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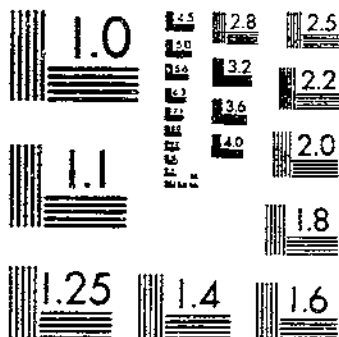
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TYPES OF FARMING IN NORTH DAKOTA

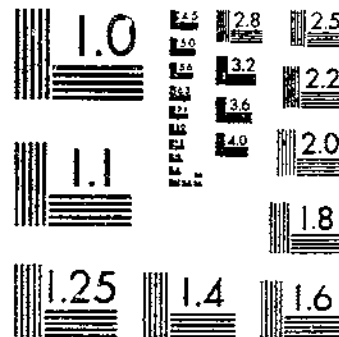
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UNITED STATES DEPARTMENT OF AGRICULTURE
WASHINGTON, D. C.

TYPES OF FARMING IN NORTH DAKOTA

By F. F. ELLIOTT and JESSE W. TAPP, *Agricultural Economists, Division of Farm Management and Costs, Bureau of Agricultural Economics, and* REX E. WILLARD, *Farm Economist, North Dakota Agricultural Experiment Station*

In Cooperation with North Dakota Agricultural
Experiment Station

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INTRODUCTION

In recent years a great deal of attention has been given to the development of regional, State, and local agricultural programs. The agencies sponsoring these programs have developed them as short-time or as long-time plans of work looking toward a better adjustment in the organization and practices of the rank and file of farmers.

Inasmuch as both farmers and farming systems vary so widely from State to State and in different type-of-farming areas within the same State such programs must be developed with accurate descriptions of these specific areas and groups in mind, otherwise they will be too general to be of much value. A program for the so-called "average" farmer is too indefinite. Blanket recommendations are

not specific enough and furthermore are likely to be misleading. What is needed is a segregation of farmers into specific groups on given sizes of farms and in homogeneous type-of-farming areas so that a correct appraisal can be made of the needs of typical groups and a true interpretation of the effect which changing conditions are likely to have upon them.

In this bulletin such a segregation and analysis is made of the agriculture of North Dakota. Methods are presented which indicate how special tabulations of census data may be used to supplement the usual agricultural census data in arriving at important type-of-farming areas in the State and in determining the typical farming systems for different sizes of farms in each area. Examples are also given illustrating how these typical farming systems may be used in conjunction with production and price information in testing out and appraising the profitableness of different types of farms as well as long-time and year-to-year adjustments in different farming systems.

The methods presented herein are equally applicable to other States and a number of the States are now cooperating with the Bureau of Agricultural Economics in making similar studies of their own agriculture. Henceforth, such studies will be published by the individual States.

The material used as a basis for the analysis and conclusions reached in this bulletin has been derived from a number of sources, including the Bureau of the Census of the United States Department of Commerce, and the Bureau of Chemistry and Soils, the Weather Bureau, and the Division of Crop and Livestock Estimates of the Bureau of Agricultural Economics of the Department of Agriculture. Special acknowledgment is made to W. L. Austin, Chief Statistician for Agriculture, Bureau of the Census, for cooperation in making special tabulations of 1925 census data.

MEANING OF "TYPE OF FARMING" AND "TYPE-OF-FARMING AREA"

The phrase "type of farming" as used in this bulletin relates to the kind, amount, and proportion of crops and livestock found on an individual farm. Thus a farm on which wheat, rye, and flax are grown almost exclusively may be spoken of as representing a cash-grain type of farming. "Type-of-farming area" is one in which there is a fair degree of uniformity in the types of farming represented by the farms in the area in which the soil, topography, climatic conditions, and price relationships are similar. In other words, a type-of-farming area is one in which a certain type of farming predominates.

