Timothy and clover hay, per ton..	\$10.00
Oats, per bu.	0.30	Butterfat, per lb.....	0.45
Barley, per bu.	0.40	Beef, per lb. ¹⁸	0.06
Rye, per bu.	0.70	Pork, per lb.....	0.08

UNIT REQUIREMENTS OF LABOR AND MATERIALS IN PRODUCTION OF CROPS AND LIVESTOCK

The normal requirements of labor, feed, and other materials for crop and livestock production on this farm were determined by comparing the standard requirements with those of this farm for three years. These are shown in Tables XLI, XLII, and XLIII.

TABLE XLI
NORMAL LABOR REQUIREMENTS FOR CROP PRODUCTION ON THIS FARM

Operations	Man hours	Horse hours	Operations	Man hours	Horse hours
Seedbed preparation			Barley		
Plowing	2.15	8.60	Plowing	2.15	8.60
Disking	0.55	2.20	Harrowing (2 times) ..	0.60	2.40
Harrowing	0.30	1.20	Seeding	0.50	2.00
Corn			Cutting	0.60	2.40
Plowing	2.15	8.60	Shocking	1.00	
Disking (1.6 times) ..	0.90	3.60	Threshing	2.00	3.50
Harrowing (2.5 times) ..	0.75	3.00	Timothy and clover		
Planting	0.62	1.24	Mowing	1.00	2.00
Cultivating (3 times) ..	3.75	7.50	Raking	0.60	1.20
Husking	10.00	16.00	Hauling and stacking	4.00	5.00
Fodder corn			Alfalfa		
Cutting	1.65	4.95	First cutting		
Shocking	3.00		Mowing	1.25	2.50
Oats			Raking	0.75	1.50
Disking (2 times)	1.10	4.40	Hauling and stacking	4.50	5.00
Harrowing (once) ...	0.30	1.20	Second cutting		
Seeding	0.50	2.00	Mowing	1.00	2.00
Cutting	0.80	3.20	Raking	0.67	1.34
Shocking	1.00		Hauling and stacking	4.00	5.00
Shock threshing	2.00	3.50			

¹⁸ This price is higher than that used in the previous illustration because a more finished product is marketed.

TABLE XLII
MATERIAL REQUIREMENTS OF CROPS

	Seed, per acre	Twine, per acre	Threshing, per bushel
Corn, lbs.	9	6	...
Oats, bu.	3.2	2.6	\$0.03
Barley, bu.	2.4	2.6	0.04
Rye, bu.	1.6	1.7	0.07
Alfalfa, lbs.	12	..	...
Clover, lbs.	8	..	...
Timothy, lbs.	6	..	...

TABLE XLIII
FEED AND LABOR REQUIREMENTS FOR LIVESTOCK

	Corn, lbs.	Small grain, lbs.	Alfalfa hay, lbs.	Clover and timothy hay, lbs.	Corn fodder, lbs.	Skim- milk, lbs.	Whole milk, lbs.	Vet. serv- ices and medicine	Hours of labor	
									Man	Horse
Per horse	1680	2000	....	6000	....	....	....	\$0.50	50	..
Per cow	1000	500	1500	1000	1000	....	....	0.35	120	7.0
Per head of misc. cattle, 0-1 yr....	150	75	400	400	100	1250	400	0.10	10	0.5
1-2 yr....	750	500	100	1000	750	....	....	0.10	10	0.5
Per 100 lbs. pork.....	400	80	....	....	....	160	....	0.20	3	0.4

RETURNS FROM PRESENT ORGANIZATION

	Acres	Yield per acre	Total yield	Amount required for feed	Salable surplus
Corn for grain, bu.....	85	40	3400	1540	1860
Oats, bu.	77	38	2926	1235	1690
Barley, bu.	15	25	375	175	200
Alfalfa, tons	5	3	15	All	....
Clover and timothy, tons.....	34	1¾	59	51	8
Corn fodder, tons.....	11	2	22	All	....

