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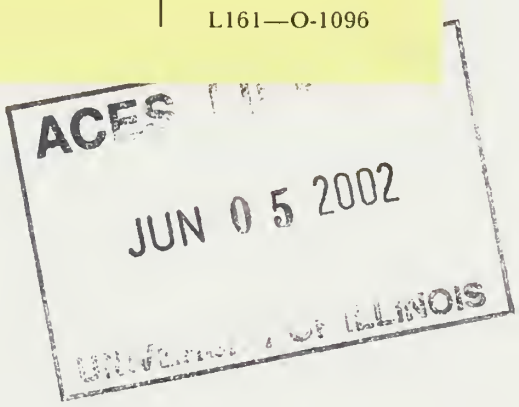

UNIVERSITY OF ILLINOIS
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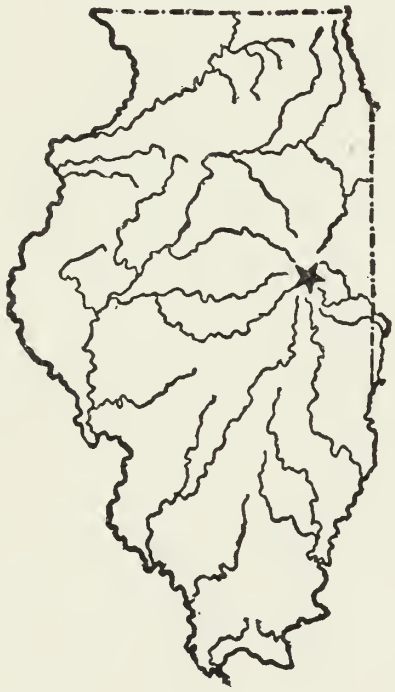
ORGANIZING THE CORN-BELT FARM FOR PROFITABLE PRODUCTION

BASED ON STUDIES OF FARMS IN EAST-CENTRAL ILLINOIS

By H. C. M. Case, R. H. Wilcox,
and H. A. Berg



URBANA, ILLINOIS, JUNE, 1929

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ORGANIZING THE CORN-BELT FARM FOR PROFITABLE PRODUCTION

By H. C. M. Case, R. H. Wilcox, and H. A. Berg[1]

The earnings of a farm depend upon the way in which it is organized and operated as well as upon soil, climate, prices, and market conditions. This statement doubtless will be accepted as a fact, since the personal factor in any business is recognized as a large one, and since observation as well as study reveals variations in earnings on farms in the same community where the natural and economic advantages are essentially the same.

Some farms, year after year, are more successful than others. What causes these contrasts in farm incomes? Certain chance conditions will now and then affect the results on any farm, and there are conditions external to the farm that influence the general level of its earnings, but aside from these it is clear that there are important factors under the control of the farm operator which, in the long run, determine what the income on his farm will be as compared with that of other farms in the neighborhood.

One of the best means of finding the influence of different factors on farm earnings is to study carefully the plans and practices that farmers are following, and compare the earnings that are being realized under different methods of organization and operation. Part I of the present bulletin gives the results of studies of successful and unsuccessful farms in east-central Illinois. Extending over a period of years, these studies bring out the long-time effect of different plans and practices and suggest certain definite principles of management that can be profitably applied to Illinois corn-belt farms. Cost-of-production data gathered in this part of the state are also presented. Part II shows how a farmer in the Illinois corn belt may go about it to apply these principles to his own farm.

The degree to which earnings among different farms may vary as a result of different methods of management is illustrated by a study of 51 farms in Woodford county, Illinois. Records were kept by the operators over a period of five years—from 1921 to 1925. The farm with the highest earnings made an average of 7.75 percent a year on an average investment of $60,674. This income was the result of years of definite effort by the operator to put the farm on an efficient production basis. The least profitable farm lacked over $300, or .56 percent, of making any return on the investment after operating expenses were paid. The difference in the returns of these two farms was then 8.31 percent annually. This would amount to

[1]H. C. M. Case, Chief in Farm Organization and Management; R. H. Wilcox, Associate Chief; and H. A. Berg, formerly Associate.

$4,922 a year on an investment of $59,225, which was the average investment for all the farms in the study. For the total five-year period the difference at this rate would be nearly $25,000 (Fig. 2).[1]

A careful study of farms on which accounts have been kept shows that the most successful men are generally those who have spent many years in building up the soil, in developing efficient herds of livestock, in equipping their farms for economical operation, in selecting good seed, in establishing a good cropping system, and in doing the many things connected with good management.

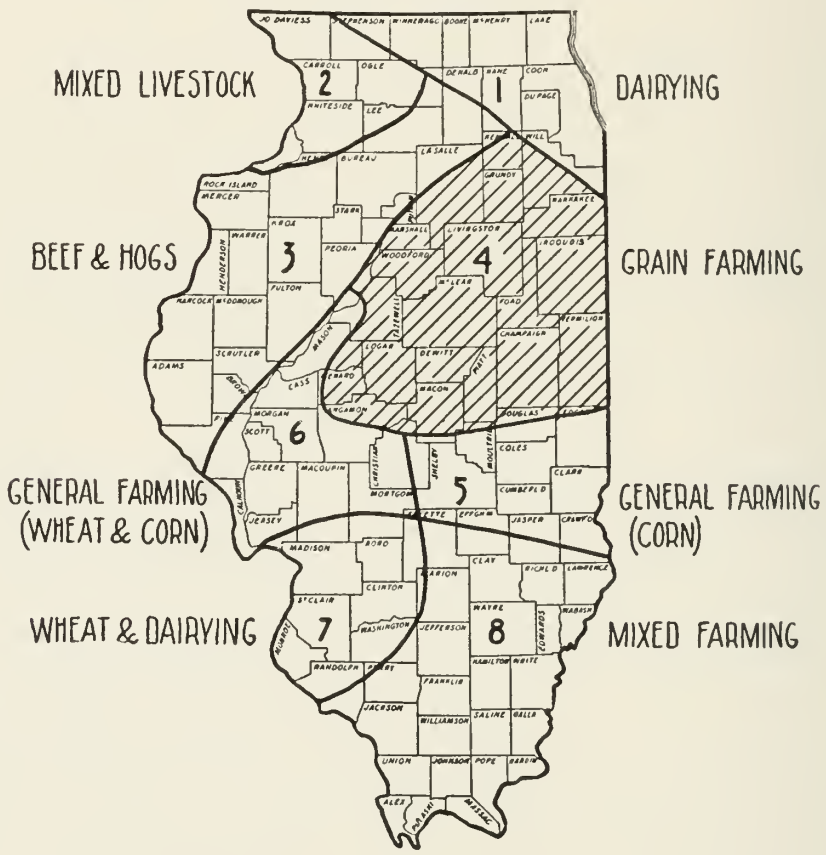

FIG. 1.—LOCATION OF EIGHT FARMING-TYPE AREAS IN ILLINOIS

The principles discussed in this bulletin apply to all areas in the state, tho the data presented apply especially to Area 4, where grain farming predominates and livestock is of secondary interest.

Furthermore, the men who keep accounts are the kind of men who are putting intelligent effort into the development of better systems of farming. This is demonstrated by a comparison of the

[1]Some people believe that differences in farm earnings are due largely to opportune marketing. There are occasional years when variations in prices received by different farmers for the same kind of products are responsible for considerable differences in income, but over a period of years this factor is not so important as are others relating directly to the organization and operation of the farm. In so far as opportune marketing is a factor in farm earnings, it is to be noted that it is because some farmers are better managers of their selling operations as well as of production.

earnings of these accounting-keeping farmers with other farms in the same area. The 51 farmers mentioned above earned about 3.2 percent on their investments in 1925. One hundred thirteen other farmers in a township in the same part of Illinois earned only 1.5 percent on their investments that year.[1] This difference of 1.7 percent, amounting to over $1,000 a farm, is characteristic of the differences found in the farm earnings of record keepers and the average of all farmers in the same community wherever similar studies have been made.

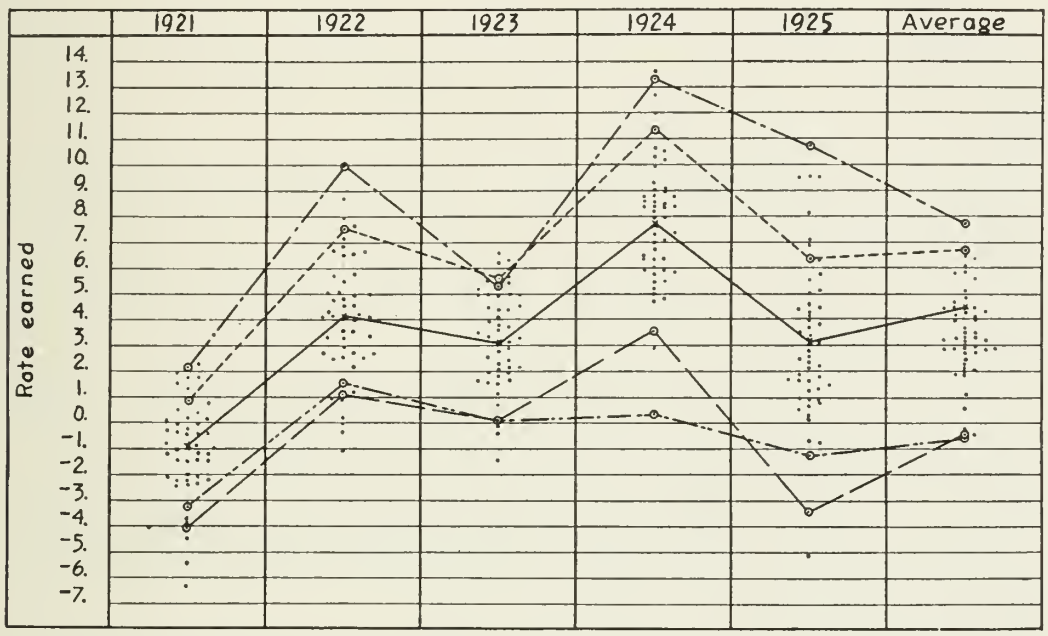

FIG. 2.—EARNINGS OVER FIVE SUCCESSIVE YEARS ON THE SAME GROUP OF WOODFORD COUNTY FARMS

The dots indicate the rate earned on each of the 51 Woodford county farms for each year from 1921 to 1925 and the average for all five years. The average rate earned by all farms each year is shown by the continuous black line in the middle of the graph. The broken lines show the standing of particular farms. It will be noted that some farms are consistently near the top in their earnings; others are just as consistently near the bottom.

In the corn belt a number of successful systems of production may be found which differ in the kinds and proportions of products grown and sold. While this bulletin is based largely on information obtained in east-central Illinois, and will therefore prove of especial interest to farmers in that region, its aim is to bring to farmers in all parts of the state a better appreciation of the factors that affect their earnings. Tenant farmers as well as owner-farmers, it is believed will be interested in the matters discussed, for while there are many advantages which an owner has that a tenant does not have, there still are many things a tenant can do in organizing and operating his farm which will help to insure the success of his operations in spite of restrictions which a farm lease may impose upon him.

[1]Farm business survey of Gridley township, McLean county, Illinois.

PART I. PRINCIPLES OF GOOD FARM ORGANIZATION

Farm management studies made in Illinois and elsewhere have shown that there are certain definite principles that need to be observed in the organization and operation of a farm if it is to be financially successful. The most important of these principles as they apply to Illinois may be stated as follows:

1. Good yields tend to reduce the unit cost of producing farm crops.
2. A large percentage of land in the higher profit crops means larger profits.
3. Livestock production as a means of marketing crops makes for larger farm income.
4. Efficient feeding and handling of livestock materially reduces cost of production.
5. A large volume of business is necessary for profitable farming.
6. A well-organized system of crop and livestock production helps use available man labor advantageously.
7. Costs are reduced when the supply of horse and mechanical power fits the farm needs and is economically handled.
8. Buildings, machinery, and other equipment expense must be kept under control if low production costs are to be obtained.
9. A good farm layout and a well-developed farmstead make for economical operation.
10. Diversity of crop production helps to insure long-time profits.
11. Production planned in accordance with market demands makes for a larger margin of profit.

Each one of these principles will be analyzed in this part of the bulletin and illustrated with facts obtained from detailed records of farms in east-central Illinois.

Good Crop Yields Reduce Production Costs

It may be said as a general truth in respect to the groups of farms studied by this Station that as yields have increased, the cost per bushel of grain has tended to decrease. It is fully realized that if an attempt were made to increase yields indefinitely, a point would finally be reached where the increase in yield would no longer pay for the added cost. Occasionally a man may make expenditures on some part of his production that are not warranted by the returns they bring, but, as shown by the data in Fig. 3, farmers generally have not yet reached that point in the production of crops.

The cost of producing corn from 1920 to 1926 on farms in Champaign and Piatt counties where detailed cost records were kept varied from 38 cents to 88 cents a bushel. In the same year the cost has varied from 38 to 78 cents a bushel. In other words, it has been more than twice as high on some farms as on others.

That yield has been one of the most important factors in causing this difference is illustrated by data obtained from three farms in 1925 (Table 1). The cost of growing an acre of corn was $28.84, $27.63, and $28.45 respectively on the three farms, while the yields were 62.8 bushels, 49.8 bushels, and 34 bushels respectively.[1] The

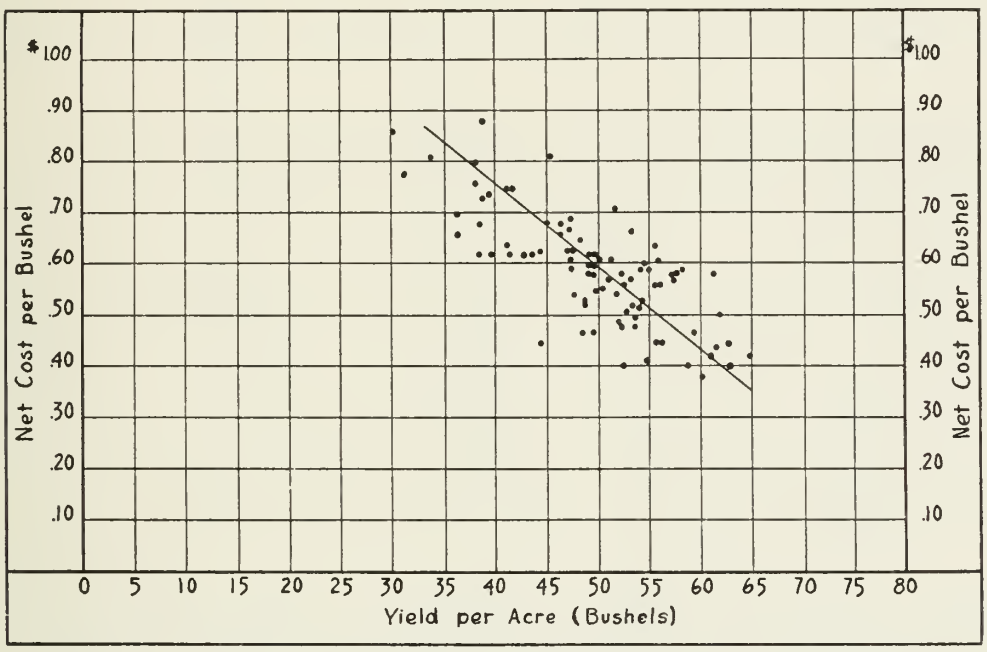

FIG. 3.—COST OF PRODUCING A BUSHEL OF CORN AS AFFECTED BY YIELD PER ACRE

As yield per acre increases, there is a marked decline in the cost per bushel. Graph is based on data obtained from certain Champaign and Piatt county farms.

net cost of producing a bushel of corn was then 45 cents, 55 cents, and 81 cents respectively after allowing a conservative value for

[1]While cost-of-production data are valuable mainly in learning the physical quantities of the various factors of production, they also illustrate some of the principles of farm organization and operation already mentioned in this bulletin. In comparing crop costs the use of a charge for land as a cost of production is frequently criticized because it is difficult to determine what the land value actually is. The main reason for retaining a charge for use of land in determining cost figures is that any variation in the value of land from farm to farm represents an actual difference in the productive value of the land in so far as it is possible to determine these differences. So far as other costs are concerned, it could be pointed out that there are difficulties in determining any item of cost in farming because of the many joint costs that exist. The main reason for using money values in comparing farm costs especially with regard to crops, is that more and more, labor, power, and various forms of capital are interchanged in growing the same product. In studying comparative results or the influence of different practices on the cost of production it is, therefore, highly desirable to reduce all costs to some common basis. Monetary costs appear to be the best basis we have for such comparisons. From a research point of view such comparisons may not be altogether necessary, but in the problem of interpreting results to cooperating farmers and others the research worker will find money costs highly useful in demonstrating the principles of farm management.

TABLE 1.—COST OF PRODUCING CORN ON THREE SELECTED FARMS IN CHAMPAIGN AND PIATT COUNTIES, 1925

Farm No.	1	2	3
Items of cost			
Man labor	$ 5.93	$ 4.50	$ 3.83
Horse labor	5.51	4.61	7.12
Tractor labor	....	1.30	....
Machinery	.67	1.49	1.04
Seed	.27	.26	.32
Manure	1.88	.60	.99
General farm expense	2.66	2.51	2.25
Miscellaneous	.04	....	.06
Operating cost	$16.96	$15.27	$15.61
Taxes on land	$ 1.88	$ 2.36	$ 3.09
Interest on land at 5 percent	10.00	10.00	9.75
Total cost	$28.84	$27.63	$28.45
Credit for pasture	$ .77	$ .16	$ .94
Yield per acre, bushels	(62.8)	(49.8)	(34.0)
Net cost per bushel	$ .45	$ .55	$ .81

the pasture provided by the cornstalks. Of course back of the higher yields are differences in the productivity of the soil, in kind of seed used, and other factors making for better production.

Higher Profit Crops Add to Total Farm Profits

The kind of crops which a farm grows is an important factor in determining its earnings. Rotations which give the best satisfaction in different parts of the country usually have three characteristics: they include a cultivated crop, a small grain crop, and a hay or pasture crop. In east-central Illinois corn is the most profitable cultivated crop, winter wheat the most profitable small grain, alfalfa the most profitable hay crop, and sweet clover the most profitable pasture crop. While it is not possible to grow the entire farm to the higher profit crops, it is important that a large part of the acreage be devoted to them.

The selection of a good crop rotation must take into account a number of factors. In the first place the relative profit from the various crops included in each of three groups mentioned above must be taken into consideration. In the second place the proportion of various crops needed to maintain the fertility of the land, to provide for the best use and distribution of labor, to use available power and equipment to advantage, to supply the amount and kinds of feed for livestock, to protect against crop failure, and to meet other requirements of good farm organization and operation must be considered. While the main discussion of the points to take into account in selecting a cropping plan is left to Part II, pages 293 to 305, some of the

practical considerations in regard to particular crops may well be taken up here.

Cultivated Crops. Corn is the only important cultivated crop that is grown thruout the corn belt. It shows a better profit than any of the small-grain crops. On 10 to 16 typical Champaign and Piatt county farms during the years 1920 to 1926 it gave an average profit of $5.55 an acre when valued at 67 cents a bushel (Table 2).

TABLE 2.—COST OF PRODUCING GRAIN CROPS ON 10 TO 16 CHAMPAIGN AND PIATT COUNTY FARMS, 1921-1926

	Corn	Winter wheat	Oats	Soybeans
Expenses per acre				
Man labor	$ 4.80	$ 2.77	$ 1.75	$ 2.76
Horse labor	5.29	3.34	1.93	3.95
Tractor	.80	.87	.29	1.02
Seed	.37	2.10	1.35	2.69
Machinery	.86	.94	.51	1.14
Twine	...	.31	.29	.26
Fuel	...	.14	.10	.14
Threshing	...	1.12	.99	1.66
Other operating expenses	3.26	2.05	1.15	2.23
Total operating expenses	$15.38	$13.64	$ 8.36	$15.85
Taxes	$ 1.97	$ 1.94	$ 1.98	$ 1.95
Interest on land	11.00	11.00	11.00	11.00
Total cost	$28.35	$26.58	$21.34	$28.80
Income per acre				
Grain	$32.98	$26.76	$14.11	$20.93
Pasture or roughage	.92	2.32	3.05	4.77
Total income	$33.90	$29.08	$17.16	$25.70
Net profit or loss per acre	$ 5.55	$ 2.50	$−4.18	$−3.10
Efficiency factors				
Net cost per bushel	$ .56	$ 1.12	$ .48	$ 1.54
Farm price at harvest 1924-26[1]	$ .67	$ 1.24	$ .37	$ 1.34
Yield in bushels	49.22	21.58	38.14	15.62
Man labor per acre, hours	14.04	10.95	6.84	12.14
Horse labor per acre, hours	32.89	21.45	12.10	26.39
Tractor use per acre, hours	.70	.51	.27	1.05
Total number of acres	9 185.46	2 456.60	4 715.91	1 001.17

[1]Cost of production data were secured for the six-year period 1921-1926. Farm prices of crops were taken for the three-year period 1924 to 1926 because of abnormal price conditions in the earlier years.

Corn is primarily a feed crop. It therefore may be marketed thru livestock when to do so is more favorable than marketing it direct. Being a cultivated crop its inclusion in the rotation results in the killing of weeds. While from this latter standpoint sweet corn and broom corn might fill a similar place in the rotation, there is no reason to grow them extensively in Illinois.

With the above advantages, it is clear that corn must be given the central place in crop rotations in this section of Illinois, other crops being chosen that will fit in with it in meeting the requirements of a good rotation.[1]

Small Grain Crops. *Wheat.*—Wheat stands above the other small grain crops of the corn belt and next to corn as a higher profit grain crop. In the study referred to above it gave a profit of $2.50 an acre when valued at $1.24 a bushel, while oats gave a loss of $4.18 at 37 cents a bushel, and soybeans a loss of $3.10 at $1.34 a bushel (Table 2). Wheat fits in especially well from the standpoint of economical farm operation (see page 298). One disadvantage in wheat production is that it is difficult to have it follow a crop of corn directly unless the corn is shocked or removed for silage. Occasionally wheat can be seeded in standing corn, but one cannot depend on such practice where heavy crops of corn are grown.

Oats.—While, as shown above, oats are the least profitable of the small grain crops, they still occupy a place which is hard to fill with any other small grain. It is difficult, for example, to grow wheat after corn in east-central Illinois, but oats fit in well between corn and wheat and so provide a workable succession of crops. The labor and power required in growing oats do not interfere seriously with the demands of corn and wheat. Oats are an especially good nurse crop for the seeding of clover or alfalfa.

One reason that oats are less profitable than other crops is that they are usually planted on land which has grown two or more cereal crops since it was in a legume. Consequently the oats do not have the same opportunity to return a profit. Oats are not grown on the most fertile land because of the danger of their lodging. When grown the third year following a legume, they give a net return comparable to that secured from corn grown the third year in succession.

Recently oats have suffered from a weak market demand resulting from the replacement of horses by motor power. In so far as a man can use oats in livestock production, the crop may yet fill as important a place in the farming plan as it did in the past.