Type of farming area in this sense considers the character of both crops and livestock grown, the amount and proportion of each, as well as the existing price relationships and the physical conditions under which they are produced. This is not, however, the meaning which is always attached to the term. Probably the measure which has been used more often than any other to differentiate types of farming or type-of-farming areas is that of source of income. Thus if a certain proportion, say 80 or 40 per cent, of the income

comes from a particular source this defines the type. Source of income under certain conditions may be a fair measure of type, but it is on the whole too unstable to be used with confidence as a final measure. This arises from the fact that the proportion of the income from different sources is constantly changing because of fluctuating acreages of crops, numbers of livestock, yields, and prices. Hence it is better to use this measure as a check in conjunction with other measures rather than as a final measure itself.

Still other measures have been used. Sometimes areas have been distinguished, for example, on the basis of a prevailing practice with respect to the kind of power and machinery used; method of harvesting a particular crop or growing and feeding out of a certain class of livestock; and character of tenure has sometimes been the measure on which the difference in areas turned. These distinctions between areas turn upon the difference in a single factor or practice. This may be desirable and satisfactory for certain purposes, as in the analysis of particular enterprises, but as a basis for differentiating specific type-of-farming areas it is not broad enough.

TYPE-OF-FARMING AREAS IN NORTH DAKOTA

The physical characteristics of a State with respect to soil type, topography, temperature, rainfall, and the like, roughly determine the way in which the land is utilized. Thus because of the prevailing distribution of these physical factors some sections of North Dakota have a larger proportion of the land area in farms than others; other areas, on the other hand, have a greater proportion of the farm area improved and in crops; and still other areas have more grazing and nontillable pasture land.

A diagonal line drawn from the western boundaries of Dickey and La Moure Counties in the southeastern corner of the State to Divide County in the northwestern corner roughly separates the important cropping and pasture areas. (Fig. 1.) The area north of this line is the important cropping center of the State, and the one to the south is devoted more extensively to pasture. In the latter area is included the area known as the Bad Lands. This area is included in the lightly shaded portion of Figure 1. Seventy-five per cent or more of the western half of Billings, eastern half of Golden Valley, south-central and eastern part of McKenzie and northern half of Dunn Counties is nontillable pasture land. Sioux County along the southern border of the State also has three-fourths or more of its area in nontillable pasture land. Here and there throughout these areas, however, are interspersed from one to several townships which can be and are used for crop production.

This classification of the land area of the State gives an idea of the broad general uses to which the land is put, but it does not show where the more important crops and livestock are grown nor indicate the area in which each is relatively most important.

The type-of-farming map for the State, (fig. 2) indicates the important type-of-farming areas within which the organization of farms and other conditions are similar. There is enough divergence in the crop and livestock organizations and in the conditions under which they are grown in the different parts of the State to

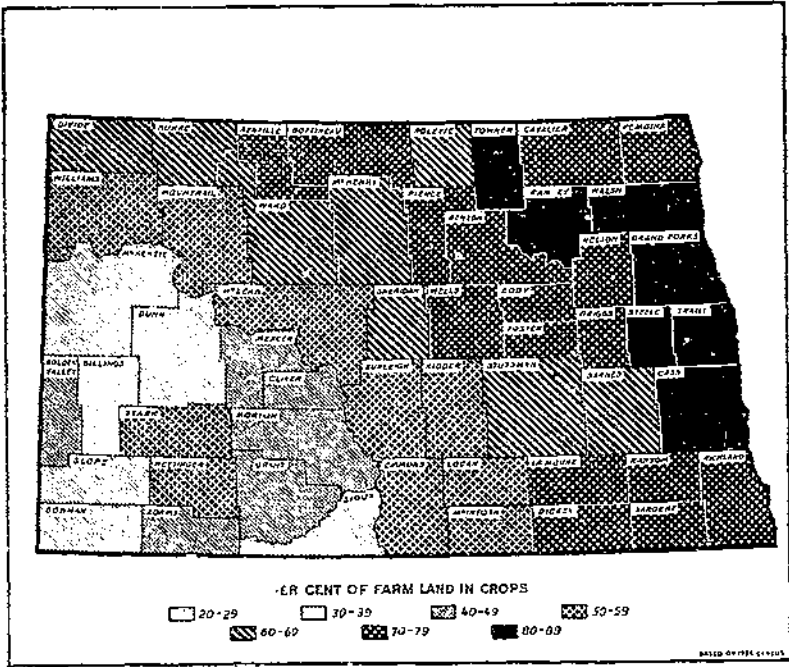


FIG. 1.—RELATIVE AMOUNT OF FARM LAND IN CROPS, BY COUNTIES IN NORTH DAKOTA

In the eastern and northern sections of the State a larger proportion of farm land is in crops than in the southwestern where the pasture area is more important