Sales: Crops

Corn, 1860 bu. at \$0.50 per bu.....	\$930
Oats, 1690 bu. at \$0.30 per bu.....	507
Barley, 200 bu. at \$0.40 per bu.....	80
Hay, 8 tons at \$10.00 per ton.....	80

Livestock Products

Butterfat, 1750 lbs. at \$0.45 per lb.....	788
Beef, 15,000 lbs. at \$0.06 per lb.....	900
Pork, 7500 lbs. at \$0.08 per lb.....	600

Total livestock sales \$2288

Total crop and livestock sales..... \$3885

	Seed	Twine	Threshing	Total
Corn	\$24	\$8	....	\$32
Oats	74	24	\$81	179
Barley	14	5	15	34
Clover and timothy.....	36	....	....	36
Alfalfa	5	....	....	5
Total	\$153	\$37	\$96	\$286

Veterinary Services and Medicine:

Cows	\$5
Young cattle	5
Hogs	15
Horses	4

Total \$29

Extra hired labor..... \$31

Total cost of extra labor and materials..... \$346

Returns to the organization after deducting cost of extra labor and materials \$3539

WEAKNESS OF PRESENT ORGANIZATION

This organization, consisting largely of corn, small grain, and mixed cattle enterprises, is a type common in this area. It is also typical of a number of farms included in this study, in that there is a relatively abundant supply of family labor for farm work. This farm is well organized for crop production but the crops are not efficiently marketed

through the livestock. Only 125 pounds of butterfat were produced per cow and the amount of beef produced is low in comparison with the feeds consumed. The hog enterprise might well be expanded. Here the possibility of improvement in the organization depends largely upon the ability of the operator to improve the livestock enterprises.

REORGANIZATION PLAN NO. I

EFFECT UPON RETURNS OF ADJUSTMENT OF CROP ACREAGES

The first plan for reorganization provides for a change in the relative amounts of corn and small grain with a view to increasing the salable product and reducing the possibility of needing extra labor in April and July. Fifteen acres of corn are substituted for a like acreage of oats.

ESTIMATED RETURNS FROM PROPOSED ORGANIZATION

	Acres	Yield per acre	Total yield	Amount required for feed	Salable surplus
Corn for grain, bu.....	100	40	4000	1540	2460
Oats, bu.	62	38	2356	1235	1120
Barley, bu.	15	25	375	175	200
Alfalfa, tons	5	3	15	All	....
Tame hay, tons.....	34	1¾	59	51	8
Corn fodder, tons.....	11	2	22	All	....

Sales: Crops

Corn, 2460 bu. at \$0.50 per bu.....	\$1230
Oats, 1120 bu. at \$0.30 per bu.....	336
Barley, 200 bu. at \$0.40 per bu.....	80
Hay, 8 tons at \$10.00 per ton.....	80

Total crop sales.....	\$1726
Livestock (same as above).....	\$2288

Total crop and livestock sales.....	\$4014
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COST OF MATERIALS

	Seed	Twine	Threshing	Total
Corn	\$27	\$8		\$35
Oats	60	19	\$71	150
Barley	14	5	15	34
Timothy and clover	36	....	....	36
Alfalfa	5	....	....	5
Total	\$142	\$32	\$86	\$260

Veterinary Services and Medicine.....	\$29
Total cost of materials.....	\$289
Returns to proposed organization after deducting cost of materials....	\$3725
Net increase over present organization.....	\$186

Fig. 30. Available Supply of Man Labor and Distribution, by Weeks, of Man Labor on Crops and Livestock on a 317-Acre Farm (Proposed Organization)

The distribution of the regular crop and livestock labor for this proposed organization is shown in Figure 30. One hundred and eighty-seven more hours of man labor would be required with this organization than are required as the farm is now organized. It is apparent from the chart that this work can be done by the regular supply of labor. Besides the regular crop and livestock work, there are 1500 hours of miscellaneous crop and livestock work to be done. There are approximately three thousand hours of regular labor available for performing this miscellaneous work and this available time is well distributed throughout the year. There is, of course, the possibility of expanding the supply by lengthening the work day in case of emergencies. When this occurs, farmers usually do not put in such long hours for a while after the rush work is over.