Barley.—Barley is not commonly grown in east-central Illinois, but experience with it, while not conclusive, indicates that it is about

[1]Data obtained in Hancock county, Illinois, over the ten-year period 1913-1922, as given in Bulletin 277 of this Station, show similar results. Over this period, which includes the period of high prices prevailing during the years of the World War, the net profits for an acre of the principal crops grown were: corn, $8.59; wheat, $5.44; rye, $4.88; oats, $2.68; red clover, including some seed crops, $9.32; alfalfa, $12.20; timonthy hay, $3.21; and mixed hay, $.18. Over the same period the prices of rye, oats, and timonthy hay were relatively higher than at present. A smaller demand for rye as a cash crop and the less-ready market for either oats or timothy hay as horse feed in cities are factors partially accounting for this situation.

as profitable as oats. From the standpoint of their places in a rotation, barley and oats have many similarities. Improvements in varieties may justify growing barley more extensively in east-central Illinois, at least when it can be fed on the farm.

Cost studies made in northern Illinois place barley among the higher profit crops in that region. Hence in planning systems of farming for that part of the state, barley may well be considered. Similar studies on a small acreage of barley and spring wheat made in Champaign county over a seven-year period indicate that these crops were no more profitable than oats during the same period, and that they fill a similar place in the crop rotation.

Soybeans.—While soybeans show a low return when compared with corn and winter wheat, this is doubtless due partially to the fact that they are a relatively new crop in this area and are without as settled a market as the more staple grains. The price placed upon soybeans in the study referred to represents the market value of the crop at the time of harvest. Some producers have been fortunate in selling the crop for seed at much better prices. In so far as a grower is assured of a market for soybeans as a seed crop, he may find them one of his most profitable crops.

Soybeans frequently are put in hurriedly after the corn is planted, without killing all the weeds. Many instances can be cited where yields have been greatly reduced by the interference of weeds. In other cases poor inoculation and poor seed undoubtedly have been factors partially responsible for unsatisfactory results. Some of these difficulties should disappear when more standardized methods of producing the crop are adopted. As better methods of production are more generally adopted, further study of their influence on the cost of production will be needed in order to show the place the crop may fill in corn-belt rotations.

Soybeans have an advantage over oats in giving a larger total value per acre but the cost of production is correspondingly higher. When soybeans are used to displace a part of the oat acreage rather than a part of the corn, the work involved is apt to interfere seriously with corn planting and cultivating unless the farm work is well planned or unless an abundant supply of labor and power is available.

Improvements in varieties of soybeans, better cultural methods, and better inoculation, as well as better knowledge of how to handle the crop, should result in larger yields and so give soybeans a more important place on the farms of east-central Illinois. This is particularly true in so far as a good market can be found for a larger crop or in so far as they may be used to advantage in livestock production.

Hay and Pasture Crops. Probably no phase of crop production receives so little attention as the production of hay, especially in east-

central Illinois. Less than 8 percent of the land on the farms keeping cost records was grown to hay. Imperfect stands both of hay and of pasture crops frequently are allowed to "stand over" in the hope that they will provide the necessary feed for the livestock kept on the farm. Very little limestone has been used, considering the total area of land on which applications would prove profitable.

Timothy, clover, and soybean hay, on the farms studied in Champaign and Piatt counties, showed losses of 39 cents, $5.66, and $11.19 respectively. However, 15 to 18 farms in Knox and Warren counties showed a profit of $16.11 an acre from alfalfa, $1.91 from clover, from mixed hay a loss of $4.01, from timothy a loss of 56 cents, and from soybean hay a loss of $10.71 an acre, as an average of the three years 1923 to 1925 (Table 3). These last figures more nearly

TABLE 3.—COST OF PRODUCING HAY CROPS ON 15 TO 18 KNOX AND WARREN COUNTY FARMS, 1923-1925

	Clover	Timothy	Mixed	Soybean	Alfalfa
Expenses per acre					
Man labor	$ 2.47	$ 1.49	$ 2.09	$ 4.12	$ 4.61
Horse labor	1.99	.86	1.32	3.96	3.00
Tractor	.04	.33	.12	2.50	.07
Seed	1.73	....	1.96	3.81	3.75
Machinery	1.01	.95	.81	3.21	1.52
Other operating expense	2.34	1.50	2.02	3.22	5.55
Total operating expenses	$ 9.58	$ 5.13	$ 8.32	$20.82	$18.50
Taxes	1.28	1.14	1.18	1.25	1.25
Interest on land	10.31	8.78	9.61	9.74	9.91
Total cost	$21.17	$15.05	$19.11	$31.81	$29.66
Income per acre[1]					
Hay	$21.71	$13.16	$13.52	$20.40	$44.64
Pasture	1.37	1.33	1.58	.70	1.13
Total income	$23.08	$14.49	$15.10	$21.10	$45.77
Net profit or loss per acre	$ 1.91	$− .56	$−4.01	$−10.71	$16.11
Efficiency factors					
Net cost per ton	$11.86	$14.60	$16.86	$19.44	$10.22
Farm price	$13.00	$14.00	$13.00	$12.00	$16.00
Yield in tons	1.67	.94	1.04	1.70	2.79
Man labor per acre, hours	8.71	5.60	7.63	14.93	16.69
Horse labor per acre, hours	12.33	5.64	9.29	23.18	22.89
Tractor used per acre, hours	....	.45	.15	2.61	.08
Total number of acres	361.66	167.03	199.19	76.87	469.03

[1]Crops valued at $16 a ton for alfalfa, $13 for clover and for mixed hay, $14 for timothy, and $12 for soybeans. These values represent comparable farm prices for the different hay crops during this period.

represent results which should be obtained, and they are in line with studies made in other sections of central Illinois.[1]

Alfalfa.—Alfalfa is an outstandingly profitable crop. Cost-of-production studies conducted from 1913 to date show that it is the most profitable hay crop in central Illinois. It also shows a larger profit over these years than corn, wheat, or any other grain crop. In these studies all crops were valued at farm prices. The average price for alfalfa thruout the period was about $16 a ton. This is a conservative price compared with that paid for hay when it is purchased, as is commonly done in many parts of Illinois.

Alfalfa has a distinct advantage in its large yield per acre. When taxes and interest on land amount to $10 an acre or more, the matter of a high yield is of great importance. Since these are costs that do not increase as yield increases, one of the best ways of reducing the unit cost of production is thru high production. In this respect alfalfa has a distinct advantage over other hay crops.

Sweet Clover.—While in the study in Champaign and Piatt counties wide variations were found in the amount of pasturage secured from the different pasture crops, depending both on the year and on the condition of the pasture, sweet clover over a period of years gave the largest production per acre on land included in the rotation. In comparing sweet clover with other crops, the pasture secured the first fall after a small grain has been removed should be included in the comparison since it sometimes amounts to one-third as much as that secured the following year.

Red Clover.—Red clover does not appear to be one of the higher profit crops (Table 3). It has, however, the distinct advantage of working into the rotation better than alfalfa, which cannot be readily rotated each year, and the return from clover grown on good soil is materially higher than from any other hay crop except alfalfa. When the hay crop is included in the regular rotation partly as a means of furnishing green manure, clover has a distinct advantage. Farmers, however, are not dependent upon a hay crop in the rotation as a means of improving the soil. Many farmers use sweet clover or a mixed legume pasture in the regular rotation, growing alfalfa hay in a separate field outside the main rotation.

Red clover or clover and timothy mixed usually gave a larger amount of pasture than the straight blue-grass. The average yield per acre was not high during the three years of study in Knox and Warren counties due to the fact that 1924 was an especially unfavorable year. However, for pasture sweet clover showed a definite advantage over other crops and it is also a good soil improver. The superiority of sweet clover as a pasture crop observed in these studies agrees with the results from the Illinois experiment fields.

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[1]See footnote on page 266.

Timothy.—With the exception of alfalfa, timothy commands a little better price per ton in this part of the state than do other hay crops. It is less profitable per acre, however, than clover and alfalfa and it produces a lower yield per acre. Timothy also reduces the fertility of the soil while legumes have the advantage of building it up.

Mixed Hay.—Considerable loss per acre is charged to this crop (Table 3). The cost of growing it is practically as high as the cost of growing a crop of clover, but the yield per acre is low. A poor stand is more frequently allowed to stand over than is a seeding

FIG. 4.—A SCENE ON A GOOD LIVESTOCK FARM

Livestock production, including beef cattle growing and feeding, dairying, hog raising, and sheep production, fits into Illinois farm conditions. It provides a use for legumes needed for crop rotation, roughage produced as a by-product of grain production, and grain that is low grade. It makes the farm a more economical operating unit and provides a means of marketing crops to advantage.

of a single legume or timothy; because it contains both clover and timothy it is often thought that it will give a large enough yield to supply the hay needs of the farm.

Mixed legume hay will prove more profitable than it is at present if soil conditions are made more favorable thru the correction of acidity and better provision for drainage.

Farms With Livestock Show Larger Earnings

Farms on which considerable livestock is kept usually make larger earnings than farms obtaining most of their income from the sale of crops.

Records kept on 51 Woodford county farms for five years show that each of the 17 farms that received the largest acre income from livestock earned $1,160 more each year than the 17 farms having the lowest income from this source (Table 4). Two-thirds of their gross receipts were from livestock. In the low earning group only about one-fourth of the gross receipts came from livestock. Reducing these figures to an acre basis, we find that the farms with the most

TABLE 4.—SUMMARY OF 51 ILLINOIS FARM RECORDS SHOWING RESULTS FOR CERTAIN EFFICIENCY FACTORS

(The farms are grouped according to their total livestock income per acre. The figures are averages for the five years 1921-1925.)

	17 *highest* farms as to livestock income	17 *medium* farms as to livestock income	17 *lowest* farms as to livestock income
Rate earned on investment	4.63%	3.26%	2.71%
Labor and management wage	$ 421	$−280	$−740
Size of farm, acres	222.6	191.5	229.3
Total investment per acre	$ 289	$ 273	$ 260
Livestock investment per acre	$ 13.78	$ 11.03	$ 5.29
Cattle	5.64	5.71	3.05
Hogs	7.34	4.48	1.54
Poultry	.80	.84	.70
Livestock income per acre	19.70	9.75	4.95
Corn yield, bushels	57.3	54.8	49.3
Percentage of land in higher profit crops	67.7	63.2	60.0
Man labor index	99	98	103
Power and machinery index	96	103	101
Expense per $100 gross income	$ 54	$ 61	$ 64
Gross receipts per acre	29.19	22.75	19.38
Total expense per acre	15.80	13.80	12.31
Net farm income per acre	13.39	8.95	7.07

livestock received $19.70 an acre from this source while the low earning group received only $4.95 an acre.

The net income of the high group from all sources was $13.39 an acre; of the low group, only $7.07 an acre. Of course not all the differences in the earnings of these two groups of farms can be attributed directly to differences in income from livestock. The high income group, for instance, made a yield of 8 bushels more corn than the low group and higher yields for other crops. Since, however, livestock usually has the effect of increasing farm earnings indirectly by making the soil more productive, this difference in yield may be attributed in a measure to the larger amount of livestock kept. Furthermore good livestock well handled will, over a number of years, give a larger return for crops fed than can be obtained by selling the crops on the market.

The 17 farms with the most livestock also had 7.7 percent more of the land in the higher profit crops, including alfalfa and sweet clover, which the livestock farmer has an opportunity to use as feed.

Regrouping these same farms according to their income from cattle, we find that the 17 farms getting the largest return per acre from

this source average $265 larger net incomes a year than the group receiving the smallest income from this source. Also, the 17 farms receiving the largest income per acre from hogs had a larger net income by $860 a year than the group receiving the smallest.

Since the farms in the different groups were approximately of the same size, these differences in income may be attributed largely to the raising of livestock. It is of interest to note, moreover, that such differences occurred in spite of the fact that Illinois farm prices during this five-year period from 1921 to 1925 were more favorable to the sale of grain than to the sale of livestock.

Some of the advantages that farms gain by continuing in livestock production are: (1) a larger return for feed crops than when they are sold on the market; (2) help in maintaining the fertility of the land; (3) a more profitable use of labor, power, and equipment during the winter; (4) reduction in the amount of labor and power required both in tilling land and in harvesting if some of the crops are fed off; (5) the profitable use of unsalable and low-grade feed; and (6) the spreading of overhead expenses over a larger volume of business.[1] Lack of experience with livestock, risk from disease, or lack of equipment may be handicaps to increased livestock production, as brought out in Part II of this bulletin.

Livestock Efficiently Handled Reduces Cost of Production

A special study of the cost of producing hogs was made on 35 to 45 Woodford and McLean county farms for the three-year period 1924 to 1926. The average cost of producing 100 pounds of pork on the five farms having the lowest cost each year for a three-year period was $6.88. On the five farms in the same community having the highest cost it was $13.14. This difference of $6.26 was due to differences in efficiency of production. On all of these farms hog production was one of the most important sources of income.

Wide variations in the ability of men to select and handle the same kind of livestock are revealed in this study. No excessive losses of hogs due to death occurred on any of the farms, but there were many factors over which a manager has a large measure of control that account for the differences in cost. The selection of the best feed and pasture crops and the best type of hog to breed, the adoption of practices that mean a large number of pigs raised per litter, the control of disease, selling the hogs at the best age and weight, economy in the use of labor, buildings, and other equipment, all have their influence in keeping the unit cost low.

Similar variations in the cost of producing other kinds of livestock and livestock products have been found in other studies. On 37 farms in north-central Illinois in 1926, for example, the cost of

[1]See Illinois Bulletin 261, "Cattle Feeding in Relation to Farm Management."

producing 100 pounds of milk varied from $1.56 to $3.18. Differences in farm practice and in the efficiency with which the livestock was handled account for a large part of such variations as this. In bulletins 261 and 301 of this Station the reader will find variations in the cost of feeding cattle and of producing hogs for market discussed at length.

Large Volume of Business Necessary for Best Return

A large volume of business is necessary for the most profitable farming. Volume may be obtained either by a better selection and proportioning of enterprises so as to increase the income per acre, or by having a farm of larger acreage. Of these two methods it is more important, in the main part of the corn belt, to increase the income per acre, for most farms in this area are already large enough to yield a good income if the organization of the farm is properly adjusted to its acreage.

Land is high-priced in east-central Illinois, and interest on the investment in the land and taxes are a heavy fixed expense regardless of income. The annual cost of buildings, machinery, and equipment, and of labor and power result in high acre expenses which cannot be reduced below a certain minimum in growing the crops that are commonly produced in this section.

A study of many farm accounts in this part of Illinois shows that expenses do not vary nearly so widely on the acre basis as do incomes. Among the 49 farms in Woodford county, following the same general type of farming, the 10 most profitable incurred an operating cost of $14.51 an acre and the 10 least profitable a cost of $14.80 an acre[1]—practically no difference. These figures cover the five-year period 1921 to 1925 and include all items except an interest charge for the use of land, buildings, and equipment (Fig. 5). The income from the two groups of farms was $31.71 and $16.94 an acre respectively. Thus while there was a difference of only 29 cents an acre in operating costs, there was a difference of $14.77 an acre in total income, or a difference in net income of $15.06 an acre.

The larger incomes from the 10 most profitable farms were secured mainly thru attention to the first four principles of management listed as necessary for profitable farming; namely, the securing of large crop yields, the growing of a large percentage of high-profit crops, the inclusion of livestock in the farm scheme, and the efficient handling of livestock. A study of crop costs shows that as the income per acre increases, as a result of higher yields, costs of operation do not increase in proportion; that is to say, they do not unless far more effort is made to secure larger yields than was done on the farms

[1]Money values are used as a measure of volume in this section because they provide the best basis for comparison where different products are involved and the data extend over several years.

studied. Neither do labor, power, and equipment costs increase greatly as yields increase; nor does the efficient handling of livestock require a much larger expense than indifferent care. To variations in receipts rather than to differences in expenses must be laid most

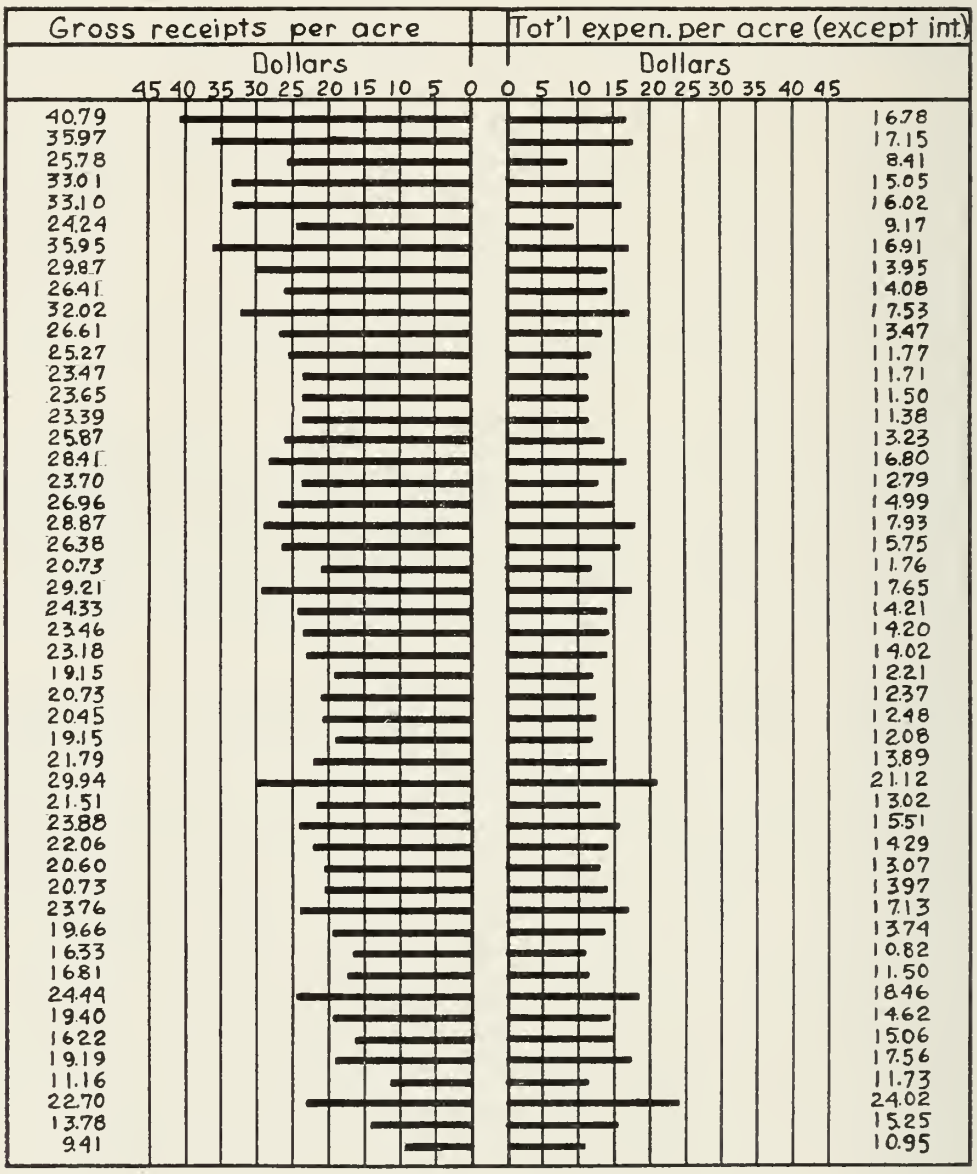


FIG. 5.—AVERAGE ANNUAL INCOME AND EXPENSE PER ACRE ON 49 WOODFORD COUNTY FARMS FOLLOWING THE SAME TYPE OF FARMING

The farms are arranged from top to bottom of the graph according to their net income per acre, those having the highest net income being placed at the top. The expenses per acre, it will be noted, are practically the same for any group near the top as for any group near the bottom. Thus the farms with the largest volume of business, as indicated by total gross income per acre, are in general the most profitable farms.

of the differences that occur in farm incomes. Frequently, of course, farms are found that are not financially successful because of high expenses, but low receipts are a more common defect.

In some instances securing a larger volume of business by increasing the size of the farm is desirable. The question of increasing the size above that of the average of the community depends more on the ability of the manager than upon any other factor. Some men will handle a farm of 400 acres as efficiently as others will handle one of 200 acres. It is necessary, however, to have a certain minimum acreage for the type of farming followed if the farm is to be operated economically. Whether it is wise to enlarge it beyond that point, either by renting land or buying, depends upon the ability of the operator as a manager.

Except near towns, where some form of specialized production may be found, there are few farms in east-central Illinois under 100 acres in size and most of them are over 150 acres. While larger farms are best adapted to some types of farming, it is possible in this part of Illinois to develop a profitable system on 150 acres or even less. This is due in part to the fact that natural conditions and good market outlets make it possible to grow many different products profitably.

Good System of Farming Helps Use Labor to Advantage

Most farms in east-central Illinois cling to the old two-crop system of corn and oats with little livestock. This plan makes a very uneven demand for man labor, and farmers are frequently put to the necessity of hiring extra labor for short periods. Furthermore these periods come when wages are high.

Since in Illinois most farm families supply a large part of the necessary farm labor and this labor is on the farm the year around, the plan of farming should be such as to use it to advantage. This can be done by carefully planning the kinds of crops and livestock to be grown and the relative amounts of each that can be advantageously handled. This point is well illustrated by studies which the Experiment Station has made of actual farms. In Fig. 6 is shown the labor distribution on a Champaign county farm. The crops consist of corn, wheat, oats, soybeans, and mixed hay. The livestock are cattle and hogs. This combination, it will be noted, gives an even demand for labor thruout the year if miscellaneous farm jobs are shifted to slack periods.

There usually are advantages in providing regular employment for hired labor. This can be done by working in with maximum-profit crops such other crops and livestock as will make the best use of the available labor when it is not busy on the maximum-profit crops and at the same time will add most to the farm income. Experience shows that desirable hired labor can be secured most easily if all-year employment is provided. This is another reason for following a crop and livestock program that will use labor to advantage thruout the year.

Power Should Fit Farm Needs and Be Efficiently Handled

The cost of power is one of the largest items of expense in operating farms, frequently amounting to 25 percent of all operating costs. A careful study of the power needs of a farm with a view to selecting

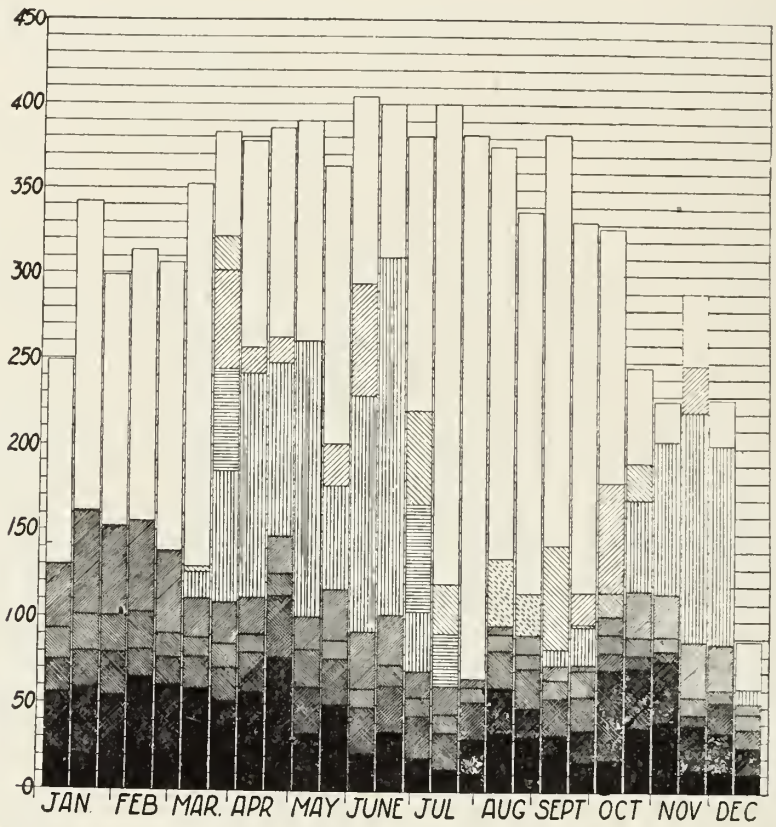


FIG. 6.—MONTHLY DISTRIBUTION OF MAN LABOR ON A 200-ACRE CHAMPAIGN COUNTY FARM

This graph shows an unusually even distribution of man labor thru the year, made possible by a well-balanced farm business. The shaded area indicates the hours of man labor spent directly in the production of crops and livestock. The upper ends of the bars, shown in white, indicate the hours of labor spent in the upkeep of the farm and in general work, much of which can be shifted from one part of the year to another.

the kind and amount that will best lend itself to the efficient operation of the farm becomes, therefore, a matter of large importance. The problem is to keep the cost as low as possible in proportion to income and at the same time provide adequate power at all seasons.