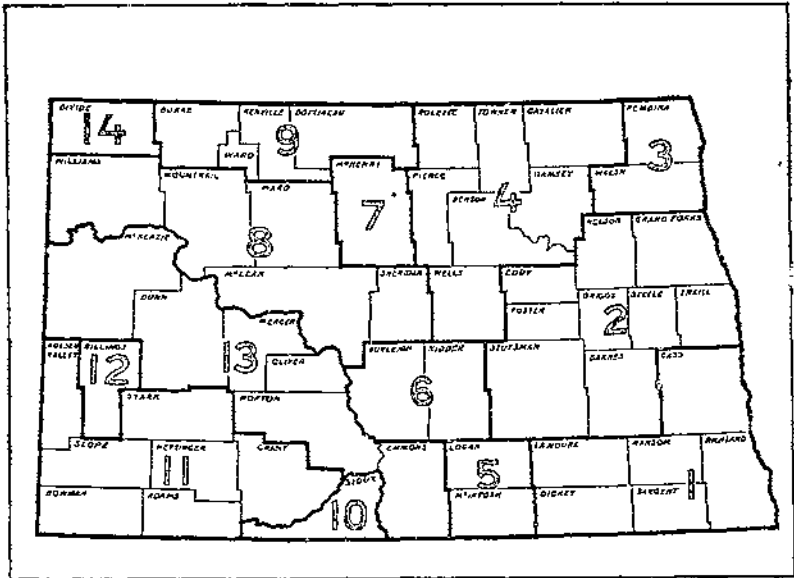


FIG. 2.—TYPE-OF-FARMING AREAS IN NORTH DAKOTA

There are 14 separate type-of-farming areas in the State. Since the production of the cash crops, wheat, rye, and flax are important in all sections, the differences between most of the areas are largely differences of degree rather than of kind

warrant the differentiation of 14 different type-of-farming areas. These areas vary considerably both in extent and in the number of counties included. Four of the areas comprise only 1 county each, 3 include 2, and the other 7 include from 3 to 9 counties each.

Inasmuch as county data are used as a basis for determining the type-of-farming areas, the lines dividing the different areas follow county lines. Data by smaller geographic units would make possible a more accurate line of demarcation. Such a dividing line at best, however, is probably a very indefinite one, gradually shading off from one area to another and frequently shifting position from time to time. The actual limits of these areas should not be considered as so definite and fixed as they appear on the map.

With the possible exception of southeastern North Dakota and portions of the country south and west of the Missouri River, the dominant kind of farming in the State is one in which cash crops are the center of the farming system. The distinction between the various areas, therefore, is more one of degree than it is one of kind.

For example, the chief difference between areas 3 and 4 turns largely on the amount of wheat, rye, barley, and oats grown. Wheat and rye occupy a larger proportion of the farm area in 4 than in 3, whereas oats and barley are relatively more important in 3. Likewise, the distinction between the other areas hinges in the same way on the proportion of the crops grown rather than on differences in kinds of crop or livestock. Probably the type of farming in area 7 in McHenry County is as distinct as any in the State—yet with the exception of the rye acreage the other crops are not very different.

A more detailed discussion of the distinction between different areas and of the dominant types of farming prevailing in each is presented in the latter half of this bulletin, pp. 21 to 49.¹

FACTORS CONSIDERED IN LOCATING AND DIFFERENTIATING THE AREAS

Three general groups of factors were taken into consideration and used as a basis for determining the different areas and the limits of each: (1) Physical factors, such as soil type, topography, length of growing season, and precipitation; (2) nature of crop and livestock organization, and (3) trend in acreage of crops and numbers of livestock. In addition to these three groups of factors some attention was given to the variation in crop yields and to the proportion of the total income from different sources.