EFFECT ON RETURNS OF REPLACING BARLEY WITH OATS

The relative position of the oats and barley crops in this organization is significant. The yield per acre of barley on this farm is relatively lower than that of oats. These grains produce about the same amount of feed per acre. As shown in the chart, most of the seedbed preparation and seeding of barley comes after the oats have been seeded. This obviates the necessity of hiring extra labor in order to get the oats in on time. Also additional labor is available in time to assist with the barley work. Again, at harvest time the barley work usually comes just before the oats and fits in well with the labor program. It also reduces the risk of crop failure. The difference in returns due to replacing the barley crop with oats on this farm is shown below.

Oats, 15 acres, 38 bu. per acre, 570 bu. at \$0.30 per bu.....	\$171
Barley, 15 acres, 25 bu. per acre, 375 bu. at \$0.40 per bu.....	150
	<hr/>
Increase in value of oats over barley.....	\$21
Increase in cost of seed, twine, and threshing.....	2
	<hr/>
Added returns from choice of 15 acres of oats.....	\$19

This advantage in favor of oats is too small to be significant and is offset by the element of diversity introduced by the barley crop.

EFFECT ON RETURNS OF CHANGE IN RELATIVE PRICES OF OATS AND BARLEY

At times the relative prices of grains shift materially, making a change in the acreage of each advisable. The effect of such a change in prices on the farm income is significant in the following example. Assuming that the price of barley has remained the same as in the preceding example, and the price of oats to have advanced to 40 cents per bushel, the gain by changing from barley to oats would be as follows:

Oats, 15 acres, 38 bu. per acre, 570 bu. at \$0.30 per bu.....	\$228
Barley, 15 acres, 25 bu. per acre, 375 bu. at \$0.40 per bu.....	150
	<hr/>
Increase in value of oats over barley.....	\$78
Increase in cost of seed, twine, and threshing.....	5
	<hr/>
Added returns from the choice of 15 acres of oats.....	\$73

It is obvious that this increase is large enough to warrant a shift from barley to oats. Any change in the relative yields of these crops over a period of years with the relative prices remaining the same would affect the profits in a similar way.

EFFECT ON RETURNS OF SUBSTITUTING RYE FOR OATS AS A CASH SMALL GRAIN CROP

As this farm produces small grain for sale, the possibility of substituting rye, which has a relatively higher value per acre, is worth consideration. Using the data on yields and prices given above, the effect of replacing twenty acres of oats with rye would be as follows:

Rye, 20 acres, 18 bu. per acre, 360 bu. at \$0.70 per bu.....	\$252
Oats, 20 acres, 38 bu. per acre, 760 bu. at \$0.30 per bu.....	228
	<hr/>
Increase in value of rye over oats.....	\$24
Extra costs of seed, twine, and threshing.....	6
	<hr/>
Added value from choice of 20 acres of rye.....	\$18

The substitution of this acreage of rye for oats would improve the distribution of labor by providing more work during August and September and reducing the amount required in April. It would spread out the harvest labor, as rye comes ahead of the oats and barley, but may conflict with haying or corn cultivation. The rye would require more total labor in the preparation of the seedbed, as it is common to plow for rye. However, this comes at a time when there is little other work and could be done without increasing the supply of labor.

This change would necessitate the seeding of rye after oats or barley unless the fodder corn was cut and shocked in time to put in rye. Rye is a better nurse crop for clover and grass than oats and from this standpoint could be advantageously included in the rotation. However, it does not fit into the cropping scheme as well as oats, as it must be seeded in the fall before the corn crop can be removed.