Variations in Cost of Horse Labor. During the past seven years the cost of horse labor on farms keeping cost records in Champaign and Piatt counties has averaged 15½ cents an hour. A three-horse team in the field 10 hours represents on the average farm a cost of about $4.50. Since a large part of the cost of horse labor is represented by feed grown on the farm, the cost of horse power is not

usually appreciated. Feeds, however, represent a real cost in terms of the value they would have had on the market had they not been fed, and this item must therefore be figured in the cost as truly as if a cash outlay had been required.

FIG. 7.—PLOWING UNDER A HEAVY GROWTH OF SWEET CLOVER WITH THE AID OF A TRACTOR

One of the big problems of Illinois farmers is to adjust their farm power supply to the needs of the farm. Farm power, including both horse and mechanical types, exacts one of the largest costs in operating a farm.

FIG. 8.—LARGER TEAMS ARE BEING USED GENERALLY IN ILLINOIS

One way of economizing on man labor is to make it possible for one man to do more field work and do it more thoroly thru the use of larger power units.

The cost of horse labor per hour varies widely on different farms. It is not unusual to find it practically three times as high on some farms as on others. On 15 farms in Champaign and Piatt counties

in 1926 it varied from 9.6 cents to 17 cents between farms (Table 5). The net cost of keeping a horse was $68.06 on one farm while on an adjoining farm it was $179.71. One farmer worked his horses an average of 583 hours a year while a neighbor was able to get 1,008 hours a year. It is evident that the wide differences that exist between farms in the cost of horse labor may be due either to wide variations in the cost of keeping the horses or to the fact that some farmers get a larger number of hours of work from their horses in a year's time than do others. The hours of labor that can be got from a horse are very largely dependent upon the system of farming which is followed and the number of horses kept. A system that provides for as even a distribution of horse labor as possible thruout the year will enable a farmer to get along with fewer horses

Tractor Costs. Similar differences in costs occur in the use of tractors. On cost-accounting farms in Champaign and Piatt counties in 1926 an hour of tractor labor varied in cost from 72 cents to $1.71 for tractors of the same size. Interest on the money invested in a tractor and depreciation, the two items which are incurred regardless of the number of hours a tractor is used, make up the biggest part of the cost of operation. The hour cost is therefore markedly influenced by the number of hours of work the tractor is made to perform. Another item that influences the hour cost of tractor labor is the ability of the operator to operate it efficiently.

Planning Power Distribution. While it is not always possible to plan a system of farming that calls for uniform power thruout the year and at the same time provides maximum returns from the farm as a whole, some farmers are working out a relatively uniform demand for horse power by using a tractor to take care of the peak of power demands. It is careful planning of this kind that helps keep production costs low.

The successful distribution of power on a farm in central Illinois is shown in Fig. 9. There were 11 two-week periods during the year when horses were used over 600 hours. In no two-week period, however, did the amount of horse labor exceed 800 hours. In April there was a total power demand equivalent to more than 1,200 hours of horse labor (counting 1 hour of tractor use as equivalent to 5 hours of horse labor). If horses had been depended on to meet this maximum demand for power, and the work had been performed at the same time, one-half again as many horses would have had to be kept than were kept on this particular farm. Of course if a tractor had not been available, this work could have been spread over a longer period in most years without adversely affecting yields, but it still would have required the keeping of more horses.

On some farms the mistake has been made of introducing a tractor without reducing the number of horses kept, and this has been responsible for greatly increased power costs.

TABLE 5.—AVERAGE NET COST OF KEEPING A HORSE ON 15 FARMS IN CHAMPAIGN AND PIATT COUNTIES, 1926; NUMBER OF HOURS WORKED PER HORSE AND COST PER HOUR OF WORK DONE

Farm No.	1	2	3	4	5	6	7	8	9
Cost items per work horse									
Feed	$ 51.76	$ 65.35	$ 79.81	$ 70.73	$ 61.56	$ 75.10	$ 70.07	$ 57.32	$ 57.38
Man labor	7.71	9.53	17.78	13.71	8.64	25.35	11.61	12.29	13.19
Horse labor	2.43	.80	.25	.20	....	....	.11	.03	....
Interest on investment at 5 percent	5.41	3.88	5.18	6.58	4.36	4.21	6.99	6.16	4.50
Depreciation	3.27	5.78	6.73	....	....	9.47	....	5.19	11.00
Shelter	4.05	3.88	3.81	9.44	1.35	5.00	11.27	5.22	5.81
Harness	.44	4.47	4.26	8.18	4.50	2.02	3.47	5.96	3.79
Miscellaneous	....	.40	1.94	7.07	2.58	1.74	3.38	.43	3.90
Total cost for year	$ 75.07	$ 94.09	$119.76	$115.91	$ 82.99	$122.89	$106.90	$ 92.60	$ 99.57
Appreciation	....	....	....	21.35	3.03	....	9.26	....	....
Manure credit	7.01	2.41	2.87	5.98	3.33	9.83	10.91	3.99	5.60
Net cost for year	$ 68.06	$ 91.68	$116.89	$ 88.58	$ 76.63	$113.06	$ 86.73	$ 88.61	$ 93.97
Feed per work horse, pounds									
Corn	1 733	1 136	1 878	1 951	1 541	2 760	1 900	1 690	1 396
Oats	89	1 059	1 350	249	1 170	1 081	915	1 351	962
Other concentrates	14	....	....	....	2	33	....	....	....
Total concentrates	1 836	2 195	3 228	2 200	2 713	3 874	2 815	3 041	2 358
Hay	1 216	640	533	....	263	....	....	1 417	400
Other roughage	1 689	2 167	3 702	4 223	2 956	3 466	4 468	342	3 330
Number of pasture days	204	187	165	162	236	170	184	173	182
Labor									
Man hours	28.4	35.7	66.7	51.2	31.3	90.5	41.7	47.5	47.4
Horse hours	....	7.3	2.18	1.8	....	....	.9	.28	....
Number of work horses	7.4	9	5.5	4.5	9.58	7.6	5.4	14.25	5
Hours of work per horse for year	703	830	1 034	773	644	944	720	731	701
Net cost per hour, cents	9.6	11.0	11.3	11.4	11.9	11.9	12.0	12.0	13.4

TABLE 5.—*Concluded*

Farm No.	10	11	12	13	14	15	Average
Cost items per work horse							
Feed	$ 62.32	$ 86.40	$ 50.76	$ 82.02	$126.97	$ 72.33	$ 71.23
Man labor	13.53	26.33	15.26	21.79	31.20	15.90	15.91
Horse labor	....	.43	....	.10	.94	....	.20
Interest on investment at 5 percent	3.55	5.24	5.84	7.13	8.78	5.62	5.31
Depreciation	10.71	9.78	13.33	13.68	3.33	12.00	6.76
Shelter	2.91	9.57	3.22	16.21	7.23	2.13	5.36
Harness	2.95	7.21	6.35	4.94	6.09	3.21	4.68
Miscellaneous	.29	4.15	.56	1.30	.37	.47	1.51
Total cost for year	$ 96.26	$149.11	$ 95.32	$147.17	$184.91	$111.66	$110.96
Appreciation	....	....	....	....	....	....	1.56
Manure credit	3.20	4.53	3.10	5.38	5.20	5.21	4.96
Net cost for year	$ 93.06	$144.58	$ 92.22	$141.79	$179.71	$106.45	$104.44
Feed per work horse, pounds							
Corn	1 044	2 434	1 087	1 441	4 027	1 495	1 853
Oats	1 780	1 050	965	958	2 810	1 493	1 189
Other concentrates	....	....	....	....	....	....	3
Total concentrates	2 824	3 484	2 052	2 399	6 837	2 988	3 045
Hay	900	2 681	500	2 777	2 552	585	998
Other roughage	3 297	1 963	3 453	2 737	1 500	5 153	2 711
Number of pasture days	137	184	182	222	189	209	184
Labor							
Man hours	47.6	95.6	52.7	68.6	105.8	56.2	56.76
Horse hours	....	2.8	....	.6	5.8	....	1.52
Number of work horses	11.66	4.6	6.0	4.75	10.5	6.66	7.49
Hours of work per work horse for year	671	935	583	889	1 108	624	789
Net cost per hour, cents	13.9	15.3	15.8	15.9	16.2	17.0	13.2

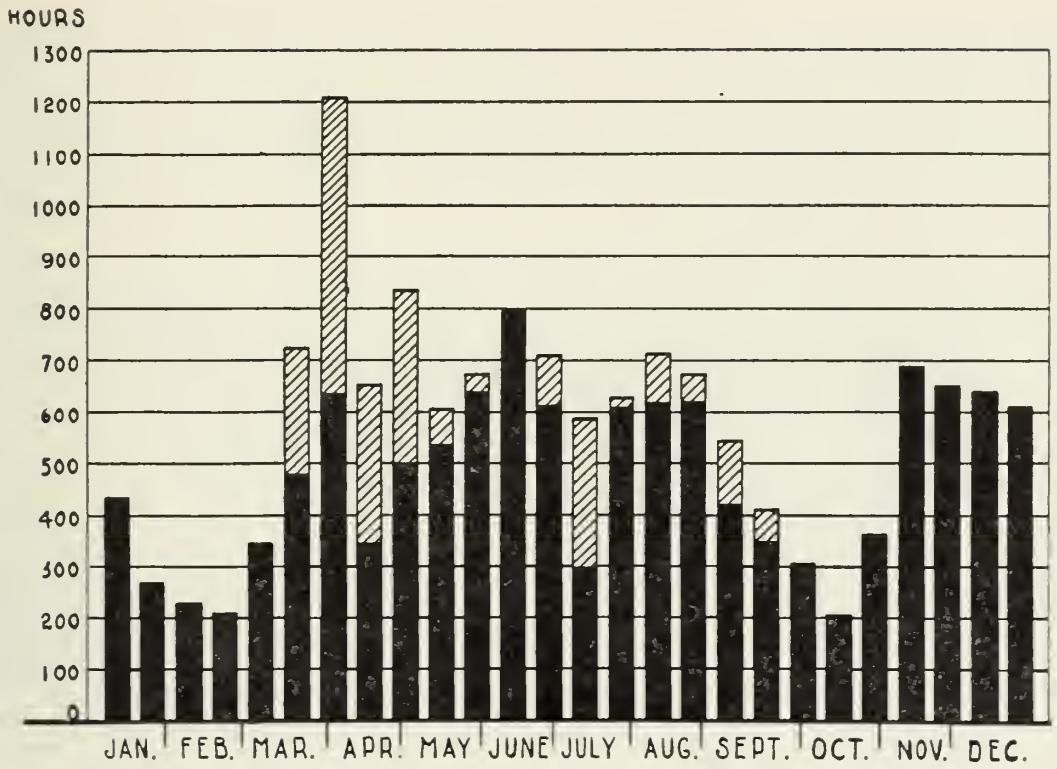


FIG. 9.—DISTRIBUTION OF POWER BY TWO-WEEK PERIODS ON A CENTRAL ILLINOIS FARM

This figure shows the way in which horse and mechanical power were combined on this farm giving an unusually even distribution of horse power thruout the year, while the tractor power was used mainly during the periods of heavy power demands.

Equipment Costs Must Be Kept Under Control

Failure to control equipment costs is holding down the profits on many farms. Every piece of new equipment that is contemplated raises the question whether the saving it will bring in labor, power, or other costs, or other advantages it offers, will pay for the cost. It is not enough that a new piece of equipment will reduce total labor or total power cost; its justification must be based on the fact that it will add to the total farm earnings. This problem is becoming more acute with the advance in prices of materials and labor going into the construction of such equipment and with increases in the amount of equipment called for by changes in production practices.

How operators vary in their ability to keep equipment costs down is shown by studies of the 15 Champaign and Piatt county farms already referred to. The annual cost of buildings, fences, machinery, and tools on these farms in 1926 range from $1.35 to $7.27 an acre (Table 6 and Fig. 10). These costs include labor and material for current repairs, depreciation, and interest on the investment. The residence of the operator and the cost of tractors and autos were not

included in these costs, in order that the farms might be more strictly comparable.

Thus some of these farms had nearly $6 an acre greater expense for buildings, fences, farm machinery, and tools than other farms,

FIG. 10.—AN ECONOMICAL STORAGE OF CORN NEEDED FOR FEEDING

This crib was erected at a cost of 10 cents a bushel of corn stored in the field where it was fed in connection with a good system of livestock sanitation. This saved the labor of hauling the feed. The crib can be moved easily to a new site each year.

TABLE 6.—SIZE OF FARMS AND ANNUAL EXPENSE FOR BUILDINGS, FENCES, MACHINERY, AND TOOLS, 15 FARMS IN CHAMPAIGN AND PIATT COUNTIES, 1926[1]

(Figures indicate expense per acre of total farm area)

Farm No.	Size of farm	Buildings	Fence	Crop machinery and tools	Total
1.....	153.5	$4.83[1]	$ .33	$2.11[1]	$7.27
2.....	149.1	4.31	.42	1.96	6.69
3.....	201.0	2.27	.95	1.30	4.52
4.....	242.1	2.60	.34	.99	3.93
5.....	157.9	1.91	.33	1.33	3.57
6.....	159.3	1.84	.57	1.16	3.57
7.....	157.9	1.71	.44	1.04	3.19
8.....	378.0	1.57	.54	1.00	3.11
9.....	198.5	1.21	.41	1.27	2.89
10.....	209.0	1.05	.73	.95	2.73
11.....	312.5	1.23	.30	.91	2.44
12.....	581.8	1.19	.43	.81	2.43
13.....	303.7	.82	.36	1.15	2.33
14.....	245.5	.74	.18	.84	1.76
15.....	444.0	.46	.18	.71	1.35
Average....	259.6	1.57	.42	1.06	3.05

[1]In determining these expenses, the residence of the operator and all autos, trucks, and tractors were omitted in order that the items of expense might be comparable for all farms.

even tho the equipment was fairly adequate on all but two or three farms. With corn valued at 60 cents a bushel about 10 bushels more of corn to the acre and a correspondingly larger income from other land would be required to meet this extra expense found on the high-cost farms.

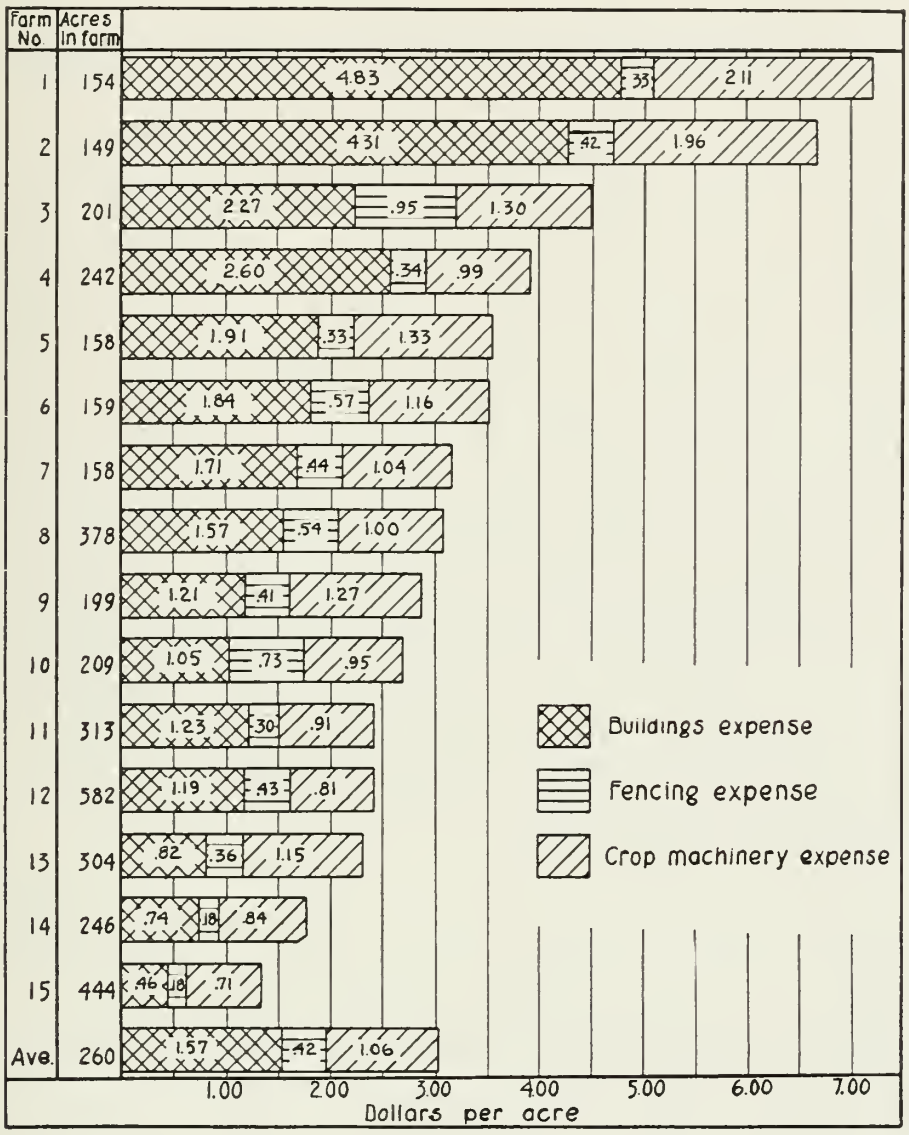


FIG. 11.—ANNUAL COST OF BUILDINGS, FENCING, AND CROP MACHINERY ON EACH OF 15 CHAMPAIGN AND PIATT COUNTY FARMS, 1926

The costs for the above returns on these farms ranged from $2.07 to $8.92 an acre. All farms followed similar types of farming, and with the exception of one or two they had adequate equipment.

The two farms with the highest costs for improvements and machinery were below average size. Some other farms of like size had less than half the expense per acre for these same items. The widest variation in these costs, as shown in Fig. 11, was for farm buildings.

Well-Arranged Fields and Farmsteads Save Time

Large fields readily accessible from buildings and lots are the means of saving much time in field work and in getting teams, machinery, crops, and manure to and from the fields and farmstead. Fields of rectangular shape which are considerably longer than wide require relatively little turning and save much time in doing field

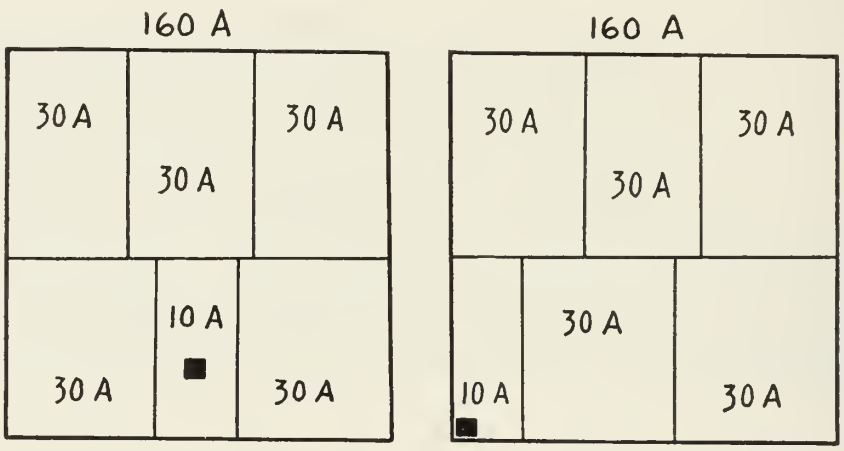


FIG. 12.—TWO PLANS FOR LOCATING THE FARMSTEAD ON A 160-ACRE CORN-BELT FARM

When the farmstead, on an all-tillable farm of this size, is placed midway on one side of the farm instead of in one corner, there is a saving in a year of about ten days in making trips to and from the fields. This estimate of time saved is based on the fact that about 1,200 of these trips are made in a year, and that a saving of about 60 rods to a trip is made possible with the more central location.

work. Even tho the amount of time saved each day from working large rectangular fields instead of many small fields may be small, in the course of a year it is likely to loom large.

On a 160-acre farm where livestock is handled there are approximately 1,200 trips to and from the fields in a year.[1] A large share of these trips are made to haul heavy loads of bulky crops. Some must be made during threshing, silo filling, and haying, when time is very limited and when one cannot afford to waste it. The thought and effort necessary to bring about a good field arrangement will be more than repaid in time saved (Fig. 12).

A good arrangement of buildings and lots will, in much the same way, save no small amount of time in doing chores. Records of typical central Illinois farms show that usually from 50 to 60 percent of the man labor used during the year is spent on work about the farmstead. On many farms this means that labor worth over $1,000 a year is used about the buildings. That many men devote twice

[1]These trips include only the labor required in growing and harvesting crops and hauling manure; they do not include trips caring for livestock.

the time others do to handling like amounts of livestock is also shown by records kept on these farms. Much of this difference in labor is due to the arrangement of buildings and lots.

A good arrangement of fields and buildings is not a thing that can be accomplished in a short time. If, however, new or rebuilt fences or buildings are placed in accordance with a carefully worked-out plan, it is possible in a few years to realize the entire plan with little or no extra cost or effort. The trouble on most farms is that each improvement is made as needed without regard to future plans.

Diversity of Production Helps Insure Long-Time Profits

The advantages in diversity of production apply chiefly to crops. Among these advantages, part of which have been previously discussed as requirements of a good rotation, are the following: (1) The maintenance or improvement of the soil is better provided for, especially if legume crops are included in the rotation. (2) It is possible to provide for better distribution and use of labor, power, and equipment thruout the year. (3) Since climatic conditions are apt to be less favorable for some crops than for others in any year, diversification provides some insurance against complete crop failure. (4) Plant diseases and insects are better controlled. (5) More of the feeds needed in livestock production are provided for. (6) There is a succession of deep- and shallow-rooted plants. (7) It is easier to control weeds.

As markets and transportation facilities develop, the trend in farming is toward somewhat greater specialization in products that are sold. This does not mean, however, that a farmer cannot plan to advantage for diversification among the crops he raises. He may have a cropping system that provides all the advantages given above for diversification and still specialize in the products sold from the farm. A dairyman, for example, may sell little but whole milk, but he can nevertheless have a well diversified cropping system.

It is evident, however, that unless a farmer is highly successful in the production of some one product for the market, it is better that the farm plan provide for diversity of income as well as diversity of production. Certainly a farm with several sources of income is subject to less risk from changing market demands and from influences beyond the control of the farmer that depress production than is a highly specialized farm.