SOIL TYPE AND TOPOGRAPHY

Generally speaking, such effect as soil type has upon types of farming comes about largely through its influence upon the physical adaptability of crops. Because of peculiar biological characteristics certain crops are particularly affected by the physical texture of the soil, others by its chemical content, and others by its water-holding capacity, or other factors. It is not so much a question of absolute

¹ Those interested in a more detailed presentation of data relating to the agriculture of the various counties in North Dakota are referred to the following bulletin: WILLARD, R. E., and FULLER, O. M. TYPE-OF-FARMING AREAS IN NORTH DAKOTA. N. Dak. Agr. Expt. Sta. Bul. 212, 268 p., illus. 1927.

adaptability as it is of relative adaptability. That is, it is not so much a question whether a crop will or will not grow on a certain type of soil as it is whether one crop will do better than others on such a soil. It is from this latter standpoint that the effect of soil upon farming types is primarily considered.

The soils of the Red River Valley are derived from the deposits of old lake beds and consist primarily of loams and sandy loams, with occasional patches of sandy land.² (Fig. 3.) Crop yields in this section of the State are higher than in any other part of the State. (Fig. 6.)

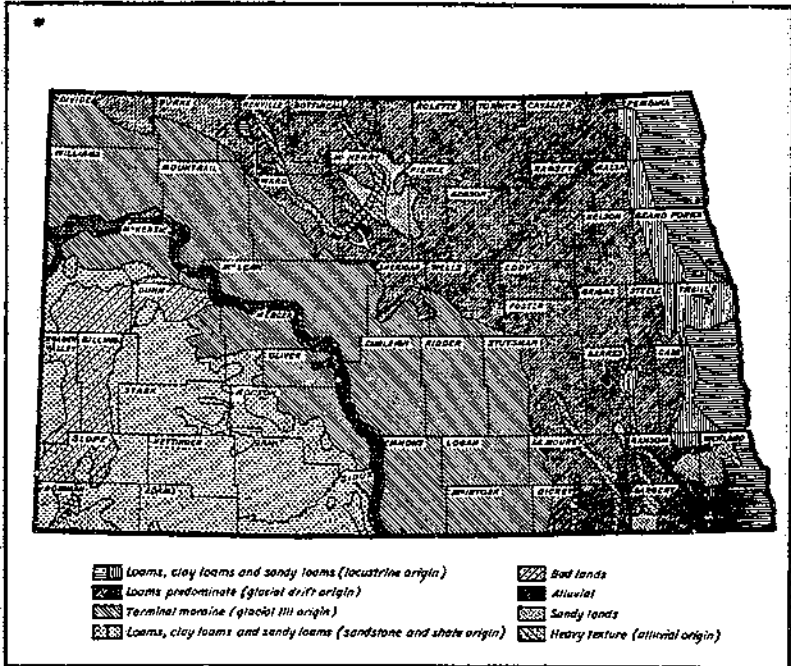


FIG. 3.—THE SOIL SERIES OF NORTH DAKOTA

The soils of the eastern part of the State are derived from the deposits of old lake beds. In other parts of the State either they are nonglaciated or are derived mostly from the weathering of glacial drift or glacial till.

To the west of the Red River Valley in a triangular area extending from Dickey and La Moure Counties diagonally across the State to Divide County and then back along the Canadian border the soils have been derived from the weathering of glacial drift. Loams predominate in this area and on the whole are probably less fertile than the soils of the Red River Valley but are much better drained, and as they are of a lighter texture they are more easily tilled. The yields in this section of the State, although somewhat less than in the Red River Valley, are higher than in most other parts of the State. (Fig. 6.)

²The material relating to soil type is taken largely from the following: WALSTER, H. L. THE SOILS OF NORTH DAKOTA. Quart. Jour. Univ. N. Dak. 14, 165-176, illus. 1924.

Within this broad area, and in Richland and Ransom Counties of the other area, are patches of soils of a somewhat different nature. These soils are of a decidedly sandy nature and are much less productive than those in the other areas already mentioned. There are two general areas of this type of soil which are important. One is in Richland and Ransom Counties and the other in McHenry and contiguous counties to the north and east.

Another important area of glaciated soil lies in a narrow belt of counties extending diagonally across the State from McIntosh and Emmons Counties in the south to Williams and Divide Counties in the extreme northwestern part of the State. The soil in this area presumably was derived from glacial till. Much of the area is rough in character, as it is largely terminal moraine country. The rock and other débris embedded in the ice were deposited as the glacier receded, and the resulting terrain is uneven and in many places rough and stony.