EFFECT OF CHANGE IN RELATIVE PRICES OF RYE AND OATS ON CHOICE BETWEEN THESE GROUPS

A relative increase in the price of rye over oats might warrant some adjustment in the oats and rye acreages. With oats at 30 cents and rye at \$1, the returns would be affected as follows:

Rye, 20 acres, 18 bu. per acre, 630 bu. at \$1.00 per bu.....	\$360
Oats, 20 acres, 38 bu. per acre, 760 bu. at \$0.30 per bu.....	228
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Increase in value of rye over oats.....	\$132
Extra cost of seed, twine, and threshing.....	15
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Added returns from 20 acres of rye instead of oats..... \$117

This would no doubt make it advisable to shift from oats to rye as a cash small grain crop.

REORGANIZATION PLAN NO. 2

EFFECT ON RETURNS OF INCREASED LIVESTOCK PRODUCTION

The foregoing plan does not provide for any substantial increase in the returns to the farm. The points of greatest weakness in the present organization are in the hog and cattle enterprises rather than in the cropping plan. The following plan assumes that the farmer can increase the production of butterfat per cow up to 160 pounds by better feeding and care of the cows and at the same time increase the production of pork up to 20,000 pounds, thus utilizing the skim milk available and marketing through livestock more of the grain produced.

	Acres	Yield per acre	Total yield	Amount required for feed	Salable surplus
Corn for grain, bu.....	100	40	4000	2500	1500
Oats, bu.	62	38	2356	1656	700
Barley, bu.	15	25	375	175	200
Alfalfa, tons	5	3	15	All	....
Clover and timothy, tons....	34	1¾	59	55	4
Corn fodder, tons.....	11	2	22	All	....

Sales: Crops

Corn, 1500 bu. at \$0.50 per bu.....	\$750
Oats, 700 bu. at \$0.30 per bu.....	210
Barley, 200 bu. at \$0.40 per bu.....	80
Hay, 4 tons, at \$10.00 per ton.....	40
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Total crop sales..... \$1080

Livestock

Butterfat, 14 cows, 160 pounds per cow, 2240 pounds at \$0.45 per lb....	\$1008
Pork, 20000 pounds, at \$0.08 per lb.....	1600
Beef, 15,000 lbs. at \$0.06 per lb.....	900
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Total livestock sales \$3508

Total crop and livestock sales..... \$4588

Cost of Materials:

Crops (same as above).....	\$260
Veterinary Services and Medicine:	
Cows	\$5
Young cattle	5
Hogs	40
Horses	4
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Total	\$54
Total cost of materials.....	\$314
Total returns to the organization after deducting material costs.....	\$4274
Net increase over present plan of operation.....	\$735

This plan calls for an increase of 562 hours in the direct man labor on crops and livestock over the present organization. It may also necessitate a slight increase in the maintenance labor required. However, on account of the better seasonal distribution of labor it should not be necessary to have any additional labor to handle this increase. No change in resources is assumed except an increase from 10 to 18 in the number of brood sows. Since the farmer raises his own brood sows this change involves no cash outlay. This increased efficiency in the marketing of crops through livestock will return \$735 more to the organization.

EFFECT ON RETURNS OF EXPANDING THE DAIRY ENTERPRISE

A further expansion of the dairy enterprise to 18 cows and an additional increase in the hog enterprise to utilize the skim milk and more of the grain produced, would affect the returns as follows:

Pork, 5000 lbs. additional, at \$0.08 per lb.....	\$400
Butterfat, 640 lbs. additional, at \$0.45 per lb.....	288
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Total value additional product.....	\$688
Decrease in sales:	
Corn, 490 bu. at \$0.50 per bu.....	\$245
Oats, 250 bu. at \$0.30 per bu.....	75
Hay, 2 tons, at \$10.00 per ton.....	20
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Total	\$340
Increased veterinary service and medicine costs.....	\$12
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Total subtraction	\$352
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Net increase in returns to the organization.....	\$336

This expansion of the livestock enterprises would provide for a much fuller utilization of the labor available, as approximately 630 additional hours of man labor would be required. This additional labor would be quite uniformly distributed throughout the year and with

good management would not necessitate hiring extra labor, altho the extra returns are sufficient to warrant hiring some extra labor if needed. More corn would have to be cut for fodder and more alfalfa grown in order to meet the roughage requirements of the cows. Even then the margin of safety between the amount of hay produced and that needed by livestock is greatly reduced. The effect upon the soil fertility and crop yields of using more grain for feeding instead of selling it can not be determined, but it is reasonable to expect some long-time improvement from this source.