So far as east-central Illinois is concerned, it can be said that few farming sections are so well favored in being naturally adapted to the production of many different products. Favorable conditions of soil, topography, labor, transportation, markets, credit, and climate, as well as others that determine the most profitable kinds of farming for a region, exist here for many products.

Production Should Be Planned to Meet Market Demands

Within the past ten years the prices of corn and hogs have varied so greatly that the value of 100 pounds of pork expressed in bushels of corn has ranged from about 7 bushels to over 21 bushels (Fig. 13). Cost-of-production data show that on an average it costs farmers the price of 11 to 12 bushels of corn to produce 100 pounds of pork.

FIG. 13.—THE CORN-HOG RATIO FROM 1913 TO 1927 BASED ON ILLINOIS FARM PRICES

The amount of corn necessary to equal the price of 100 pounds of hogs has varied from less than 7 bushels to more than 21 bushels.

With this wide variation in market demand from time to time, it is apparent that the average hog producer might gain considerably by selling his corn in the form of hogs when hogs are high-priced in comparison with corn and by selling corn directly when hogs are low-priced in comparison. It is not possible, of course, to anticipate just when all of these changes will come, but the most successful farmers are able to anticipate some such changes and to profit thereby. This requires a high degree of skill.[1]

[1]For further discussion of this subject, see Bulletin 293 of this Station, "Adjusting Hog Production to Market Demand," and Bulletin 301, "The Place of Hog Production in Corn Belt Farming."

In making such comparisons as illustrated by corn and hogs which are two of the leading products sold in east-central Illinois, it is apparent that there is opportunity for farmers to adjust their production to meet market demands. A more complete analysis of the advantage of adjusting production to meet market demands for both crops and livestock is discussed in Part II, pages 315 to 319.

The Importance of These Principles

A brief survey of the present farm practices in east-central Illinois and the conditions leading to them will help the reader to understand the importance of the foregoing principles of farm management. East-central Illinois has long been known as a grain-producing and

TABLE 7.—USE OF LAND IN HENSLEY TOWNSHIP, CHAMPAIGN COUNTY, ILLINOIS, 1925

	Acres	Percent
Total acreage	21 113.0	100.0
Crop acres	18 436.5	87.3
Non-crop acres	2 676.5	12.7
Crop acres	18 436.5	100.0
Corn	9 386.5	50.9
Oats	5 787.5	31.4
Winter wheat	1 303.0	7.1
Clover	755.0	4.1
Soybeans	651.0	3.5
Timothy	232.0	1.3
Clover and timothy mixed	216.0	1.1
Alfalfa	70.5	.4
Other crops	35.0	.2

a grain-selling region, and a large proportion of the tilled land has grown corn or oats each year for many years. The Census of 1880 shows more than half the crop land devoted to corn and over one-third to oats, and conditions have not changed to any marked extent since then. Corn, oats, and wheat are still grown on about 90 percent of the land devoted to crop production. In 1925 in Hensley township, Champaign county, 82 percent of the crop land grew corn and oats (Table 7).

Further evidence of the extent of grain farming in east-central Illinois is furnished by records of farmers in Gridley township, McLean county. One hundred thirteen farmers, including practically every farm in the township, have submitted to the University business records of their farms. These farms averaged 189 acres, of which 87 were grown to corn, 65 to oats, and 2½ to wheat; a total of 154.4 acres being devoted to these three grain crops. With some permanent pasture and approximately 10 acres of each farm taken up by buildings, barnlots, and roads, a very small amount of land is left for the production of other crops.

The gross income on these McLean county farms averaged $3,216 per farm. Of this, 72 percent, or $2,318, came from grain and feed crops, and only 27 percent, or $870, from livestock. These farms, however, are typical of east-central Illinois which, as stated above, is essentially a grain-producing and a grain-selling area. In some parts of the state 80 percent or more of the income is from livestock and livestock products.

The extent to which the crops produced in east-central Illinois are sold directly on the market is illustrated by the records of eight typical farms in Champaign and Piatt counties (Table 8). As an

TABLE 8.—DISPOSITION OF CROPS ON EIGHT FARMS IN CHAMPAIGN AND PIATT COUNTIES, ILLINOIS, 1921-1925

	Total	Sold	Seed	Fed
	bu.	*perct.*	*perct.*	*perct.*
Corn	204 687[1]	71.5[1]	.3[1]	26.5[1]
Oats	88 171	68.7	7.4	21.4
Wheat	25 836	92.9	4.4	1.7
Soybeans	3 829	84.6	3.7	6.7
	tons	*tons*	*tons*	*tons*
Soybean hay	128	....	....	76.1
Timothy	164	2.2	....	97.4
Mixed hay	63	23.4	....	74.1
Clover	496	19.6	....	73.0
Alfalfa	11	....	....	79.0
Straw	1 885	3.1	....	28.1

[1]Failure of the total crop production to balance with sales, seed, and feed is due to the fact that part of the produce remained on the farm at the end of the four-year period and that some feeds were purchased in addition to those grown.

average of five years, 71.5 percent of the corn, 68.7 percent of the oats, and 92.9 percent of the wheat was sold directly from the farm. In the case of soybeans, the other important grain crop, 84.6 percent of the production was marketed. Over three-fourths of the hay crops were fed on the farms where they were produced.

The practice in this area of putting such a large proportion of land in corn and oats and of selling the crops has been due to two circumstances—the soil has been rich enough to withstand heavy cropping for a long period without great reduction in yields and this section of Illinois lies close to large grain markets. On the best of the east-central Illinois land, where corn and oats have been largely grown and sold from the farm, productivity has been greatly reduced. Declining yields under such conditions are shown on the Morrow plots at the University of Illinois. On land that has grown corn continuously since 1887, with no soil treatment, the yield has averaged 25.1 bushels to the acre as an average of the period 1904

to 1926. On an adjoining plot that has grown corn and oats continuously in rotation, a yield of 35.6 bushels of corn and 34 bushels of oats has been secured. On the plots growing corn, oats, and red clover in rotation, the results have been quite different—50 bushels of corn to the acre, 45.1 bushels of oats, and 1.4 tons of red clover.[1] It is

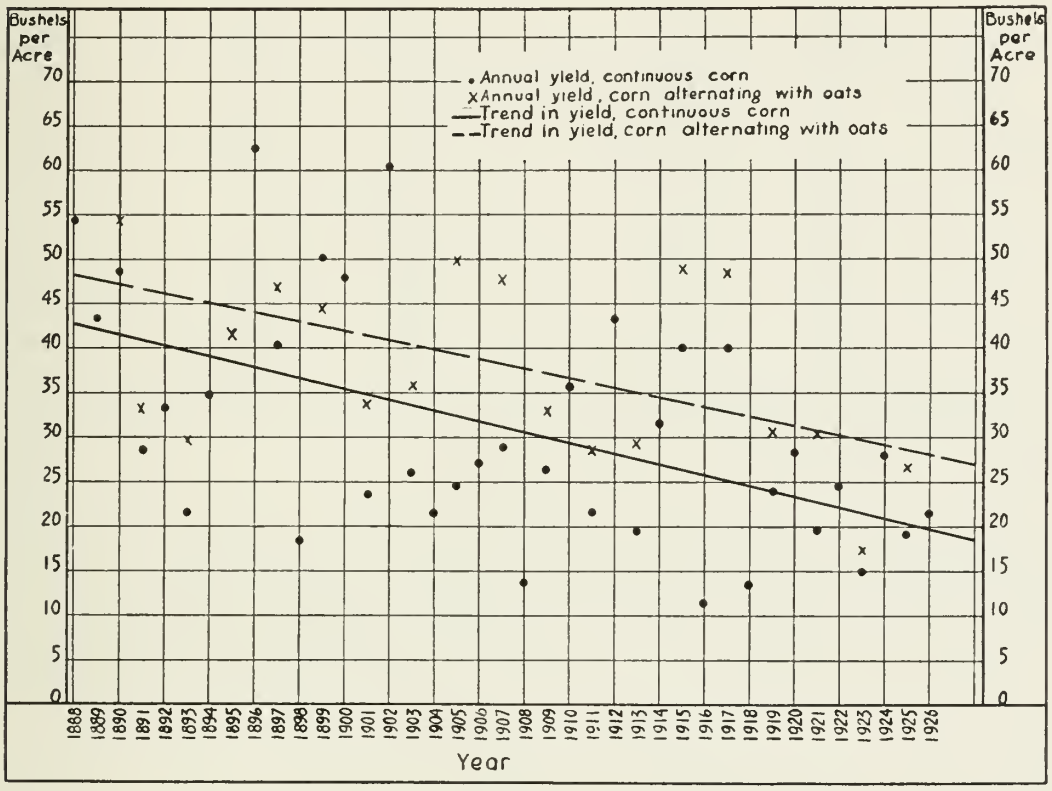


FIG. 14.—DECLINE IN YIELD OF CORN ON CERTAIN OF THE MORROW PLOTS, UNIVERSITY OF ILLINOIS

On one of the Morrow plots corn has been grown continuously since 1888. On another plot corn has been alternated with oats. The trend lines show the steadiness with which yields on both plots have gone down.

evident that land growing only grain crops will gradually become less productive (Fig. 14).

Additional evidence of lowering productivity on farms in east-central Illinois is furnished by the bureau of Crop Estimates of the U. S. Department of Agriculture. Accepting the estimates of farmers for average yields of corn in Champaign, Piatt, Macon, and DeWitt counties each year from 1896 to 1925, a decline from 42.4 bushels for the first five years of the period to 38.5 bushels for the last five years is to be noted (Table 9). This decline has occurred in spite of the fact that marked improvement has been made in farm practice. Better yielding varieties of corn, improved machinery for the preparation of the soil and the cultivation of the crop, and

[1]For further information on these points, see Bulletin 300 of this Station, "Lessons from the Morrow Plots."

TABLE 9.—AVERAGE YIELD OF CORN BY YEARS AND BY FIVE-YEAR PERIODS IN CHAMPAIGN, DEWITT, FORD, AND PIATT COUNTIES, ILLINOIS[1]

Year	Yield per acre	Year	Yield per acre	Year	Yield per acre
	bu.		*bu.*		*bu.*
1896	48.0	1906	39.5	1916	31.6
1897	43.8	1907	37.0	1917	45.4
1898	31.5	1908	33.3	1918	41.9
1899	42.3	1909	40.5	1919	37.5
1900	46.5	1910	46.5	1920	34.7
Average	42.4	Average	39.4	Average	38.2
1901	25.3	1911	38.1	1921	33.0
1902	45.5	1912	42.6	1922	37.9
1903	39.8	1913	28.4	1923	42.0
1904	38.3	1914	36.7	1924	38.4
1905	46.3	1915	47.0	1925	41.2
Average	39.0	Average	38.5	Average	38.5

[1]Crop-estimate figures secured by the Bureau of Agricultural Economics, U. S. Department of Agriculture.

better methods of testing and handling seed corn have doubtless retarded the rate of decline but they have not prevented it.

The need of more carefully worked out plans of farming which have regard for long-time results is clearly indicated by the foregoing facts.[1]

[1]There are certain conditions peculiar to agriculture that should be recognized before attempting to make definite plans for the operation of any farm. While many other businesses are affected by rainfall, temperature and other natural factors, farming is peculiarly dependent upon such conditions. Other businesses also have the difficulty of using labor, power, and equipment to advantage thruout the year, but in very few other industries do the seasons and other climatic conditions govern labor utilization so rigidly as they do in agriculture. In order to use labor to full capacity, employment other than that needed in the fields must be found. A variety of farm enterprises must be associated together to distribute labor. Most labor is not equally efficient in handling all farm enterprises.

This variety of enterprises and diversity of effort is an insurance also against changing weather and market conditions. Weather unfavorable to one crop will often be best for another. Adverse weather will, during some years, result in crops of poor quality that had best be fed on the farm. Changing market prices will likewise make it advisable to feed more livestock at some times than at others. The maintenance of the soil requires a variety of crop production; also every farm produces large quantities of roughages as by-products in the production of grain, which together with the clovers, that should be used in maintain soil fertility, make it necessary to include livestock in the farm plan in order to make the best use of all crops.

With meat-producing livestock there is little opportunity of holding finished animals for a period of time in order to take advantage of market movements; since finished animals must be marketed irrespective of the current market conditions. Thus while farming has some characteristics in common with other lines of industry, there are some conditions quite peculiar to agriculture that influence the organization and operation of farms.

PART II. PLANNING A PROFITABLE SYSTEM OF FARMING

Successful farming requires the fitting together of different kinds of crops and livestock in the proportions that will make a good net income. Each enterprise should add to the net returns from the farm as a whole either by increasing the income or by reducing the costs.

Most farms have strong points as well as points of weakness. It is the weak points that need first attention, for farm profits can usually be increased more effectively by correcting weaknesses than by putting additional emphasis on the strong points. Too frequently the tendency is for a man to devote time and effort to developing further those parts of the business that are already efficiently developed, when the same time and effort devoted to the less profitable enterprises would bring better returns. The result is that losses in one part of the farm business overshadow the success in the efficient enterprise. To overcome such a mistake a definite plan for the organization and operation of the farm should be prepared which will take into account the various principles discussed in Part I of this bulletin. The most successful farmers are those who have a well-balanced plan of production and are doing fairly well in every phase of their business, rather than those who are especially successful at one point while neglecting others.

Value of Farm Accounting

The first step in developing a good farm plan is to keep an adequate system of records to use as a basis for analyzing the business. Farm accounting experience in Illinois over the past fifteen years shows that a man who has not had much experience in keeping records had best begin with a rather simple system. Such a system should include an inventory of the farm business both at the beginning and end of the year, a record of all farm receipts and expenses, and a record of the production of crops and livestock. Additional records may be added as their need is recognized, but until a farmer has made full use of the type of record suggested above, there will be little reason for him to go into greater detail.

The "Illinois Farm Account Book," developed out of the experience of many hundreds of farmers thruout Illinois is available to any farmer in Illinois who desires it. A farmer who uses this book has the distinct advantage of being able to compare his results with many hundreds of other farmers over the state thru a system of analytical reports prepared from these accounts by the Department of Farm Organization and Management of the University of Illinois. Also, the better farms of the community may be used as a standard with which a man can compare his own operations and correct defects in his organization or planning, for while the more profitable farms frequently do not follow the same type of production they almost

always will be found to be practicing most of the principles of good farm management set forth in Part I of this bulletin. While no one farm may be expected to excel at every point, different farms will serve as standards with reference to some particular enterprise or part of their business.

The "Illinois Farm Account Book" provides also for keeping a record of feeds fed to different classes of livestock and of the farm-grown produce used in the home. Farmers who are raising considerable livestock may profit from keeping a record of the feed that goes to each class of livestock. This applies generally thruout east-central Illinois. A man who specializes in some one product, for example, may wish to develop his record keeping still further by keeping a cost-of-production record on that product. When a man reaches this point, however, the need of additional records on the farm business may be so varied, depending upon the type of farming followed and the information desired that it is difficult to make definite recommendations without knowing the particular problem on the farm. The system of accounts referred to, however, seems to offer the best simple basis on which to develop a system of accounting for practical purposes.

The following discussion attempts to show how a man who has kept a record of his farm business may proceed to make the principles of farm management apply to his farm.

Maintaining and Improving the Soil

The reduced productivity of the soil of most farms in Illinois calls for a better system of soil management than has been practiced in the past. In fact, a definite plan for handling the soil is basic to developing a good system of farming.

There are two sources of information that will be of especial help to Illinois farmers in deciding upon the best soil treatments for their farms: one is the recorded yields of the experiment fields maintained by the Agricultural Experiment Station of the University of Illinois on different types of soil thruout the state; and the other is the information obtained thru the Illinois Soil Survey. The yields from the experiment fields under different systems of treatment offer standards with which farmers may compare their own yields; and the facts determined by the detailed Soil Survey and discussed in a series of County Soil Reports make it possible for every Illinois farmer to know the essential characteristics of the soil of his farm. For practically every county in the state colored soil maps based on the detailed Soil Survey and showing the types of soil on every farm in the county are now available. In these County Soil Reports recommendations for treatment of different soil types are given, and the fact that many farmers, when following the recommended practices,

have obtained yields approaching those on the soil experiment fields, indicates that the standards set up are within the scope of practical farming.

The best suggestion to Illinois farmers, therefore, in working out a careful plan for the maintenance or improvement of their soil, is to make use of the sources of information described above.[1] The next step is to test the soil for acidity so that its need for limestone may be determined. This has become a common practice in most parts of the state thru the work of the farm advisers. It is a necessary part of the procedure for each individual farm since soil acidity may vary greatly even from one part of a field to another.

Aside from the individual study needed for each farm, three or four general facts concerning the needs of east-central Illinois farms may be suggested. Because of continuous grain farming thru this section, most soils are especially deficient in organic matter. This deficiency can be overcome by growing legumes and returning them to the soil either directly or in the form of farm manure, but in order to grow legumes limestone must be applied to much of this land, for the soil has grown sour under long-continued cropping. In any long-time plan for the development of most corn-belt soils consideration should be given to bringing as much as possible of the land now in pasture into the rotation scheme. While some farms have land that it is recognized must be kept in pasture, there are many others that have fields continuously in pasture that would be much more profitable if included in the rotation.

Including the Higher Profit Crops in Rotations

Certain crops have proved distinctly more profitable over long periods of time than have other crops grown in the same region (Tables 2 and 3). The second step in planning a good system of farming is therefore to select a rotation that includes a large proportion of these higher profit crops. Of course only a portion of the farm can be devoted to such crops, since considerations of soil fertility, the economical use of man labor and of farm power and equipment, the production of feeds for livestock, and the control of diseases and insects make it necessary to grow a variety of crops.

Rotations that appear to be giving the best results in all sections of the country, as pointed out in Part I of this bulletin, usually have three characteristics: they include a cultivated crop, which is needed to provide for the killing of weeds and for the maintenance of tilth; they include one small grain crop in order to provide for the seeding of grass or legume crops; and they include a grass or legume

[1]For further information on this subject, see Circular 302 of this Station, "What the Illinois Farmer Can Do to Learn About His Soils."

crop to rest or improve the soil. Since a rotation may vary in length from three to several years, emphasis may be placed on any one of these three kinds of crops. On rolling land a grass or legume crop is apt to be grown for two or three years. This is typical of New England, where land is left in a hay or pasture crop much of the time and usually only one year of small grain and one year of cultivated crop are grown in the rotation. In the northwestern wheat belt two or three years of the rotation are given to small-grain crops and generally only a year each to legumes and a cultivated crop.

In east-central Illinois *corn* is the highest profit grain crop, and it is practically the only cultivated crop grown extensively (Table 2). In planning the rotation for this section, provision should therefore be made for as large a proportion of land in this crop as can be handled economically.

At least one small-grain crop is necessary to provide for seeding the land to a legume crop. *Wheat* is the high-profit crop for this purpose, according to cost records obtained in east-central Illinois.

While it is possible to follow corn with an annual legume such as soybeans, a deeper rooting legume than soybeans is desirable some time in the rotation in order to maintain tilth and add organic matter more rapidly. *Sweet clover* as a pasture crop and *alfalfa* as a hay crop are the two common legumes that have the deepest root systems and they are usually also the highest profit legume crops.

In east-central Illinois a legume should be grown at least one year in four or five as a means of maintaining nitrogen and organic matter in the soil. While cost-of-production studies show that alfalfa is the most profitable of the hay crops, it does not fit in well if grown but a single year in the rotation, for it is a perennial and the seed is relatively expensive. A more satisfactory practice is to grow sweet clover in the rotation as a pasture crop, plowing it under as a means of improving the soil, and then growing alfalfa for hay on a field that is not included in the main rotation. Red clover, while not having the deep rooting qualities of alfalfa and sweet clover, adds materially to the improvement of the soil if it is kept on the farm as feed for livestock or is plowed under and it fits well into the rotation. This legume may be considered an intermediate-profit crop.

The above discussion leads to the conclusion that a rotation in this area made up largely of *corn, wheat, sweet clover,* and *alfalfa* is desirable from the standpoint both of profit and of good general farming. In some areas canning crops and soybeans sold for seed may bring a return that would place them among the higher profit crops. Also, as varieties of soybeans are improved, better cultural practices and methods of harvesting worked out, and better prices obtained, this crop may prove more profitable, as suggested on page 267.

Proportion of Higher Profit Crops to Include. Some difficulties in planning a rotation to include only the higher profit crops will be

experienced, for it is almost impossible to follow corn with wheat unless the corn is removed for silage or cut and shocked in time to permit sowing the wheat crop. Also, it is practically impossible over a long period to depend on seeding wheat in the standing corn. From the standpoint of the practical means of following one crop with another, it is almost necessary for some crop to be grown between corn and wheat. Oats, barley, and soybeans are probably the best crops adapted to this purpose.

In east-central Illinois at present less than 60 percent of the land is grown to the higher profit crops, when corn, wheat, alfalfa and sweet clover are so considered. Corn makes up a large proportion of this total. From the standpoint of economical production of crops and the maintenance of the soil, certainly not more than 50 percent of the land can be profitably grown to corn over a long period. As the proportion of the land in corn goes above 50 percent the cost of production increases rapidly, owing to the high seasonal and short-time use of labor, power, and equipment. Furthermore, from a soil fertility standpoint not over 50 percent of the land should be grown to any one crop even when careful attention is given to the treatment of the soils. This is a principle which may well be kept in mind in planning a rotation in this area.

A combination of corn, wheat, sweet clover, and alfalfa, however, may easily make up 70 to 85 percent of the crops grown on many farms even tho it is necessary to use oats, barley, or soybeans after corn and before wheat. The livestock producer can readily plan his feeding operations so as to use up to 20 percent of his land in oats, barley, and soybeans. As feed, these crops can be included in profitable systems of farming.

On some farms because of soil conditions it may be necessary to put less of the land in the higher profit crops than would otherwise be desirable. The proportion of a farm that is untillable, the need of drainage, and other soil conditions will directly influence the selection of a crop rotation.

Labor and power requirements of different crops and the way in which different crops fit in with the system of livestock production are also to be considered. Winterkilling of wheat and legume crops will sometimes interrupt the cropping plan. When one crop fails, another should be substituted that will interfere with the regular rotation as little as possible.

Future Crop Plans. Cost of production and market demand seem to have determined quite definitely the relative profitableness of the different crops that are commonly grown at the present time. Changes in these relations, however, may occur in the future as the result of changes in production costs, the introduction of new crops, or the development of serious plant diseases or insect ravages, and if they

do, crop plans will need to be adjusted accordingly. While the type of agriculture in a region shows little change over a period of years, certain changes in farm practice may take place even during a brief period. Alfalfa, sweet clover, and soybeans, for example, have been introduced into the systems of farming in east-central Illinois within the past fifteen years. Only an occasional farm was growing these crops prior to that time. It hardly seems probable that a like number of new crops will be introduced to the same extent in the immediate future, but experience suggests that the advantage of a new crop should be carefully considered. A rotation that has proved successful should not, however, be changed markedly until the advantages of a change are pretty definitely established.

Providing Good Seed. The acre yield of a crop is a large factor in determining its profitableness; hence special attention should be given to securing seed from high-yielding varieties that are adapted to local conditions. For a section such as east-central Illinois, the yielding qualities of the different varieties of the leading crops have been pretty well established both by farm tests and by controlled experimentation. Information on this point is available in a number of publications of this Station.[1]

While the cost of seed for different crops varies from only a few cents to three or four dollars an acre, it is not unusual to find on many farms that the cost of purchased seed will run to two or three hundred dollars in a year. Many farmers are reducing their purchases of seed to a minimum by selecting their own seed, and by preserving, testing, and treating it for disease. For the amount of labor expended, the home preparation of seed offers one of the best means of reducing farm expenses, for most of the work can be done at seasons of the year when there is not a rush demand for labor. Cooperative effort of farmers in providing adequate storage and other facilities for handling seed is an indication of more general recognition of this fact.