The area south and west of the Missouri River comprises largely nonglaciated soil. This soil, technically known as the Morton series, has resulted from the weathering of fine-grained sandstones and shales. The soils vary from loams to clay loams and clay; areas of sandy loams are occasionally found. The topography is undulating to rolling.

Probably the best example of the influence of soil upon the crops grown is found in McHenry County. The soil in this county is of a decidedly sandy nature, and largely because of the sandy soil this county is the most important rye center in the State, because rye does better on this type of soil than do wheat or the other small grains. The same situation is found in small areas in other counties of the State, notably in La Moure, Dickey, and Ward.

There are possibly other local areas where similar effects of soil type upon the type of farming are to be found, though in the main the other areas in the State, so far as soil type goes, appear to be about equally adapted to the crops that are grown. Other physical factors such as topography, length of growing season, and precipitation, have an influence apart from soil type.

The character of the land surface has an important bearing upon the type of agriculture followed. Because of the large amount of non-tillable pasture land in the southwestern part of the State, for example, the land is given over largely to grazing even though there are many areas of arable land within the rougher sections of the Bad Lands which are devoted to crop production. Topography in areas like the Turtle Mountain region in Rolette County and some of the terminal moraine country in the south and west-central part of the State also influence the agriculture to a considerable extent. But so far as the main crop-producing areas of the State go, topography is not a factor of great importance.

LENGTH OF GROWING SEASON

The length of growing season in the important type-of-farming areas of the State is shown in Figure 4. The extremities of the divided bars show the date in the spring when in four-fifths of the years the last frost is past and the date in the fall which is free from

frosts in four-fifths of the years. In other words, they show the length of the growing season for four-fifths of the years. By adding the extreme limits of the last frost in the spring and the first frost in fall to each end of the divided bars the complete picture is obtained.

There is considerable range in these extreme limits. The last frost in the spring was as early as April 15 in one year in area 8, for example, whereas in another year there was a frost as late as July in the same area. Extremes similar to this may be noted both in the spring and in the fall in practically all the areas.

In general, the length of growing season follows latitude but is modified in certain areas by elevation and possibly by bodies of water such as the Missouri River. Such an area seems to be found in parts

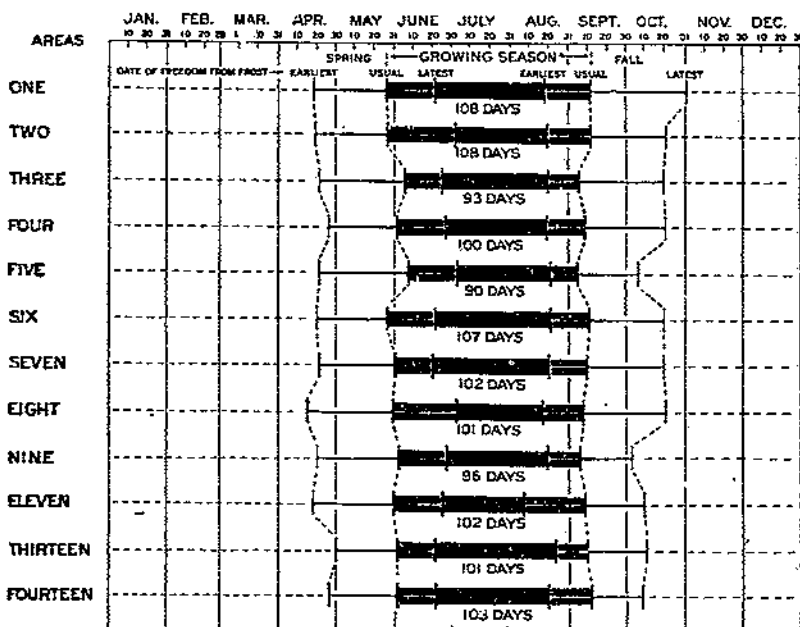


FIG. 4. LENGTH OF GROWING SEASON BY TYPE-OF-FARMING AREAS IN NORTH DAKOTA

The length of the growing season is most important in the case of corn. The longer growing season in area 1 accounts in part for the larger acreages of corn in that area.

of Logan and McIntosh Counties. It seems to be a common occurrence for this area to be visited by late killing frosts in the spring. The same is true of Pembina and Walsh Counties in the northeastern part of the State.