EFFECT ON RETURNS OF SHIFTING FROM BEEF TO BUTTERFAT PRODUCTION

Another possibility is the expansion of the dairy enterprise to 18 cows at the expense of the beef enterprise. By reducing the production of beef 3000 pounds, four more cows producing 160 pounds of butterfat each could be kept on practically the same feeds. The relative returns would be as follows:

Butterfat, 4 cows, 640 lbs. at \$0.45 per lb.....	\$288
Beef, 3000 lbs. at \$0.06 per lb.....	180

Net increase in returns from producing butterfat instead of beef..... \$108

This change could be effected without hiring additional labor or reducing the margin of safety between the feeds being produced and those required for the stock. It would, however, require 400 additional hours of work on the part of the family.

APPLICATION TO PLANNING THE FARM ORGANIZATION

The examples presented in Part III illustrate a method of using unit requirement data in planning the farm organization. With the data presented in Part II available, it is possible to project with a reasonable degree of accuracy farming operations for a year on the farms of this area and to estimate the probable variations in returns that may normally be expected, as well as the variations in the outlay to be made if each of the several probable alternatives is chosen.

The data in Part II can also be used by farmers in other areas operating under conditions similar to those prevailing in this area. The description of the farms studied and the history and description of the area, presented in Part I, enable farmers located elsewhere to determine to what extent their conditions are sufficiently comparable to make the data applicable to their problems.

Each farmer must study the relative opportunities offered by all possible alternative plans in order to determine which plan of organization promises the largest return to the resources at his command. Other

factors than the securing of the highest returns from farming may affect the choice of farm enterprises. The farmers' likes and dislikes or the effect of changes in organization upon the farm as a home and other non-economic factors may influence his decisions. In any event the actual working out of these plans on paper will serve both as a check upon what has been accomplished and as a guide to future possibilities. Knowing this, it is then for the farmer to decide whether the increased returns that may be secured from changes in organization are sufficient to induce him to make the changes.

Returns from any organization plan are calculated on the basis of probable future prices. Prices of all commodities are constantly shifting, sometimes erratically, sometimes in fairly definite cycles. These changes may be frequent and rapid or they may be relatively few and gradual. There is a considerable tendency for the farmer to base his plans for the coming year on the prices received for his products during the present year. This practice always involves a large element of risk, as a high price for a given commodity one year may stimulate so serious an over-production of that commodity the following year as to reduce its price and make it highly unprofitable. At the present time the farmer can safely adjust his business in response to price changes only so far as these appear to be due to relatively permanent changes in economic conditions. However, a large number of both public and private agencies are now giving considerable attention to price forecasting. As these agencies collect information covering the factors that determine price and the farmer learns to interpret it or has it interpreted for him, it will be increasingly possible for him to use price forecasts in connection with the method of analysis outlined in this study.

The question of price making or the possibility of artificial regulation of prices is outside the realm of this study. However, it is suggested that the proper consideration of the problem of choice and adjustment of enterprises will lead to a more rapid and accurate adjustment of production to permanently changed conditions of the market. This will mean more stability as between the relative prices of different agricultural products. The proper consideration of the probable returns from different types of farm organization plans may also result in a more rapid adjustment between agricultural production as a whole and production in other industries.

The process of analysis outlined in this study will help individual farmers to decide whether the returns from farming are sufficient to keep them in the business and, if so, what to produce and how to product it.

SUMMARY

PART I

History shows that during the latter part of the nineteenth century there was a rapid opening up and settlement of new farming land in southwestern Minnesota. In Cottonwood county, in 1860, 260 acres of land were farmed, while forty years later more than 370,000 acres were in farms. Of this area 92.2 per cent was under cultivation in 1900.