The seed of some crops commonly grown in this section, especially alfalfa, cannot be produced locally to advantage, but when good varieties of grain are once secured, it is not difficult to maintain them at a relatively small cost, as suggested above.

Using Labor, Power, and Equipment to Best Advantage

In addition to the factors already discussed that are to be considered in planning a crop rotation, variations in the demands for labor, power, and equipment make it important to consider carefully

[1]See "Productiveness of Varieties of Winter Wheat in Illinois," (Bul. 276); "Spring Wheat Production in Illinois," (Bul. 267); "Varieties of Barley for Illinois," (Bul. 297); "Productiveness of Certain Varieties of Corn in Illinois" (Bul. 294).

the ways in which crops may be fitted together in the rotation scheme (Table 10 and Figs. 15 and 16).

In planning a rotation with attention to labor requirements, it is a good idea first to list the operations which are normally required in growing a combination of crops under average weather conditions. Then assuming that one is able to accomplish a normal day's work at each operation, the total labor requirements may be estimated. Tables 11 and 12 will be found useful in this connection. By listing the operations according to time of year they will have to be performed, it is an easy matter to approximate the distribution of labor and power necessary in growing a given acreage of each crop.

Demands of Higher Profit Crops Well Distributed. Corn and wheat fit together admirably from the standpoint of labor and equipment. The oat crop also fits in well before corn and after wheat is cut. The same is true of barley. While barley was not grown on the farms in east-central Illinois which were studied, records in northern Illinois show that it has about the same production requirements as oats.

Soybeans, more than any other crop commonly grown in Illinois, conflict with the planting and cultivation of the corn crop. Careful planning of the field work, however, will help to overcome this disadvantage. Some of the more successful soybean growers plow the soybean land ahead of that spring-plowed for corn, thus spreading the labor on soybeans over a longer period and in this way overcoming in part the conflict between corn and soybeans.

Alfalfa, which must be cut three times usually during the year, interferes with labor needed for most of the other crops (Fig. 15). It has the advantage, however, of using labor at several times during the year and the cutting of the first crop follows the heaviest spring demand for labor and power. Usually the second and third cuttings can be handled with other farm work if the farm work is planned with some forethought.

Pasturing of sweet clover tends to reduce labor and equipment demands. If, for instance, 15 to 20 percent of the land is grown to this crop, no labor will be needed on that much of the land that year. Even tho the returns from sweet-clover pasture are low in comparison with those from other crops, the fact that operating costs are low makes the crop relatively profitable.

Thus the high-profit crops in this region—*corn, wheat, alfalfa,* and *sweet clover*—fit in well with a good labor and power distribution. In fairly normal years, a farmer can tell in advance approximately what operations will be needed for growing the different crops, and whether the combination he is considering will reduce them. The

practice of growing corn, corn, and oats, for example, with sweet clover seeded in the oats and plowed down the next spring for corn,

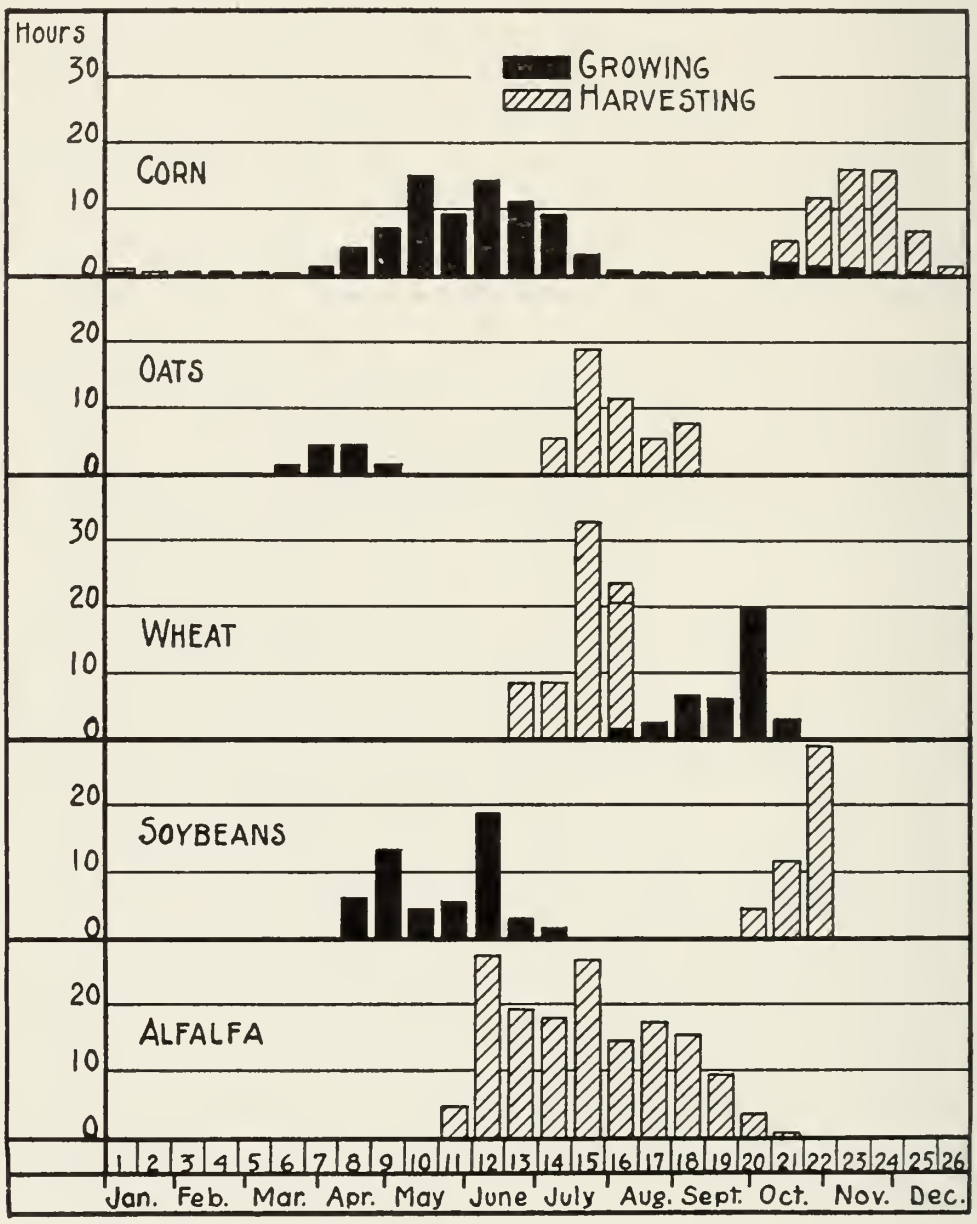


FIG. 15.—HOURS OF MAN LABOR REQUIRED TO GROW AND HARVEST TEN ACRES OF EACH CROP INDICATED

The bars show the hours devoted to each crop by two-week periods thru the year. The graph suggests the possibilities of combining crops in the right proportions to use labor to advantage, which is one of the essentials in keeping the cost of production low.

will require the plowing of two-thirds of the land in the spring of each year. A rotation of corn, corn, oats, wheat, and sweet clover grown for pasture requires that only 60 percent of the land be plowed each year, two-thirds of which may be plowed in the fall, leaving only one-third of it or 20 percent of all the crop land to be plowed in the

TABLE 10.—MAN LABOR, HORSE LABOR, AND TRACTOR POWER USED IN GROWING 10 ACRES OF VARIOUS CROPS ON REPRESENTATIVE FARMS IN CENTRAL ILLINOIS, 1920-1926

(Distribution of labor is shown by two-week periods)

Two-week periods	(Jan. 1 to Mar. 6)[1]	March		April		May			June		July			August		September		October			November		December		Total
		7	21	4	18	2	16	30	13	27	11	25		8	22	5	19	3	17	31	14	28	12	26	
CORN																									
Man labor																									
Growing, with horses	1.1	.7	3.0	7.5	14.2	18.4	9.6	16.7	11.1	7.6	1.6	.2	.4	.6	.2	..	.9	.4	.4	.4	.2	..	95.2
Growing, with horses and tractor	.9	.2	1.2	4.1	7.5	15.1	9.7	14.4	11.4	9.6	3.7	.8	.1	.4	.5	.7	2.0	1.8	1.1	.7	.8	..	86.7
Harvesting, with horses	1.4	..	..	..	..	..	..	..	..	..	..	..	..	..	.1	.1	3.7	10.3	15.9	15.4	6.1	1.7	54.7
Horse labor																									
Growing, without tractor	2.8	2.7	11.4	31.4	54.6	63.4	26.2	35.6	23.5	15.5	3.0	.1	.7	2.0	1.1	..	4.1	1.3	1.2	1.0	.5	..	282.1
Growing, with tractor	1.0	.4	2.8	11.5	21.1	41.3	24.2	34.2	18.6	18.0	5.5	.3	..	.5	.9	2.0	2.7	2.4	1.1	..	.2	..	188.7
Harvesting, with horses	2.7	..	..	..	..	..	..	..	..	..	..	..	..	..	.1	.1	6.2	19.8	30.7	29.5	11.7	3.5	104.3
Tractor work																									
Growing, with horses	.3	.1	.5	1.4	2.5	2.9	1.1	.2	.1	..	..	..	..	.1	.2	.3	1.3	1.4	.9	.7	.7	..	14.7
OATS																									
Man labor																									
Growing, with horses	1.0	2.3	9.0	4.6	3.9	..	.2	.7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	21.7
Harvesting, with horses	..	..	..	..	..	..	..	..	1.2	6.5	20.6	10.0	10.1	7.1	..	..	..	..	..	..	..	..	55.5
Growing, with horses and tractor	..	1.6	4.5	4.5	1.6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	12.2
Harvesting, with horses and tractor	..	..	..	..	..	..	..	..	..	5.2	18.9	11.5	5.2	7.7	..	..	..	..	..	..	..	..	48.5
Horse labor																									
Growing, without tractor	2.0	8.5	31.5	16.7	13.5	.1	.7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	73.0
Harvesting, without tractor	..	..	..	..	..	..	..	..	2.3	10.5	29.4	12.1	15.4	9.4	..	..	..	..	..	..	..	..	79.1
Growing, with tractor	..	3.2	9.7	12.8	3.9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	29.6
Harvesting, with tractor	..	..	..	..	..	..	..	..	..	3.1	21.8	10.8	5.4	10.4	..	..	..	..	..	..	..	..	51.5
Tractor work																									
Growing, with horses	..	.6	1.6	.9	.5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	3.6
Harvesting, with horses	..	..	..	..	..	..	..	..	..	1.2	1.0	.4	..	..	..	..	..	..	..	..	..	..	2.6

[1]This column shows the total work done on crops from January 1 to March 6 inclusive.

TABLE 10.—*Continued*

Two-week periods	(Jan. 1 to Mar. 6)[1]	March 7	March 21	April 4	April 18	May 2	May 16	May 30	June 13	June 27	July 11	July 25	August 8	August 22	September 5	September 19	October 3	October 17	October 31	November 14	November 28	December 12	December 26	Total
SOYBEAN HAY																								
Man labor																								
Growing, with horses	2.2	..	..	9.0	7.4	2.5	19.3	4.5	16.0	1.2	..	..	..	..	..	..	..	..	..	..	..	..	..	62.1
Growing, with horses and tractor	..	..	..	6.1	13.3	4.3	5.5	18.9	3.0	1.3	..	..	..	..	..	..	..	..	..	..	..	..	..	52.4
Harvesting, with horses	..	..	..	..	..	..	..	..	..	..	..	..	..	23.5	20.4	36.0	3.6	..	..	..	..	..	..	83.5
Horse labor																								
Growing, without tractor	6.6	..	..	36.6	26.9	10.1	68.3	15.9	44.7	.5	..	..	..	..	..	..	..	..	..	..	..	..	..	209.6
Growing, with tractor	..	..	..	14.7	38.5	12.1	14.2	56.2	7.2	2.8	..	..	..	..	..	..	..	..	..	..	..	..	..	145.7
Harvesting, with horses	..	..	..	..	..	..	..	..	..	..	..	..	..	25.9	24.0	38.9	5.5	..	..	..	..	..	..	94.3
Tractor work																								
Growing, with horses	..	..	..	3.3	5.8	1.2	..	3.6	.6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	14.5
ALFALFA HAY																								
Man labor, harvesting	..	..	..	..	..	..	4.9	27.2	18.6	17.0	26.9	14.3	17.5	15.3	9.3	3.4	.3	..	..	..	..	..	..	154.7
Horse labor, harvesting	..	..	..	..	..	..	6.7	38.9	28.4	22.4	34.4	19.9	20.9	19.6	13.4	4.1	.4	..	..	..	..	..	..	209.1
CLOVER HAY																								
Man labor, harvesting	..	..	..	..	..	..	..	..	25.0	16.3	9.3	9.9	2.6	1.1	3.7	4.2	.6	..	2.7	..	..	..	..	75.4
Horse labor, harvesting	..	..	..	..	..	..	..	..	28.6	24.3	13.0	12.3	3.1	1.8	6.0	7.6	.2	..	2.6	..	..	..	..	99.5
MIXED HAY																								
Man labor, harvesting	..	..	..	..	..	..	..	..	13.0	12.3	41.3	..	2.4	1.7	1.3	1.6	.8	..	..	..	..	..	..	74.4
Horse labor, harvesting	..	..	..	..	..	..	..	..	17.4	17.5	35.3	..	4.8	2.7	1.9	1.5	1.0	..	..	..	..	..	..	82.1
TIMOTHY HAY																								
Man labor, harvesting	..	..	..	..	..	..	..	..	..	2.9	25.1	19.2	5.0	4.8	..	..	..	..	..	..	..	..	..	57.0
Horse labor, harvesting	..	..	..	..	..	..	..	..	..	4.3	25.9	22.8	7.6	1.2	..	..	..	..	..	..	..	..	..	61.8

[1]This column shows the total work done on crops from January 1 to March 6 inclusive.

TABLE 10.—*Concluded*

Two-week periods	(Jan. 1 to Mar. 6)[1]	March 7	March 21	April 4	April 18	May 2	May 16	May 30	June 13	June 27	July 11	July 25	August 8	August 22	September 5	September 19	October 3	October 17	October 31	November 14	November 28	December 12	December 26	Total
WHEAT																								
Man labor																								
Growing, with horses	..	..	.1	..	..	..	..	..	..	..	.5	2.8	3.4	6.6	6.7	12.5	4.8	1.5	..	..	..	..	38.9
Harvesting, with horses	..	..	..	..	..	..	..	..	12.8	6.3	31.8	17.6	3.5	..	..	..	..	..	..	..	..	..	72.0
Growing, with horses and tractor	.2	..	..	..	..	..	..	..	..	..	..	1.5	2.7	6.4	5.9	20.0	3.0	..	..	..	..	..	39.6
Harvesting, with horses and tractor	..	..	..	..	..	..	..	..	8.7	8 3	32.7	20.5	..	..	..	..	..	..	..	..	..	..	70.2
Horse labor																								
Growing, without tractor	..	.1	.3	..	..	..	..	..	..	..	2.0	11.6	13.5	26.8	25.9	38.6	16.0	5.2	..	..	..	..	140.1
Harvesting, without tractor	..	..	..	..	..	..	..	..	16.2	8.0	46.4	24.1	3.7	..	..	..	..	..	..	..	..	..	98.4
Growing, with tractor	.2	..	..	..	..	..	..	..	..	..	..	1.6	3.2	9.3	12.7	56.7	6.6	..	..	..	..	..	90.3
Harvesting, with tractor	..	..	..	..	..	..	..	..	3.8	10.7	38.4	23.3	..	..	..	..	..	..	..	..	..	..	76.2
Tractor work																								
Growing, with horses	..	..	..	..	..	..	..	..	..	..	..	1.2	1.4	4.0	2.1	1.2	..	..	..	..	..	..	9.9
Harvesting, with horses	..	..	..	..	..	..	..	..	..	.1	.7	..	..	..	..	..	..	..	..	..	..	..	.8
SOYBEANS																								
Man labor																								
Growing, with horses	2.2	..	..	9.0	7.4	2.5	19.3	4.5	15.0	1.2	..	..	..	..	..	..	..	..	..	..	..	..	61.1
Harvesting, with horses	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1.5	17.0	31.1	..	..	..	..	..	49.6
Growing, with horses and tractor	..	..	..	6.1	13.3	4.3	5.5	18.9	3.0	1.3	..	..	..	..	..	..	..	..	..	..	..	..	52.4
Harvesting, with horses and tractor	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4.4	11.6	28.8	..	..	..	5.2	50.0
Horse labor																								
Growing, without tractor	6.6	..	..	36.6	26.9	10.1	68.3	15.9	44.7	.5	..	..	..	..	..	..	..	..	..	..	..	..	209.6
Harvesting, without tractor	..	..	..	..	..	..	..	..	..	..	..	..	..	..	5.9	28.9	37.5	..	..	..	..	..	72.3
Growing, with tractor	..	..	..	14.7	38.5	12.1	14.2	56.2	7.2	2.8	..	..	..	..	..	..	..	..	..	..	..	..	145.7
Harvesting, with tractor	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	10.8	..	31.6	..	..	..	..	42.4
Tractor work																								
Growing, with horses	..	..	..	3.3	5.8	1.2	..	3.6	.6	..	..	..	..	..	..	..	..	..	..	..	..	..	14.5
Harvesting, with horses	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1.0	..	2.1	..	..	..	..	3.1

[1]This column shows the total work done on crops from January 1 to March 6 inclusive.

spring. The effects which certain crop combinations have on labor demands during the course of a year are illustrated in Figs. 15 and 16. A criticism that applies to corn-belt farming in general is that

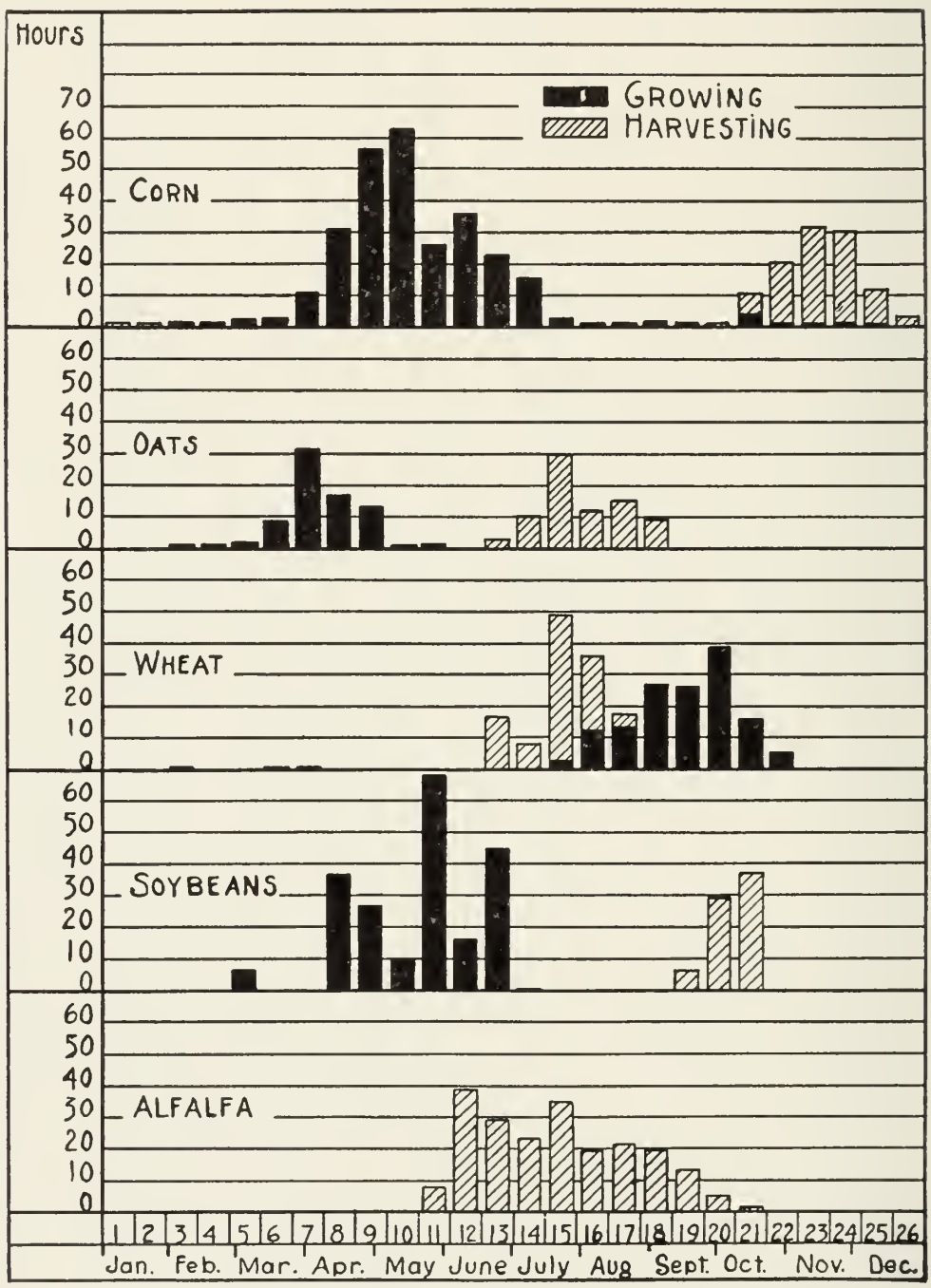


FIG. 16.—HOURS OF HORSE LABOR REQUIRED TO GROW AND HARVEST TEN ACRES OF EACH CROP INDICATED

As in the case of man labor, this graph shows the possibilities of choosing crops that will advantageously distribute the power demands thruout the growing season. The figure is based on farms using horses as the exclusive source of power.

not enough attention has been given to the selection of crop rotations that utilize labor and power to good advantage.

Adapting Crop Plan to Labor Supply. The supply and experience of labor available at different seasons of the year is also to be considered when planning crop systems. Family labor, for example, may be available during only a portion of the year, but if the crops are well arranged it frequently is possible to make good use of it. If boys

TABLE 11.—STANDARDS FOR FARM OPERATIONS BASED ON LABOR RECORDS ON FARMS IN CENTRAL ILLINOIS

Operation	Width of implement	Number of men	Number of horses	Acres per 10-hour day (once over)	Hours per acre (once over)	
					Man	Horse
With horses						
Plowing	16″	1	3	3	3.3	10
Plowing	28″	1	5	5	2	10
Disking, single	9′	1	5	20	.5	2.5
Harrowing	20′	1	4	40	.3	1
Rolling	8′	1	4	20	.5	2
Seeding, endgate	35′	1	2	50	.2	.4
Drilling	8′	1	4	16	.6	2.5
Planting corn	40″	1	2	16	.6	1.3
Cultivating	1-row	1	2	7.5	1.3	2.7
Cultivating	2-row	1	3	12.5	.8	2.4
Cultivating, rotary hoe	8′	1	2	18	.6	1.1
Cutting hay	5′	1	2	10	1	2
Raking hay	10′	1	2	20	.5	1
Putting up hay, with loader						
1¼-ton yield	..	2[1]	2	12.5	1.8	1.5
2-ton yield	..	2[1]	2	8	2.8	2.5
Putting up hay, by hand						
1¼-ton yield	..	3	2	8	3.7	2.5
2-ton yield	..	3	2	5	6	4
Cutting grain, with binder	8′	1	4	16	.6	2.5
Shocking grain	..	1	..	10	1	..
Threshing	..	..	..	...	3	4
Silo filling, per ton	..	..	..	...	1.4	2

[1]In addition, a boy would be used for driving the team for loader and hay fork.

of school age capable of doing field work are at home during the summer, they can be counted on for wheat harvest and the preparation of ground for the seeding of the new crop. Under such circumstances wheat may well have a larger place in the rotation than it has on farms where such labor is not available. Soybeans raised for hay might also absorb extra labor of this kind, since the work of preparing the ground and seeding the crop may be done after school

closes in the spring. Corn cultivation can also be done by such help. Where a large acreage of both corn and soybeans is grown, this kind of labor may materially help in handling the peak load of labor.