The most pronounced effect of this factor upon type of farming is to be found in the case of corn. The principal center of corn production is found in area 1 in the southeastern part of the State. In areas 1 and 2 the growing season is longer than in the other parts of the State. Area 1 also has a mean summer temperature and moisture conditions which are favorable to the growth of corn. In areas farther north these factors are not so favorable. Corn is grown but is used for fodder or silage. Farther west and in the southwest

moisture probably is the deciding factor. So far as the other major crops are concerned this factor is of less influence.

PRECIPITATION

North Dakota can be divided roughly into three general areas or belts according to the total annual precipitation. In the eastern third of the State the annual precipitation ranges from 18 to 24 inches; in the central portion from 16 to 18 inches; and in the western part from 12 to 16 inches. (Fig. 5.)

Between these general regions or belts and within each of them there is considerable variation in precipitation from month to month.

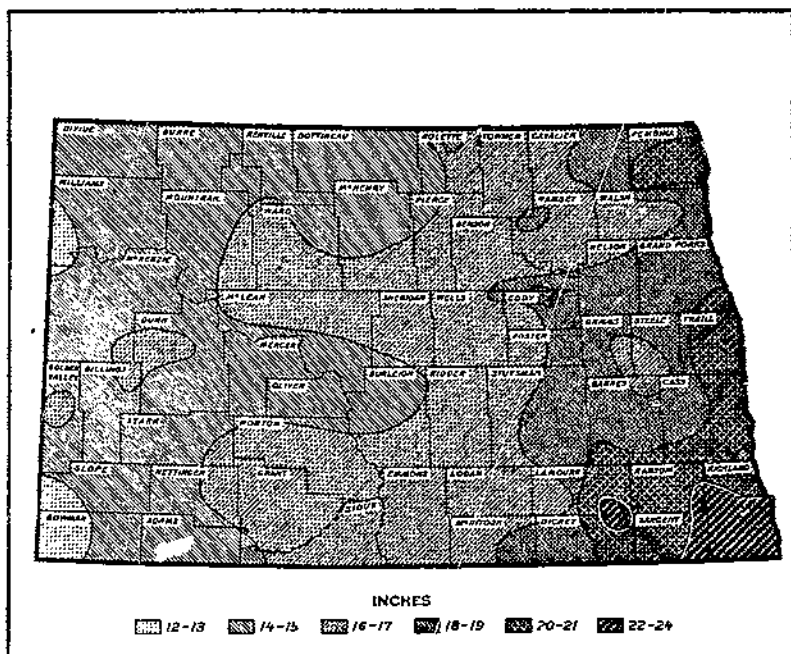


FIG. 5.—AVERAGE ANNUAL PRECIPITATION IN NORTH DAKOTA

The average annual precipitation decreases from 18 to 24 inches in the eastern third of the State to 12 to 16 inches in the western third. About three-fourths of the total precipitation comes during the growing season, from April to October

With one or two exceptions the peak of precipitation comes in June in all of these areas, although in some areas there is a more rapid falling off in subsequent months than in others. This is particularly true in the western areas, notably 11, 13, and 14. The amount of precipitation which comes during the fall and winter months in these areas is of considerable importance. The more moisture that can be stored prior to the growing season, the better chance these areas have of making a good crop the next year.

The precipitation also totals much higher in the early spring months in certain of the areas than in others. In certain of the Red River Valley counties where the level terrain and heavy type of soil make for poor drainage it does not take a large amount of pre-

precipitation in the early spring months to interfere appreciably with seeding operations. In these areas heavy rainfall at this time may be disadvantageous, whereas in the drier areas of the western part of the State the same amount would be decidedly advantageous.

For the majority of the areas of the State about three-fourths of the total precipitation comes during the growing season, from April to October. There is an actual range, however, from 11 to 17.5 inches. This divergence is of considerable importance in causing certain crops to center in some districts rather than in others. In the southeastern part of the State the rainfall during the summer months totals almost 10.5 inches which probably accounts in part for the relatively larger acreages of corn grown in this area.