Throughout the early years and until 1905, wheat occupied the most prominent place among crops in Cottonwood and Jackson counties. Since 1905 oats and corn have gradually become the important crops in respect to acreage planted, until at the time of this study oats were grown on 33.9 per cent and corn on 31.7 per cent of the area devoted to crops.

As these shifts were going on, the production of livestock and livestock products was gradually expanding, the principal emphasis being put upon the growing of hogs and cattle.

Sheep raising increased in importance until 1890, after which time the rapid breaking up of virgin pasture land for crop raising resulted in a rapid decline in the number of sheep.

During the three years, 1920 to 1922, inclusive, there was an average of 9.6 dairy cows, 13.4 other cattle, 30 hogs, and 2.6 sheep per farm in Cottonwood and Jackson counties.

The swine enterprise is the largest source of income on the farms in this study, furnishing more than a third of the gross income from 1920 to 1922, inclusive.

PART II

This study brings out the wide variations in amount of labor put on crops, together with variations in the amount of feed used in the production of livestock and livestock products, by individual farmers, and points out the principal causes for these variations.

The speed and efficiency with which field operations can be performed depend upon the size and type of implement and power unit, the size and shape of fields; the intensity of culture, the condition of the soil or crop upon which the work is being done, the practice followed in performing the operations, and the managerial ability of the operator.

From the data presented on basic requirements used in production it is possible for other producers in the area to determine the relative efficiency of their performances by comparing them with the practices used and results secured by those farmers who have high standards in their work.

Standard requirements are set forth together with variations in the amount of labor used from farm to farm for the production of the principal crops grown and livestock raised in southwestern Minnesota.

The miscellaneous man and horse labor about the farm, not put directly upon crops or livestock, unless given thought and direction may consume too much of the available labor or may not be applied to the odd jobs that must be out of the way when crops and livestock demand labor. On the 22 farms under study, miscellaneous work about the farm consumed from 5.2 to 25.1 per cent of the total man labor expended and from 2 to 15.9 per cent of the total horse labor used on the whole farm.

Much of the success in farming rests on the day-to-day management and decisions of the farm operator. A plan of classifying work as to its relative fixity is set forth. This plan can serve as a guide in laying out farm operations from day to day so that the important work for each day will not be interfered with by miscellaneous work that could be performed during slack periods.

PART III

The data presented upon the requirements of crops and livestock production bring out the fact that the different lines of production vary in their demands upon the farmer and his resources. Not only do they vary in quantity demands, but each crop or kind of livestock usually makes demands at certain definite times that must be met if best results are to be secured.

On these Southwestern Minnesota farms there often are unmarketable feeds and also slack seasons during which little demand is made upon the time of the farmer by crops, making it very advantageous for him to use this feed and labor in livestock production.

Part III aims to set forth by illustration the principles underlying the proper combination of enterprises together with increased efficiency in production, and to measure improved farm organization through increased farm returns.

A typical farm was used in these illustrations, showing the methods of making choice and adjustment of enterprises. Calculations were first made for the present organization of crops and livestock as they existed on the farm in 1922, using normal yields and estimated market prices. Under this "present" crop and livestock organization are determined the production requirements and labor distribution as well as total production and returns, based on normal yields and estimated prices.

With the same farm area a reorganization plan is next shown which reduced the acreage of oats, barley, and rye and increased the acreage devoted to corn and hay. With the same yields of crops and livestock but with this shift in acreage a new financial balance is struck, indicating increased net returns equal to \$202 for the farm year.

The influence of price changes on the making of proper choices between beef and dairy cattle is next brought out by example.

Another general reorganization plan indicates that if this farmer rented additional land and expanded his production he could increase his net income by \$690 without hiring additional labor except during corn husking.

A second farm is discussed to show the effect on the income of the farm of increased efficiency within individual enterprises as well as shifts and expansion in production.