TABLE 11.—*Concluded*

Operation	Width of implement	Number of men	Number of horses	Acres per 10-hour day (once over)	Hours per acre (once over)	
					Man	Horse
Hand husking						
40 bushels	..	1	2	2	5	10
50 bushels	..	1	2	1.7	6	12
60 bushels	..	1	2	1.5	6.7	13.4
With 2-plow tractor						
Plowing	28″	1	..	6.7	1.5	...
Disking (tandem)	7′	1	..	18	.6	...
Cultivating	2-row	1	..	20	.5	...
Cutting grain, with binder	10′	2	..	25	.8	...
Cutting grain, with combine	10′	2	..	22	.9	...
(Hauling grain not included)						
With 3-plow tractor						
Plowing	42″	1	..	9	1.1	...
Disking, tandem	10′	1	..	25	.4	...
Cutting grain, with combine	12′	2	..	25	.8	...
Corn picker	1-row	1	..	8	1.3	...
Corn picker	2-row	1	..	12	.8	...
(Hauling corn not included)						

Not infrequently a crop that does not bring a direct profit has an important place in a rotation. If it does not require labor at the same time as some other more profitable crops, such a crop can be made to furnish some return for labor that would otherwise be idle or not used to best advantage. Oats, for example, are not usually a profitable crop, but the oat crop may be sown before the land is prepared for corn and harvested after the corn crop is laid by and the cutting of wheat has been completed. Thus it usually will return something for labor and equipment that otherwise would not be fully used.

The overhead cost of keeping horses is especially to be considered, for it must be met whether the horses work or not. By including oats in the crop system, the demand for horse labor is better distributed, less being required during the peak load and more being utilized in

slack seasons. Fewer horses are then required to do the work on the same acreage, and thus the total cost of farm power is reduced.

Livestock Necessary for Good Labor Distribution. On most farms man and horse labor would not be fully employed thruout the year unless some livestock were kept. If the winter employment of men and horses were not provided for, it would mean on many farms that the entire labor and power bill for the year would have to be charged to fewer hours of work. This would mean a heavier labor charge carried by field crops, for which labor and power are needed only during a portion of the year.

TABLE 12.—BEGINNING AND FINISHING DATES FOR CERTAIN IMPORTANT OPERATIONS ON FARMS OF COST-ACCOUNTING COOPERATORS, 1923-1925, CHAMPAIGN AND PIATT COUNTIES, ILLINOIS

Farm operation	Date of beginning			Date of ending		
	Earliest date	Average date	Latest date	Earliest date	Average date	Ending date
Oats						
Seeding	Mar. 26	April 1	April 14	April 2	April 11	April 17
Cutting	July 6	July 8	July 14	July 20	July 25	Aug. 11
Threshing	July 17	Aug. 1	Aug. 4	Aug. 11	Aug. 15	Sept. 21
Spring wheat						
Seeding	Mar. 21	April 2	April 3	Mar. 21	April 4	April 5
Cutting	July 6	July 14	July 21	July 14	July 23	Aug. 11
Threshing	July 23	July 28	Aug. 12	July 27	Aug. 8	Aug. 14
Winter wheat						
Seeding	Sept. 26	Sept. 29	Sept. 29	Oct. 6	Oct. 12	Oct. 23
Cutting	June 29	July 4	July 10	July 16	July 20	July 31
Threshing	July 17	July 28	Aug. 5	July 28	Aug. 10	Sept. 14
Corn						
Planting	May 2	May 5	May 9	May 23	May 26	June 13
Cultivating	May 17	May 28	May 30	July 9	July 12	Aug. 2
Husking	Sept. 15	Oct. 12	Oct. 17	Dec. 12	Dec. 16	Jan. 28
Alfalfa harvesting						
First crop	June 1	June 8	June 22	June 17	June 20	June 30
Second crop	July 8	July 14	July 16	July 23	July 28	Aug. 11
Third crop	Aug. 15	Aug. 23	Aug. 25	Sept. 7	Sept. 12	Sept. 25
Clover and mixed hay harvesting						
First crop	June 18	June 20	June 21	July 16	July 20	July 29

NOTE.—This table gives the extreme dates for beginning and finishing the different farm operations, while the average date given is the modal date for all farms included in the results of each year.

Since the different livestock enterprises vary in the amount of labor they require and in the season when they require it, the feeding of livestock may be so arranged as to use available labor and power to advantage. Beef-cattle feeding, sheep feeding, the growing of beef cattle, and winter dairying utilize labor during the winter season. (Table 13 and Fig. 17). Even tho such an enterprise may give only a small return above the value of the feed used, it may mean adding much to the total farm income in the future thru increased yields as

well as adding something to the present income. The direct benefit comes thru livestock paying something for the man and horse labor that would otherwise not be fully used.

The amount of available labor on the farm will influence the kind and amount of livestock that can fit into the labor program.

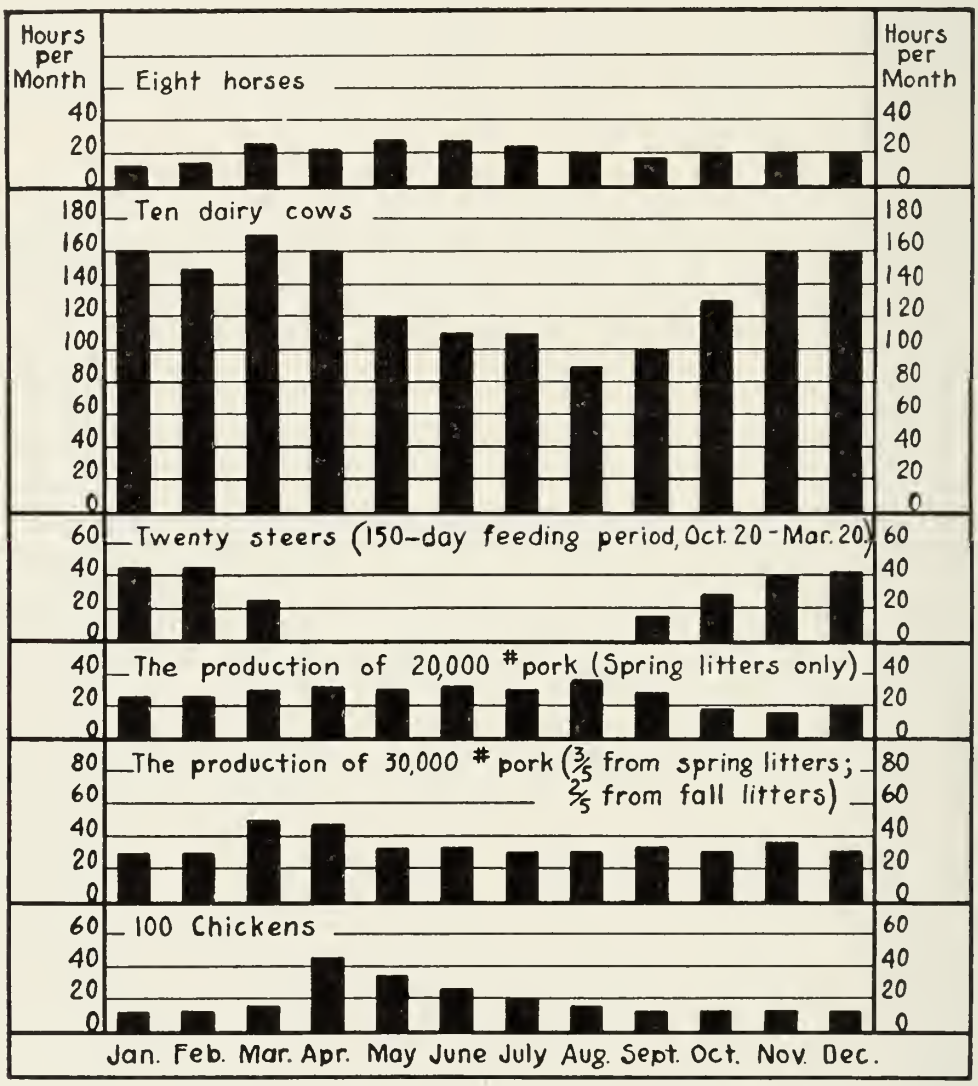


FIG. 17.—HOURS OF MAN LABOR REQUIRED MONTHLY IN CARING FOR LIVESTOCK

Some kinds of livestock, such as feeder steers or sheep fed during winter months, require little labor during the growing season and do not interfere seriously with the growing and harvesting of crops. Thus they help to make possible an economical labor program.

Dairying has been included in the organization of some farms because there were boys available to help with chores mornings and evenings during school months, as well as full time during the summer. This subject will be treated more in detail in the section on balancing crop and livestock production.

TABLE 13.—DISTRIBUTION OF MAN LABOR IN CARING FOR LIVESTOCK ON TYPICAL FARMS IN CENTRAL ILLINOIS

(Figures indicate hours of labor required each month for amount of livestock shown)

Item	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
One work horse	1.7	1.9	3.4	3.0	3.7	3.6	3.2	2.7	2.3	2.6	2.6	2.6	33.3
One dairy cow													
In herds of 10 or less	16	15	17	16	12	11	11	9	10	13	16	16	162
In herds of 11 to 20	13	12	13	13	11	8	8	8	8	10	12	13	129
In herds of more than 20	14	13	14	13	12	9	9	9	10	11	14	15	143
Feeding steers, per 20 steers	35 hours per month, varying from 50 minutes per day at beginning of feeding period to 90 minutes per day at end												
One beef cow and calf, basis 20-cow herd	3.0	3.0	3.0	4.0	.5	.5	.5	.5	.5	4.5	2.5	2.5	25.0
Hogs, 1,000 pounds of pork, March to June farrow	1.3	1.3	1.5	1.6	1.5	1.6	1.5	1.8	1.4	.9	.8	1.0	16.2
Hogs, 1,000 pounds of pork, Feb. to May and Aug. to Nov. farrow[1]	1.0	1.0	1.7	1.6	1.1	1.1	1.0	1.0	1.1	1.0	1.2	1.0	13.8
Chickens, per 100 hens	12	12	15	45	33	25	20	15	12	12	12	12	225

[1]There were one and one-half times as many pigs raised in spring as in fall.

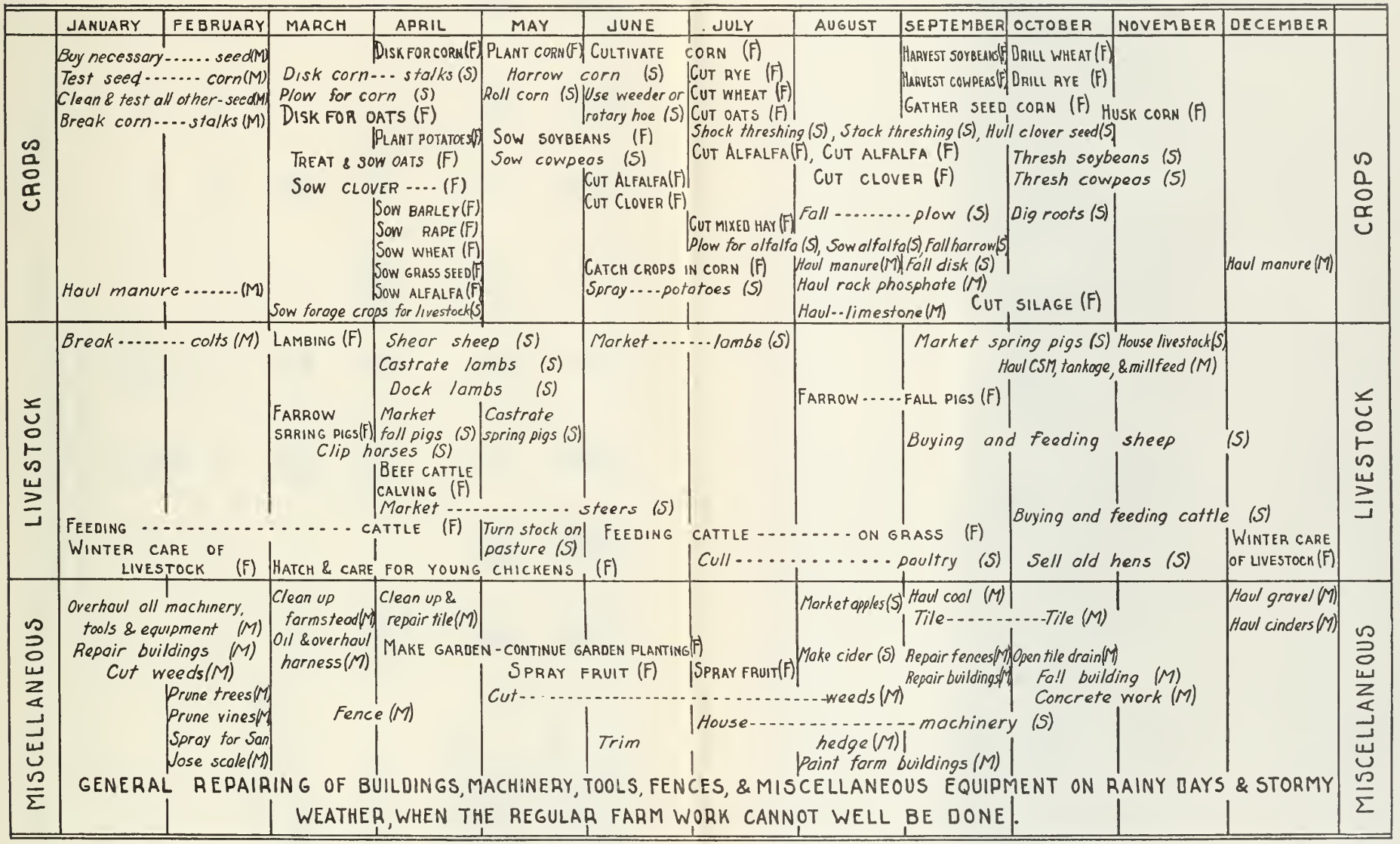
Shifting Odd Jobs to Seasons of Low Labor Demand. The crops and livestock for any farm having been determined and the time when they will demand labor pretty well fixed, attention should be given to the miscellaneous jobs about the farm which can be shifted to the seasons of low labor demands. Rainy days and other periods of slack employment can be filled with labor on repair work, preparing seed for sale or for planting, hauling of manure, cutting weeds, and various other odd jobs on the farm that can be shifted about (Fig. 18). A schedule for fitting in this miscellaneous farm labor can be worked out if a small notebook is carried to write down odd jobs that need attention but can best be done when labor is not needed on more important jobs. Scheduling work will avoid taking labor from crops or livestock during the rush periods.

Balancing Crop and Livestock Production

The kinds and numbers of livestock that can be advantageously produced on a farm will depend on many circumstances. If a man has had little or no experience with stock, it may be a mistake for him to go into the enterprise on too large a scale. If he is not interested and does not like to give the continuous care which most livestock require, he would do well to confine his farming operations largely to crop production. He cannot expect, however, to obtain as large earnings as a man who produces livestock with average efficiency and is equally efficient in crop production. In choosing the kinds of livestock to produce, local demands for certain livestock products should be considered, as well as marketing facilities, including transportation to central markets.

The amount of rough and untillable land which a farm contains may go far in determining the kind and amount of livestock that will be profitable, since the different kinds of stock vary in their ability to utilize different kinds of feed to advantage. Horses, for example, utilize a larger amount of roughage than of grain. The same is true of dairy cattle, sheep, and stocker or feeder cattle under some conditions. Hogs, on the other hand, while one of the most profitable livestock enterprises, use large amounts of salable grain and small amounts of roughage compared with beef breeding herds and horses. The same is true of poultry (Table 14).

While east-central Illinois is primarily a grain-selling region, a considerable part of the grain shipped out of this region eventually finds a market as feed for livestock produced in some other section. The thoughtful farmer who recognizes that the productivity of his land is on the decline may well consider whether he might feed more of his crops on his own land. While it is possible to maintain soil fertility without livestock by using mineral fertilizers and by growing a sufficient acreage of legumes and plowing them under, it is poor



This calendar is based on the conditions found on the general farms of the corn belt, mainly, central Illinois.
Many operations listed will vary with latitude and season, and, to some extent, with individual farms
The letters following the operations listed above are used to indicate their classification: (F), for fixed work; (S), semi-fixed; and (M), for movable work.

FIG. 18.—LABOR CALENDAR FOR THE CORN BELT

This calendar is based on conditions found on the ordinary farms of the corn belt and applies particularly to central Illinois. Many operations listed will vary with latitude and season and, to some extent, with individual farms. The letters that follow the operation indicate whether they are fixed (F) as to the time the work must be done, semi-fixed (S), or movable (M).

TABLE 14.—AMOUNTS AND KINDS OF FEED USED BY DIFFERENT CLASSES OF LIVESTOCK, AS FOUND IN COST STUDIES BY ILLINOIS STATION

(Amounts are per head except as otherwise indicated)

Class of livestock	Grain	Supplements	Legume hay or equivalent roughage	Non-legume roughage: straw and clover	Silage	Pasture	Daily gain	Days fed
	lbs.	*lbs.*	*lbs.*	*lbs.*	*lbs.*	*days*	*lbs.*	
Work horses								
Champaign and Piatt counties, 1923-1924	2 650	....	2 000	2 000	....	180	....	....
Knox and Warren counties, 1923-1924	2 860	....	2 450	1 850	....	120	....	....
Yearlings, grade colts	1 000	....	2 000	1 500	....	200	....	....
Beef cattle, herd								
Cow	May	....	800-1 000	1 500	5 000	180	....	....
Calf 6 months after weaning	easily	....	700- 900	500	2 500	...	....	....
Yearling stocker	use 500 to 1000	....	800	1 000	3 500	180	....	....
Beef cattle, fattening								
With silage (for 100 pounds gain)								
Calves, 400 to 550 pounds	339	7.1	71	124	1 391	19	1.49	156
Yearlings, 550 to 750	429	15.2	160	142	1 662	17	1.55	160
Medium weight, 750 to 950	576	26.6	83	249	1 941	17	1.55	142
Heavy steers, 950 to 1,100	693	17.0	37	262	2 147	13	1.73	94
Without silage, for 100 pounds gain								
Calves, 400 to 550 pounds	616	13.2	199	51	....	19	1.55	181
Yearlings, 550 to 750	833	7.3	266	65	....	19	1.69	163
Medium weight, 750 to 950	890	13.9	242	134	....	16	1.82	148
Heavy steers, 950 to 1,100	966	10.6	270	124	....	....	1.95	125

TABLE 14.—*Concluded*

Class of livestock	Grain	Supplements	Legume hay or equivalent roughage	Non-legume roughage: straw and clover	Silage	Pasture	Daily gain	Days fed
	lbs.	*lbs.*	*lbs.*	*lbs.*	*lbs.*	*lbs.*	*days*	*lbs.*
Dairy cattle								
5,000 pounds production	1 400	....	2 000	1 000	7 000	175	....	....
7,000 pounds production	1 800	....	2 500	1 000	8 000	175	....	....
9,000 pounds production	2 500	....	2 500	1 000	9 000	175	....	....
Hogs, breeding herd								
Brood sow	1 500	60	....	....	....	10	....	....
100 pounds gain, entire herd	460	20	....	....	....	3	....	....
100 pounds gain, pigs after weaning	415	15	....	....	....	2	....	....
Ewe No. 1	125	....	300	....	....	30	....	....
Ewe No. 2	150	....	150	....	300	30	....	....
Lambs, full feed, per 100 pounds gain (25 pounds gain per lamb)	400	....	500	....	....	....	....	....
Poultry								
Laying flock, 100 hens	5 400	600	....	....	....	....	....	....
Pullets to 5 months of age, egg breeds, 100 hens	1 800	200	....	....	....	....	....	....
American breeds, 100 hens	2 250	250	....	....	....	....	....	....

economy on most farms to grow the legumes necessary to keep up the soil and then not use them for livestock. If the manure is carefully conserved and returned to the crop land, much of the required fertilizing elements are kept in the soil and at the same time some

TABLE 15.—AVERAGE ANNUAL PRODUCTION OF CORN, OATS, WHEAT, AND CLOVER FROM UNTREATED PLOTS, AND TOTAL PRODUCTION WITH DIFFERENT SOIL TREATMENT: DAVENPORT PLOTS, UNIVERSITY OF ILLINOIS, URBANA, 1921-1924

(Figures indicate pounds per acre)

Crop	Untreated		Manure		Manure and limestone	
	Grain	Roughage	Grain	Roughage	Grain	Roughage
Corn.....	13 132	13 300	16 002	18 620	18 662	21 480
Oats.....	7 520	6 260	8 224	7 180	8 553.6	7 520
Wheat.....	6 792	10 900	8 172	14 200	9 504	16 560
Clover.....	....	11 080	....	14 940	....	21 080
Total for four years	27 444	41 540	32 398	54 940	36 719.6	66 640
Average per year.....	6 861	10 385	8 099.5	13 735	9 179.9	16 660

current income is obtained from the legume crop. The value of the fertility lost in feeding the legumes to livestock instead of plowing them under directly is usually more than made up by the plant food returned to the soil as a result of feeding grain to livestock. Also, on farms handling considerable livestock the feeding of supplemental nitrogenous feeds adds materially to the fertility returned to the soil. For many years some of the older agricultural regions especially in the eastern states have helped to maintain their soil thru the purchase of feed grains from the corn belt. This experience should hold a lesson for the corn-belt farmers, where soils are showing reduced productivity.

It is not usually appreciated that a normal crop rotation in this section produces in weight more roughage than grain. A rotation of corn, oats, wheat, and clover, for example, produces nearly twice as much roughage as grain by weight (Table 15). Much of such roughage it is true is not of high feeding value, but on the other hand it is capable of producing considerable meat, wool, and dairy products when properly combined with other feeds. While these by-products of grain production can be plowed under to improve the soil, most farmers will prefer to use a part of them for feed for livestock in order to get some direct return from them. Livestock therefore provide a profitable means of utilizing the large amount of roughages that usually go to waste on farms in east-central Illinois. Climatic conditions in east-central Illinois are not always favorable to the production of high-grade grain. Better returns are usually obtained from such crops by feeding them than by placing them on the market.

Aside from marketing the crops to the best advantage, there are other advantages in the production of livestock. One advantage in surplus-grain producing areas is that the livestock enterprise may be added to the farm business without displacing any of the crop enterprises, thus adding to the volume of the farm business without requiring more acreage. This is an important item where the value of the land makes up as large a part of the total farm investment as it does in east-central Illinois.

TABLE 16.—VALUE OF FEED USED FOR DIFFERENT CLASSES OF LIVESTOCK ON TWELVE ILLINOIS FARMS, AND INCOME RECEIVED OVER A THREE-YEAR PERIOD, 1923-1925

	Feed	Income	Return for $100 of feed
Cattle	$115 173.01	$120 546.97	$104.67
Hogs	104 176.59	134 733.44	129.33
Sheep	3 956.45	6 480.56	163.80
Poultry	5 432.13	13 399.53	246.67
Total	$228 738.18	$275 160.50	$120.30 (aver.)

The man who includes livestock production as one of his farm enterprises has more independence in marketing his grain crops than the man who produces crops only for direct marketing. One has the alternative of feeding more or less of his crops and of shifting the balance of income from crop sales to livestock sales, or vice versa, in response to changes in market prices. At the present time in east-central Illinois a large part of the grain crops produced are sold directly on the market.

The value of crops converted into livestock is larger normally than the value of such crops when sold direct. Over a three-year period, for 12 typical farms, $228,738 worth of feed used for all classes of livestock except horses brought a return of $275,160 (Table 16). The income from $100 worth of feed returned an average of $120. Much of the feed had little or no market value, or at least it would not have been sold from the farm if it had not been fed to the livestock. In determining the charge for such feed, however, it was valued at its farm value in replacing feeds that had a more definite market value. The return shown is therefore conservative, and in addition there is the advantage of having retained on the farm the manure from the livestock operations.

While it is clear that livestock have a place on general farms in the corn belt, there is always the question of how much should be carried on a particular farm. Studies made on actual farms indicate that as more legumes are introduced in the cropping system a larger percentage of the grain crops are fed to livestock. In other words, the grow-

ing of more legumes is a factor which encourages the keeping of more livestock. The need of legumes to replace or maintain the soil nitrogen on many farms is such that it is an easy matter to carry enough livestock to consume all the grains grown. One should, however, avoid developing the livestock enterprise to such an extent that it requires the buying of large amounts of grain feeds in years when yields are low. As a general guide it may be stated that the safest system of livestock farming is one that will require only as much feed as is produced under normal crop conditions or perhaps in years of somewhat low yields since prices for feed are apt to be high in years of low crop production.

The first step in estimating the probable numbers and kinds of stock that can be profitably carried is then to estimate the amount of feed that will be necessary for them and compare this with the feed crops likely to be produced with the cropping system that will be followed. In Table 14 are shown the amounts of grain (including nitrogenous supplements), silage, hay, pasture and other roughage, used by farmers in feeding various kinds of stock. When feeding operations are started, it is possible to estimate about the length of time that the meat animals will be kept on feed. With the information in Table 14, the feed required until new crops are available can be quite accurately figured.

Feed requirements can be worked out more accurately by taking into account the adaptation of different rations for different kinds of stock. The information in Table 14 is based on average farm practice in feeding the different crops. No doubt better results could be obtained by altering some of the feeding practices in accordance with the findings of investigators.[1]

The importance of making such estimates as those suggested above is revealed by many farm records. Some men have been obliged to purchase feed at high prices in years of short production or at advanced prices late in the season merely because they failed to anticipate their feed requirements.

Planning a Large Volume of Business

In making the final selection of the kinds and amounts of crops and livestock to be included in the organization of the farm, due consideration must be given to securing as large a volume of business as possible. The profit on any farm is quite directly determined by the total farm income. This does not mean, however, that the acreage

[1]See the following publications of this Station: Feeding Farm Work Horses and Mules (Bul. 238); Soybean Hay and Sweet-Clover Pasture for Growing Purebred Draft Fillies (Bul. 292); Feeding and Management of the Dairy Herd (Circ. 272); Vitamines in Livestock Feeding (Circ. 282). See also Feeds and Feeding, published by Henry and Morrison.

of a farm with an insufficient volume of business should necessarily be enlarged, for much can be done to choose an organization of crops and livestock which will produce a large income even tho the acreage may not be large.

Many farms in Illinois have a total income of less than $2,500. After deducting the necessary operating expenses, these farms cannot give a satisfactory net income. Frequently the size of the farm with the kinds and amounts of crops and livestock produced do not provide for the full employment of available labor, power, and equipment. In such instances some adjustment is needed as to the enterprises included in the organization. How may such farms be reorganized to provide a larger volume of business?

Increasing Amount of Livestock on Grain Farms. Some of the smaller grain farms may well produce more livestock. Dairying, beef-cattle feeding, hog production, or poultry production are good enterprises to add. This is especially true where available labor is not being fully utilized, particularly where there is a surplus of labor during the winter. For those farmers who are highly successful in handling some line of livestock, the purchase of considerable feed as a means of enlarging the livestock enterprise may be justified. While not in line with the safest system of farming, which would limit feeding operations to those that will make use of the crops grown on the farm under normal cropping conditions, this is an effective way for a man on a small farm who is a highly efficient manager of livestock to increase the size of his business.

Developing a Specialized Crop or Side Line. A farm that is producing corn and oats mainly for the market, even tho it includes considerable acreage, is quite definitely limited as to the size of the income. The production of some specialized crop which brings a large gross income per acre will help solve the income problem on many such farms, especially if they are well located. This is true even tho the labor and power requirements per acre for the specialized crop are large. A choice among the more common crops on the basis of their utilization of labor and power is also to be considered. The gross return per acre for soybeans, for example, is very much higher than for oats, but the cost of production ordinarily is correspondingly higher, so that the net return per acre is not very different unless the soybeans are sold for seed. On farms having an ample supply of labor, power, and equipment, however, one may be justified in growing a relatively large acreage of soybeans because of their larger gross return per acre and because they provide a means of marketing a certain amount of labor and power which would not be fully used in growing oats.

On some farms the development of side lines is a satisfactory way of increasing the volume of business. Seed production is a good

example. The preparation of tested and graded seed during the winter provides a profitable means of using available labor.

Renting Additional Land. When a man is definitely limited in income by the size of farm he is operating and yet does not care to change his type of farming, he may remedy the income situation in many parts of Illinois by renting additional land. It is not uncommon for a farmer to be able to handle 20 to 80 additional acres without being put to the necessity of acquiring any additional power and equipment and on some farms no additional labor is necessary.

How large a farm a man can operate successfully is determined by his ability as a manager. It may be stated as a general rule that a farm should be at least as large as the average farm in the community engaged in the same type of production. It usually is a good plan for a man to grow into the management of a farm much larger than the average, and farms less than average in size are often too small for economical operation.

The foregoing suggestions regarding desirable size and the various ways of increasing volume of business apply equally well when one is purchasing a farm. For the man with only a limited amount of capital, the purchase of a small farm, with the opportunity to rent additional land nearby, offers distinct advantage over being a tenant in that buildings and other improvements needed in developing a good system of farming can be placed as rapidly as resources will permit. Care must be used, however, not to over equip the small area in order to operate additional rented land, for there is always the possibility of not being able to continue to rent land that is close enough for economical operation.

Adjusting Production to Meet Changing Market Conditions

A part of good farm planning is to study carefully the opportunity of adjusting farm production to meet changing market conditions. Variations occur in the relative prices paid for different farm products, as illustrated by the relatively lower price of oats compared with corn and wheat in recent years. Changes also occur in the demand for new products in certain localities as urban population increases. The growth of cities, for example, may give rise to new markets for products which have not been grown in the community previously or may have been produced in but a small way on farms closely adjacent to the cities. The development of hard roads may give the farmers of a community access to new markets and justify some changes in the type of their production.

The more immediate question, however, is: To what extent should a man change his production from one year to the next in response to changes in market conditions which are of a *temporary* nature?

The success one has in adjusting his farm production to probable future prices depends upon his ability to interpret market conditions.

Before discussing specific adjustments which can be made in the farm business in anticipation of future prices, however, there are some facts relating to both crop and livestock production which should be considered.

Crop-Acreage Adjustments Limited. The total production of the leading grains from year to year is influenced more by variation in acre yield than by changes in acreage (Fig. 19). It is impossible to

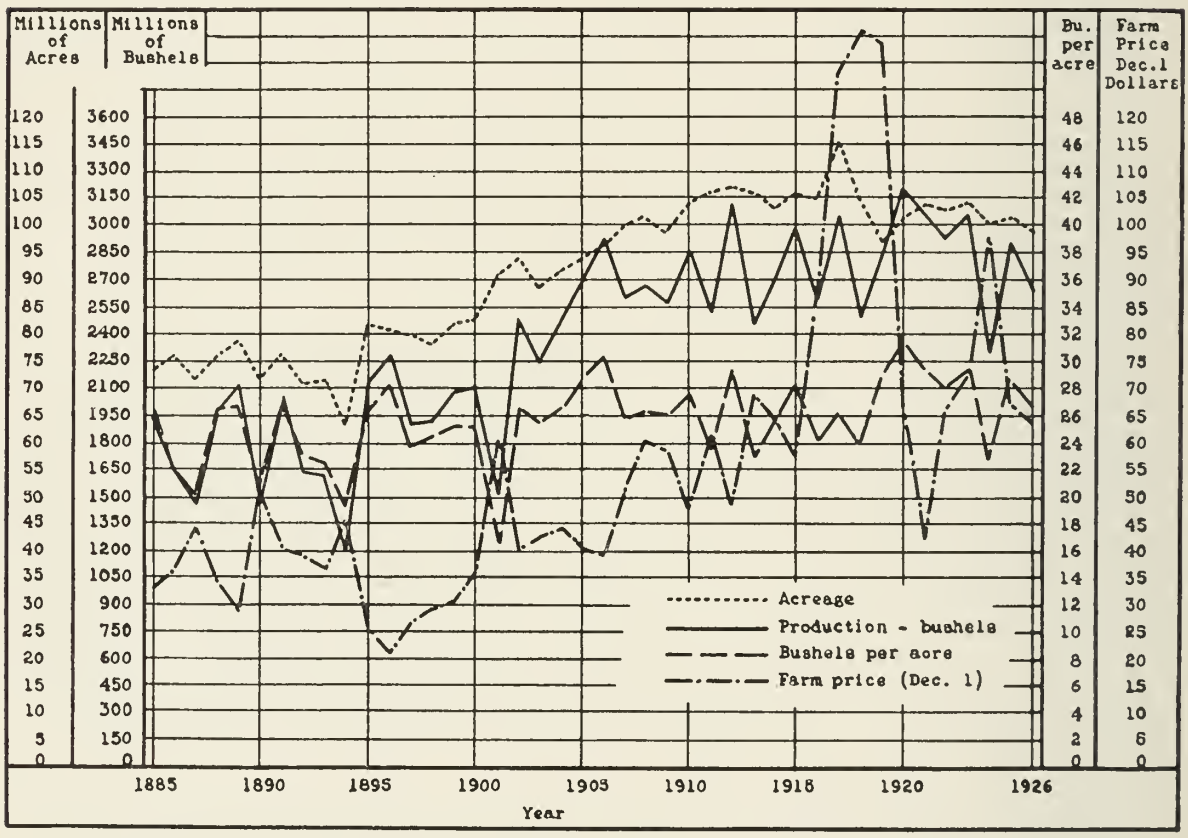


FIG. 19.—VARIATIONS IN ACREAGE, TOTAL PRODUCTION, YIELD PER ACRE, AND PRICE OF CORN FROM 1885 TO 1926

The total production of the country depends more upon yield per acre than upon acreage, as will be observed from the very close similarity in the lines showing total production and average acre yield. It therefore cannot be forecast at the time of planting. The price of corn is quite inverse to the acre yield of corn.

estimate total production of the five leading grains, corn, wheat, rye, oats, and barley, very closely in advance of planting. The average acre yields of these grains may vary annually from 30 to 50 percent. Until correct long-time weather forecasts can be made, changes in acre yield cannot be foreseen and provided for. There is little opportunity, therefore, to adjust directly total production of the staple crops to probable prices by changing acreages planted.

Variation in the acreage of some minor crops, such as broomcorn, may have a marked effect on total production. This crop can be

carried over readily from year to year. When a crop is large enough to meet much more than a year's demands, there may be advantages in markedly reducing the acreage the following year. As a matter of fact, many broomcorn growers follow this practice.

Going back to staple crops it remains to be said these are in large measure interchangeable in feeding operations, and that when prices of feed crops fluctuate they usually fluctuate in the same direction. Thus no great advantage is gained from the standpoint of total feed production in reducing the acreage of one feed crop and increasing that of another.

The disruption of farm plans by varying greatly the acreage of different crops produced will tend to add to the costs of production and cause the loss of the advantages of a well-planned crop rotation. After a good cropping plan is developed it is inadvisable to vary it unless crop failure or seasonal conditions make it necessary. Likewise, since livestock play an important part in a well-organized farm it is inadvisable to change too violently the plan of livestock production. It would be a mistake, for example, not to retain good foundation breeding stock.

In east-central Illinois the staple crops grown are largely feed crops. Changes in prices of feed grains and other feed crops do not necessarily occur in the same direction as the prices of livestock and livestock products. Thus, it may be more profitable at times to sell grain, while at other times it will pay better to sell it in the form of livestock and livestock products.

Practical Problems of Adjustment. Even with livestock it takes time to change the production greatly and it is difficult to anticipate what the general level of prices will be when the animals are ready to go to market. As a matter of fact, the most efficient producers have little to gain by changing radically the plan of livestock production. The price of 100 pounds of pork within the past ten years, for instance, has varied from the equivalent of 8 bushels of corn to over 21 bushels (Fig. 9). While this indicates that it is much more profitable to produce hogs some years than others, cost of production records kept on farms thruout the same period show that a few farmers produce hogs at a total cost equivalent to the price of 8 to 9 bushels of corn every year. Such producers will practically always receive market prices or more for feed fed to hogs. The same statement applies in some degree to other types of livestock, altho the advantage is not as decided for most classes of livestock as for hogs.

The man with only average ability is apt to be more successful in improving his methods of production than he is in learning to interpret market conditions far in advance of marketing his products.

Many of the better farmers, however, profit from a careful study of information regarding the production and marketing of farm prod-

ucts so as better to adjust their own farm operations to take advantage of future market conditions.

Livestock Production Can Be Varied. In so far as temporary changes in production may be made to advantage, better results are apt to be obtained under corn-belt conditions by varying the kind of products sold from the farm rather than by varying the acreage of different crops. This means that adjustments to market conditions may be made to better advantage thru livestock than thru varying the crop acreage.

The numbers of livestock and the production of livestock products can be estimated fairly well in advance. The number of feeder cattle coming to market may be estimated a year or two in advance, since it is dependent on the number of breeding animals in the country. What the production of dairy cattle will be for at least two years is indicated quite accurately by the number of milk cows and young stock on farms. In the case of horses the supply of work stock is pretty well known several years in advance from the number of young horses and mules in the country. Even with sheep the rate of increase is relatively slow, and the breeding flocks in the country are an indication of the prospective lamb supply one or two years in advance. While the numbers of hogs and poultry on hand are not an indication of the amount which will come to market very far in advance, the intentions of farmers as to the numbers of hogs and poultry which will be produced the following year give some indications as to market supply.

The closer to the time of marketing that adjustments can be made in the amount of any farm product placed on the market, the greater is the opportunity of taking advantage of price conditions.

Short-time changes in the volume of production can be made with certain kinds of livestock that cannot be made on grain farms. For example, as stated in Bulletin 301 of this Station, "The Place of Hog Production in Corn Belt Farming," "when the relative prices of corn and hogs can be anticipated, a larger or smaller number of brood sows can be kept and either one or two litters of pigs raised each year. Within a year this will materially change the numbers available for market. At times feeder pigs may be bought to good advantage. . . . Hogs of the right type may be marketed at 175 pounds, or if conditions warrant, they may be fed to 300 or even to 350 pounds. The producer of corn and hogs can therefore change considerably the proportion of corn and pork which he sells without changing the number of hogs raised.

"The advantage of this practice of feeding to lighter or heavier weights in order to vary the marketing of corn and hogs deserves careful consideration because of the short time required to make the adjustment."

Dairy cows can be culled at a somewhat earlier age, or if the immediate outlook for the market price of milk is strong, cows may be held longer. In order to take advantage of the future market in beef cattle, adjustments can be made in the class, weight, age purchased, and the method of feeding. The number of feeder sheep can likewise be adjusted to the market of the relatively near future as handling this livestock is usually a short-time operation. Any of these adjustments in livestock can be made without changing the cropping system.

Learning how to tell what the market is going to do in the future is more difficult and requires skill of a different kind than improving one's ability as a producer. The more successful farmers, however, are those who produce efficiently and then use care and judgment in marketing their products advantageously. Efficiency in both production and marketing are essential to profitable farming.

Fitting the Field System to the Cropping Plan

After having determined in general upon a plan of crop and livestock production, similar care should be given to planning the field system and the farmstead arrangement. In few sections of the country does one have a better opportunity of planning a convenient field system than in east-central Illinois, where the land not only is level, but on most farms is uniform as to type.

In planning a desirable field arrangement, one has his choice of considering a single rotation with a separate field for each year of the rotation, or a major and minor rotation, the major rotation being so arranged as to include most of the cultivated land and the minor rotation being used for the growing of small acreages of crops near the buildings. This latter arrangement may be adopted as a means of handling livestock to better advantage and of providing a separate field for alfalfa. The rotation of small fields in the minor rotation provides the opportunity for better livestock sanitation by making it possible to shift the stock to new land each year and thus to eliminate or control diseases and parasites that are carried over in soil from one year to another.

A minor rotation is frequently convenient also in providing early feed. A small field either in early corn for hogging down or in rye, rape, or oat pasture to supply succulent annual pastures is often an advantage. On some farms, especially those larger than the average, it may be desirable to plan two major rotations, especially if there are wide differences in the type of soil on the farm.

Having determined the number and relative size of fields best fitted to the cropping plan, it will pay to devote special care to laying out the field system in a way that will save time in the use of labor and power. The fields should be rectangular in shape, if possible, and somewhat longer than wide since the greater part of the farm operations are usually done one way of the field. They should be readily

accessible from the buildings. Having them somewhat longer than wide usually makes it possible to enter them at a point nearer to the buildings. Square fields, on the other hand, are more economically fenced, and some attention should be given to this point, as mentioned later. Many farmers believe that it is more economical not to fence all the fields but to shift the division fences from year to year including within fences only areas in which livestock are pastured. Shifting the fences makes it possible also to get rid of weeds along fence rows, and it may reduce the cost of field operations, especially when two fields can be thrown together for the same operation.

Unless a field system is already fairly good, it is likely to take a number of years to develop a desirable one. The best way to revise a system is to draw a plan of the present field arrangement and a plan of the one that it is believed desirable to work toward. As new fences are built, they can be placed in accordance with the desired plan, and in a few years the new arrangement will have been accomplished with practically no extra labor or expense (Fig. 20).

Planning the Farmstead

The farmstead should provide comfortable and pleasant surroundings and make possible the economical handling of the farm business. The arrangement of buildings and lots should follow a carefully worked out plan. Each improvement made in the farmstead arrangement, as in the field arrangement, should contribute toward a final plan, even tho it may take many years to get the buildings into their ultimate position. Pleasant surroundings come as a result of careful planning and orderly arrangement of the house and the other buildings on the farmstead rather than thru a large expenditure of money.

No more land should be included in the farmstead than is needed for buildings, small lots, and trees and shrubs for landscaping and protection. The layout should be compact, so as not to waste land that might be used for crop production. Rather than keep stock in large lots around the buildings, it is a good plan to put as much of the farm land into the regular rotation as possible and move the stock, especially poultry and hogs, to clean land each year. On many farms the income from poultry and hogs could be increased considerably thru observing such sanitary precautions.

Location of House. In locating the buildings on the farmstead, the house may well be given first consideration since it is the center of the labor force as well as the home of the family. A good view of other important buildings and of the road and the surrounding country, a pleasant exposure, and good drainage are some of the essentials of a well-placed house. No other buildings should be placed between the house and the road, as they will spoil the view from the house and give the passer-by an unfavorable impression of the farmstead (Fig. 21).

In central Illinois the house should be placed to the west or the south of the barns and feed lots in order to carry disagreeable odors away from the house, as the prevailing winds are from the west and

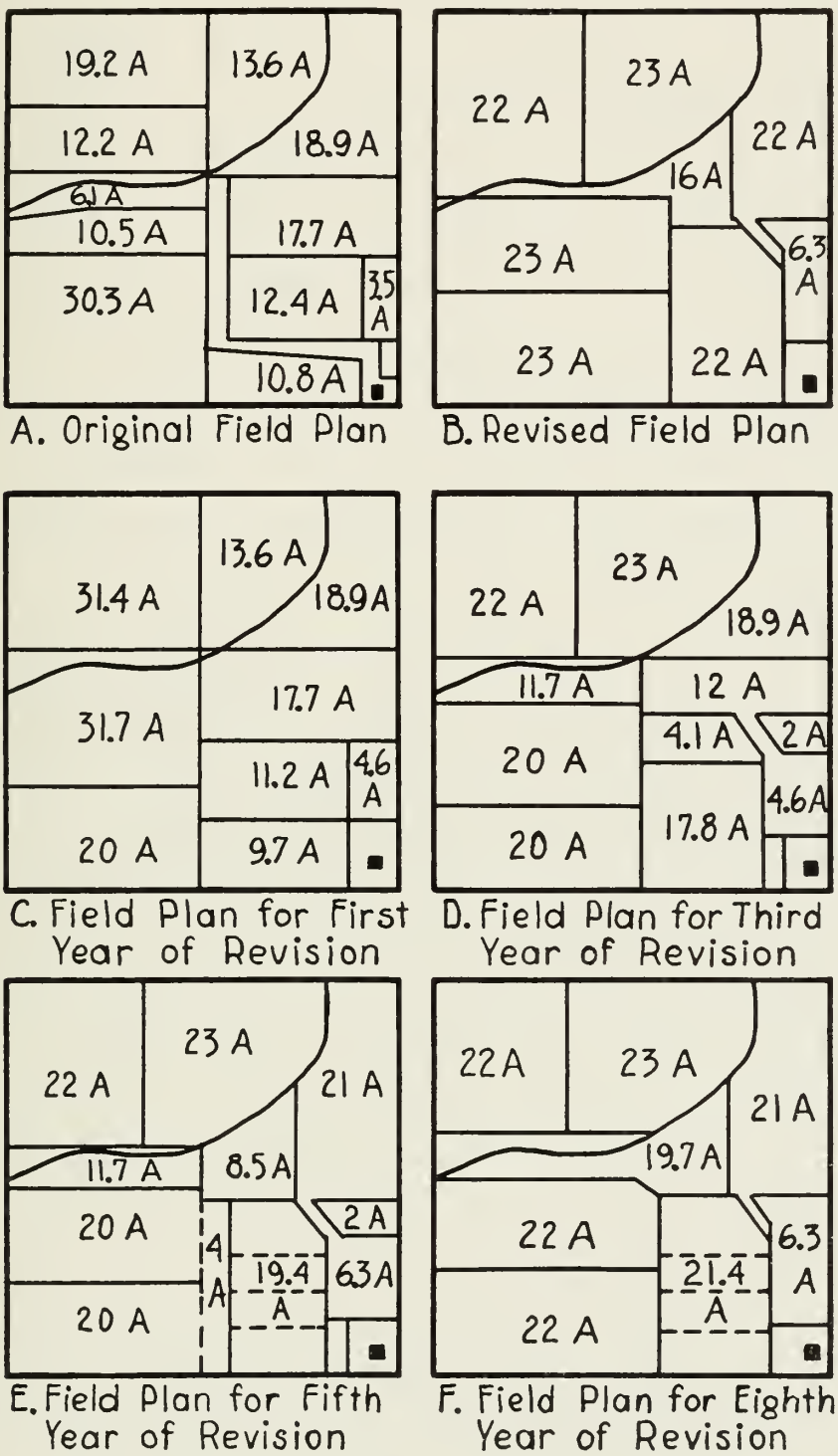


FIG. 20.—ACTUAL REVISION OF A FIELD SYSTEM ON A 160-ACRE FARM IN CENTRAL ILLINOIS

From a well-developed field plan a conveniently arranged farm may gradually be worked out. Several years may be necessary before the plan is realized and all fences are rebuilt. Such a plan is the basis also for building up a satisfactory crop rotation and economizing in the use of labor and power in field work.

southwest. It is equally important that the natural surface and subsurface drainage be away from the house toward the other buildings on the farmstead. This not only helps the appearance but often insures a

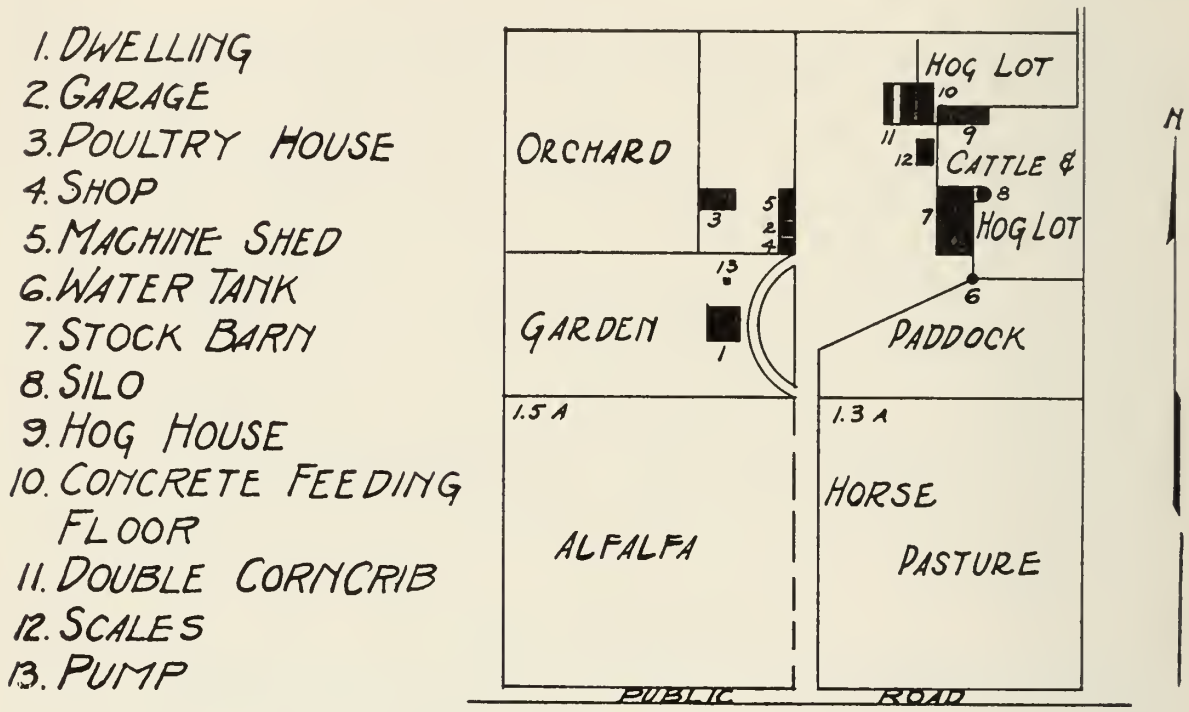


FIG. 21.—A GOOD LAYOUT FOR A FARMSTEAD ON A 160-ACRE CORN-BELT FARM

The farmstead layout shown in this figure has the following advantages: (1) The house is some distance from the road, but an open view is made possible by placing the house in front of other buildings. (2) The garden and orchard are adjacent to the house. (3) The poultry house is adjacent to the orchard, which provides runway for the poultry when it is needed. (4) The garage can be reached from the house without having to pass thru the barn lot. (5) Shop, garage, and machine shed are grouped to facilitate repair work. (6) The barns are to the east and north of the house, away from the prevailing winds. (7) The machine shed is on the way from the house and barn to the fields. (8) The water tank is accessible from three lots. (9) The feeding floor for the hogs is adjacent to the corncribs. (10) The buildings are as compactly grouped as fire hazard will permit, thus economizing on time spent in work about the buildings.

water supply that is not contaminated by seepage from barns and lots.

Many farm houses appear small in comparison with the other buildings. More prominence can be given the house by placing it on elevated land and surrounding it with good landscaping.

Arrangement of Other Buildings and Lots. The important points to consider in arranging barns, sheds, and lots are:

1. Their accessibility to the rest of the farm.

2. The placing of the buildings as close together as fire safety will permit.

3. Grouping together buildings used for the same kinds of livestock or for the same purpose.

4. Storage of feed close to or in buildings used for livestock in order to save time in doing daily chores.

5. Arrangement of the water system to permit watering livestock without moving them from one lot to another.

6. Arrangement of horse barn, machine shed, and watering tank for horses in such a way as to cause the least travel to and from the barn and fields. This will not only save time but machinery can be left at the machine shed when the field work is finished.

7. Locating buildings and lots giving rise to the most offensive odors farthest from the house.

8. Placing near the house the buildings and lots that are used most by the family or that are connected with interests that the women in the home help care for. Certain of these buildings may well be placed near the main path to the larger barns and lots. Poultry, for instance, is apt to be given more regular attention with such an arrangement than if located in an out-of-the-way place. Many steps will be saved in picking up and returning milk utensils, tools, and the like, if the buildings housing these lie between the house and the barns.

Locating the Farmstead. In addition to the actual arrangement of buildings and lots on the farmstead, there is the question of the general location of the farmstead itself in relation to the farm land. On most farms in Illinois the farmstead is already located, and farm buildings are usually of too permanent a nature to justify moving them. The unfavorable location of the farmstead may, however, in some cases justify moving the buildings if many of them are in such condition that they will soon need to be rebuilt. Another possibility, where it can be done to advantage, is to rent or buy land lying near the farmstead and sell the more distant land. When completely new sets of buildings are needed, opportunity is given to put into effect a good plan of field and building arrangement.

A well located farmstead means much saving of time. Carefully kept records have shown that where crop fields are located some distance from the farmstead, as much as one-fourth of the time devoted to crop work is spent in going to and from the fields. The poor location of a farmstead may be partially overcome by carefully rearranging the fields so as to bring some point of the field close to the farmstead. A situation about midway along the side of the farm which is on the highway is the most desirable one for the farmstead. While a farmstead so situated may not be so easily accessible to the various fields as one located in the center of the farm land, the home is not so isolated. If the road is not too heavily travelled, there will be advantages in having the farm land located on both sides of a road. The farmstead can then be both near the center of the farm land and near the road.

Planning for New Improvements and Equipment

While working out plans for fields and farmstead, careful estimates should be made of the expenditures that are likely to be necessary for new buildings, fences, machinery, and other equipment. One should be sure, too, of the benefits that will be gained thru each expenditure. Finally in purchasing building materials, machinery, fencing, and other supplies care needs to be exercised to keep expenditures in reasonable proportion to the total farm investment.

Buildings. Plans for buildings should take into account the possible future uses of such buildings. There is a distinct advantage in so arranging them that they may be used for more than one purpose. A shed type of building, for example, may be built to house machinery but in emergencies it can be used for livestock. Also a well-built open-shed type of building may, without much expenditure of capital, be converted into either a cattle-feeding shed or a dairy barn as occasion arises. Where buildings are especially constructed for one particular purpose, it is very difficult to change the organization of the farm business without either having completely to remodel buildings or to use them only partially. It would be practically impossible, for example, to use a dairy barn equipped with steel stalls and stanchions as a cattle-feeding shed if the time were to come when cattle feeding was followed on the farm instead of dairying.

On farms without large-sized machinery it may be advisable when building a new machine shed to provide wide enough sections so that larger machines can be accommodated when it is possible or necessary to buy them.

Proper sanitation for livestock makes it desirable that as many buildings as possible be of a movable type, or of less permanent construction, so that they can be moved from field to field. Whenever possible, buildings should be located so that they are readily accessible from more than one field.

Machinery. With machinery, also, one should anticipate the future farm needs and, in so far as possible, future changes that may take place in the size and type of machines. If, for example, the farm does not have a tractor, but the plan is to have one some day, then any machinery bought should be of a size and type adapted to tractor use.

Of course no machinery should be purchased until a careful estimate has been made of the amount of use that can be made of it. On the average farm many machines are used for a very short time each year. In considering the purchase of the largest machines, such as threshing machines, silage cutters, combines, and other expensive types, one may well consider the desirability of cooperative ownership, so that a lower cost of service may be secured by increasing the yearly use of the machine. Income from custom work will often carry the overhead costs on these more expensive machines.

Fencing. As the need for legumes in the rotations of east-central Illinois increases, more livestock will undoubtedly be pastured and this will require more fencing than at present. Depreciation, the cost of repairs, and interest on the capital invested in them are already items of heavy expense on many farms. Greater use is continually being made of temporary fences. This means that only those fields which are being pastured need to be fenced. If stock is used to pick up waste in the grain fields, a permanent fence around the farm can be supplemented with temporary fences where they are needed. Temporary fences can be moved when the ground is too wet to work at regular field work, or during days when field work is not demanding attention. Temporary fences not only require less capital investment than permanent fences, but the labor of cutting weeds that always grow along old fences is eliminated.

Fencing costs may be kept down by avoiding the use of lanes and by placing fencing around as large units as possible. Laneways are not only expensive to fence but they make it difficult to carry out plans of livestock sanitation which require stock to be moved to fresh land each year.

Financial Considerations

The preceding discussion of farm planning has been approached from the standpoint of the man occupying a farm and seeking to improve its organization. Before leaving the discussion some points relative to financing farming may be made both from the standpoint of the man who is contemplating purchase of a farm and from the point of view of the present landowner.

The availability of capital and credit to the individual farmer will have an important bearing on the farm plans that can be put into operation. Unless one has sufficient capital and credit at hand to purchase and operate a farm large enough to permit economical production, it is better to become a tenant and use available capital to equip the farm properly. On the whole, there is less risk involved in being a tenant than in being an owner. It may be best, therefore, for one to start as a tenant and continue on that basis until his ability is proven.

Selecting a Farm. Good judgment in the selection of a farm, either to rent or to buy, often has more influence on the income of the operator than good judgment in the organization and operation of the farm. Overpaying for a farm may handicap the owner for a life-time, and especially is this true when a large debt is incurred.

Every effort should be made to learn the productive capacity of land before it is either purchased or rented. Local conditions with respect to shipping facilities, local tax levies and proposed public improvements, local school and church facilities, together with the type of neighbors in the community, should also receive careful attention.

In estimating the value of the land, probable prices of farm products over a long period in the future, and not present prices, should be taken into consideration. At the close of the World War high prices for farm products raised the price of land to a level higher than earnings over a ten- to fifteen-year period would justify. While the experience of this period will be remembered a long time by many people, there will be a tendency for the younger generation to forget it too soon.

When buying land particular note should be taken of the improvements necessary for immediate operation. The points needing attention are: (1) whether the buildings and other improvements are such as could be used to advantage in the type of farming that will be followed; (2) whether the farm is under-improved and consequently will require a large outlay for new improvements in the near future; and (3) whether the price asked includes the value of improvements which are not essential, or at least would not need to be made until more capital was at hand.

Purchase Price. A considerable part of the purchase price of a farm should be in the hands of the buyer. He cannot count on making more than average returns from farming unless he has fully proved his ability as a superior operator in the community where the farm is located. By keeping careful farm records over a number of years before buying land and by comparing one's success with others in the community, one can get definite information as to his ability.

Even if a man were confident that he could make a 5-percent return on the land after meeting all expenses including labor, he would have to count on using a part of the income to meet family expenses. If, for example, he had to use two-fifths of the 5-percent income to meet such expenses, he would be able to pay 5 percent interest on but three-fifths of the value of the land and nothing would be left to make payments on the principal. If it is necessary to use this proportion of the net income for family expenses, it is clear that one should have capital for half of the proposed investment before purchasing. An advance in price of land does not help a man to pay off an indebtedness unless he disposes of his farm.

The amount of capital represented in the farm business in east-central Illinois is well illustrated by the inventories shown in Table 17. The data on which this table is based were taken from the records of representative farmers in the areas noted. The estimates were made by the farmers themselves working together in groups in appraising their property at present-day farm values.

Here we have an average investment of $45,000 to $60,000 per farm. The farms in the different groups include an average of 190 to 230 acres. About $200 an acre is the estimated value of the land exclusive of improvements and other farm property. Buildings and

other fixed equipment exclusive of the residence of the operator represent an investment of about $3,300 to $5,500. If they were new, they would of course represent a much larger amount. The same is true of the machinery and other movable equipment. However, since men even when beginning farming usually secure some of their machinery

TABLE 17.—DISTRIBUTION OF CAPITAL IN THE FARM BUSINESS ON TYPICAL FARMS IN EAST-CENTRAL ILLINOIS AS SHOWN BY RECORDS KEPT BY FARMERS IN 1926

Item	La Salle county	Wood-ford county	Ford and Iro-quois counties	Cham-paign county	Logan, Macon, and Piatt counties
Land	$44 181	$38 088	$45 985	$45 675	$43 069
Farm improvements except house	5 476	3 437	4 086	3 310	4 243
Machinery and equipment	2 004	1 400	1 547	1 583	1 594
Feed, grain, and supplies	3 152	2 628	2 932	2 826	3 521
Livestock, total	(2 836)	(2 234)	(2 181)	(1 949)	(2 885)
Horses	670	663	672	748	744
Cattle	1 335	730	778	656	1 012
Hogs	469	639	484	318	885
Sheep	241	55	63	24	90
Poultry	121	147	184	203	154
Total farm investment	$57 649	$47 787	$56 731	$55 343	$55 312
Size of farms, acres	203.8	191.0	231.2	225.0	226.8
Investment per acre, land only	$217	$200	$199	$203	$190
Total investment per acre	283	250	245	246	244
Percentage of land tillable	91	85	94.9	95.5	95.1
Number of farms	40	55	31	30	28

and equipment second-hand from public sales, the data in Table 17 may be taken as quite representative of the investments found on good east-central Illinois farms.

THE TEST OF FARM PLANNING

The value of farm planning is indicated by the success attained by men who have given intelligent effort to the problem. During the past fourteen years many men in Illinois have used the "Illinois Farm Account Book" in which to record facts concerning their farm business, and many have continued these records every year or nearly every year of the period. An analysis of these records yearly by the University of Illinois shows that some of the men have progressed more rapidly than their neighbors in developing good systems of farming. On all the farms where improvement in income has occurred, however, the cause can be traced to the gradual elimination of one weakness and then another that has been revealed by the farm records.

Not all the more successful men in a community have followed the same type of farming. The products sold have varied widely in number and in the proportion which they have made up of the total farm income. The point to be emphasized is that while the sources of income may vary, the operators that are succeeding are putting into practice many of the principles of good management outlined on page 262. The extent to which farms may vary in their organization and still be comparable in respect to earnings is illustrated by five farms in east-central Illinois (Table 18). *Farm 1* derives most of its income from the sales of feed and grain crops, with hogs as a secondary source of income. *Farm 2,* in contrast with No. 1, receives no income from the sale of feed and grain; nearly three-fourths of the income is from hogs, and a large part of the remainder is from cattle and dairy products. *Farm 3* derives its largest income from the sale of feed and grain; cattle and dairy products rank second; and a considerable income is derived from the sale of hogs. On *Farm 4* hogs account for a large part of the income, tho feed and grain crops also provide a considerable amount. *Farm 5* receives over 40 percent of its income from the sale of feed and grain and almost 60 percent from livestock and livestock products, the income from hogs and the combined income from cattle and dairy products being about equal.

The more common changes which these and other account-keeping farmers have made in order to improve their businesses are the following: more attention to soil improvement; better rotations of crops; larger proportions of higher profit crops; more effort to obtain better seed of high-yielding varieties; better field arrangement; more livestock and better types of livestock; livestock sanitation; balanced feeding of livestock and greater economy in feeding; better marketing practices; and the adjustment of power, buildings and equipment to the needs of the farm.

An operator whose farm is not giving the results which he might reasonably expect has many points to which to look for the cause. The factors that influence the cost of growing and harvesting a bushel of corn are analyzed in the accompanying outline. A similar chart might be made for each of the staple farm products. By checking an outline such as this, a farmer may note at what points he needs to make adjustments in order to increase the efficiency of his production. Sometimes a single factor is of enough importance to make considerable difference between profit and loss. Sometimes a few factors, seemingly of minor importance when taken separately, especially when considered from the standpoint of a single unit of product such as a bushel of grain or 100 pounds of livestock, may represent a total of no small importance when applied to an entire crop or livestock enterprise.

TABLE 18.—EARNINGS, ORGANIZATION, AND DISTRIBUTION OF CAPITAL ON FIVE SUCCESSFUL EAST-CENTRAL ILLINOIS FARMS, 1927

Farm No.	1	2	3	4	5
Rate earned	8.46%	8.12%	8%	7.81%	7.11%
Labor and management wage	$2 374	$2 369	$1 642	$3 528	$1 404
Size of farm, acres	220	197	162	320	143
Land area tillable	95%	94%	87%	95%	78%
Percent income, sources					
Feed and grain	75	..	59	21	43
Miscellaneous	5	2	..	1	..
Horses	..	1	..	..	..
Cattle	2	12	9	7	4
Hogs	12	73	13	71	25
Sheep	..	2	..	..	3
Poultry and egg sales	1	4	6	..	7
Dairy sales	5	6	13	..	18
Acres in harvested crops					
Corn	95	78	62	154	44
Oats	25	31	26	56	24
Wheat	30	..	33	9	20
Barley	..	12	..	..	..
Red clover	5	..	..	8	15
Sweet clover	10	..	10	30	..
Alfalfa	..	12	6	12	2
Soybeans	25	..	..	..	6
Mixed clover	..	42	..	..	..
Miscellaneous crops	..	12	..	..	..
Total	190	187	137	269	111
Crop yields (bushels)					
Corn	50	48	41	63	49
Oats	30	31	38	46	47
Winter wheat	20	..	23	23	21
Barley	..	32	..	..	..
Spring wheat	..	..	20	..	..
Number of—					
Work horses	7	6	6	11	6
Cows	4	7	7	3	8
Other cattle	2	5	4	36	7
Brood sows	4	32	5	40	3
Ewes	..	12	..	..	..
Chickens	60	117	105	..	151
Tractor	Yes	Yes	Yes	Yes	Yes
Investment per acre in productive livestock	$ 3.39	$ 34.53	$ 7.71	$ 16.70	$ 12.26
Receipts per acre from productive livestock	$ 5.68	$ 46.18	$ 11.65	$ 31.82	$ 17.99
Feeds purchased		2 766.96	68.00	772.00	199.00
Man labor cost per acre	4.65	7.09	6.62	6.04	6.76
Gross receipts per acre	28.27	47.58	28.32	40.45	31.00
Total expenses per acre	9.90	25.82	13.16	16.07	14.89
Net receipts per acre	18.37	21.76	15.16	24.38	16.11
Capital invested, total	$47 765	$52 780	$30 684	$99 865	$32 407
Land	37 400	37 430	23 887	72 000	24 000
Farm improvements	3 776	4 659	1 694	14 950	2 540
Machinery and equipment	1 225	1 635	1 291	1 454	1 749
Feed and supplies	3 939	2 209	2 223	6 116	1 888
Livestock	1 425	6 847	1 589	5 345	2 230
Total receipts	$ 6 219	$ 9 374	$ 4 589	$12 944	$ 4 433
Cash expenses and depreciation	$ 1 359	$ 4 336	$ 1 207	$ 4 423	$ 1 234
Unpaid operator and family labor	818	751	925	720	895
Net income from investment and management	$ 4 042	$ 4 287	$ 2 457	$ 7 801	$ 2 304

FACTORS AFFECTING THE COST OF PRODUCING A BUSHEL OF CORN

I. FACTORS AFFECTING OPERATING COSTS

A. Horse Labor Costs

1. Cost of keeping horses
   a. Feed costs
   b. Depreciation
   c. Labor
   d. Interest on Investment
   e. Shelter
2. Credit to horses for—
   a. Work done off of farm
   b. Production of good colts
   c. Value of manure
3. Hours of productive work obtained per horse, as influenced by:
   a. Size of farm
   b. Size and shape of fields
   c. Crop rotation
   d. Productive winter work for horses

B. Tractor Costs

1. Operating tractor
   a. Depreciation
   b. Interest
   c. Repairs
   d. Fuel and other operating expenses
2. Effective use of tractor
   a. Relieving peak load of labor in rush seasons
   b. Reducing number of horses
   c. Using tractor for belt and custom work

C. Man Labor Costs

1. Wages paid
2. Effectiveness of labor, as influenced by:
   a. Layout of fields
   b. Rotation of crops
   c. Methods of handling livestock
   d. Arrangement of work with reference to slack seasons
   e. Methods of harvesting crops, whether directly or with livestock

D. Machinery Costs

1. Interest on investment
2. Depreciation as affected by care while in use and protection from weather
3. Repairs
4. Other expenses

E. Other Operating Costs

1. Amount of overhead labor and other expenditures devoted to repairing buildings and fences, cutting weeds, caring for farmstead, etc.
2. Cost of seed, limestone, phosphate, and other items of soil improvement
3. Taxes and interest on investment

II. FACTORS AFFECTING CROP YIELDS

A. Soil Conditions
1. Natural fertility of soil
2. Use of manure, limestone, and other fertilizers
3. Use of legumes in rotation
4. Drainage
5. Physical condition of soil

B. Rotation of Crops
1. Proportion of land in legumes
2. Succession of deep and shallow rooted crops
3. Succession of light and heavy feeding crops

C. Seed
1. Variety
2. Vitality
3. Freedom from disease
4. Rate of seeding

D. Culture Practices
1. Preparation of seed bed
2. Cultivation
3. Control of weeds
4. Time of operations

E. Insect and Disease
1. Control by succession of crops
2. Seed treatment
3. Resistant varieties
4. Time of seeding

F. Seasonal Conditions
1. Rainfall
2. Temperature
3. Length of growing season
4. Hail, wind, or flood damage

One of the important points about successful production that is not brought out directly by such an outline is this—that much of the success in farming depends upon doing the many different things that should be done at the time when they should be done. A business that is so much dependent upon "natural" factors—season, weather, rainfall—and upon the control of disease and insects as is farming, is especially affected by any failure to do the right thing at the right time.

As the agriculture of a region grows older, farmers are brought face to face with problems of increasing importance. The once naturally fertile soil requires attention if its productivity is to be maintained or improved. Insect and disease hazards which formerly

were few in number become more and more numerous. Improved machinery offers more variation in the methods of growing and harvesting crops. Continued investigation provides more facts regarding the feeding and care of livestock. The improvement of transportation, storage, and other market facilities which bring farmers of one area into closer competition with those in other areas make marketing a more important problem. With all these developments careful study and planning of the organization and operation of the farm becomes continually more essential.