When the average amount of rainfall verges on the minimum required for successful crop production, as is the case in a number of the western tier of counties, the variation in rainfall from year to year becomes very important. In fact, in many cases it means the difference between getting a crop and not getting one. Since the importance of this variation from year to year is measured by its effect upon crop yields, probably as good a way to show it as any is by an index of yields and an index of variability in yields for the important crops in the different counties of the State. Such indices reflect the influence of soil type as well as climate and at the same time give a rough measure of the relative productiveness of the different areas of the State. Such indices also summarize the effect of all these physical factors and give a partial basis for combining the counties into areas wherein conditions are similar.

INDEX OF YIELDS

The variation in the combined yields of five of the important crops in the State is shown in Figure 6. The crops included are wheat, flax, rye, barley, and oats. The average yield of each crop for 16 years was calculated for the whole State and for each county, and then the ratio of the latter to the former was taken. The resulting ratios for each crop were then combined into the index as given for each county.

INDEX OF VARIABILITY OF YIELDS

An index of yields for 16 years such as the above, gives a rough measure of the relative productiveness of the different parts of the State, but it does not indicate how stable these yields are year after year. A measure is needed which will show this, since it is just as important to know the variability in the yield as it is to know the yield itself. In Figure 7 is presented an index of variability of the yield of the five crops used in the other index. The method of computation is similar to that used in the other case. The coefficient of variation² in the yield of each crop for each county was first computed, and the figure for each county was related to the average for all counties. The resulting ratios for the different crops were then combined into an index for each county in the State.

² Coefficient of variation in yield is computed by relating the standard deviation yield to the 16-year average yield per acre; that is, coefficient of variation = $\frac{\sigma}{\bar{m}} \times 100$.

The counties in the eastern part of the State have less variability in yields than do the counties in other parts of the State. A comparison of Figure 7 with Figure 6 shows that, in general, the areas having high yields have low variability in yields and those with low yields have high variability. Under conditions such as these it is obvious that crop production in the area south and west of the Missouri River is much more uncertain and hazardous than it is in the eastern third of the State.

As shown by this index, the counties in the northern two-thirds of the Red River Valley are the most productive in the State. Reckon-

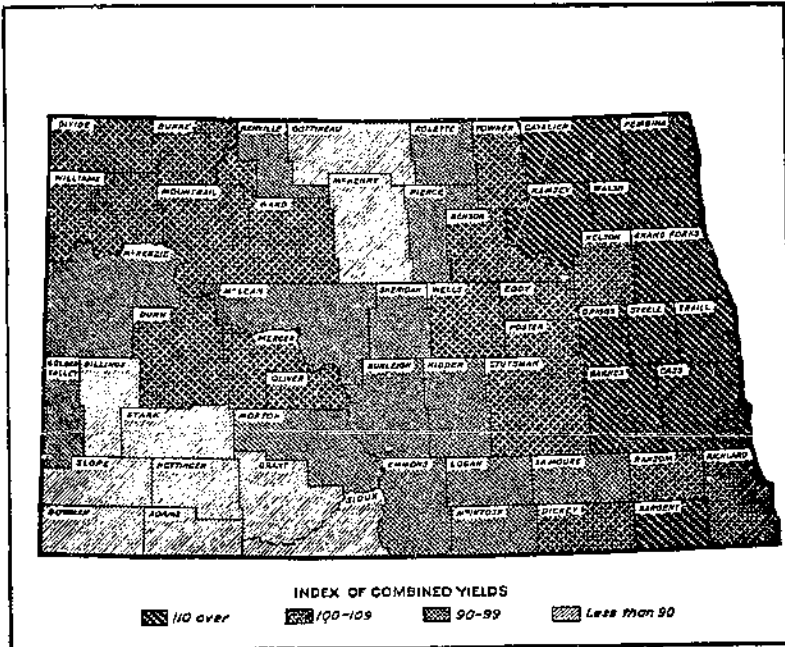


FIG. 6.—INDEX OF THE COMBINED YIELDS OF WHEAT, FLAX, RYE, BARLEY, AND OATS FOR 16 YEARS IN NORTH DAKOTA

Average crop yields are highest in the counties in the northern two-thirds of the Red River Valley and lowest in the range areas of the southwest and in McHenry and Bottineau Counties in the north-central section of the State

ing the average yield of the whole State as 100, the counties in this area have a yield which averages 10 to 25 per cent higher.

Pembina, Walsh, Grand Forks, Traill, and Cass Counties are the most productive of the Red River Valley, their production ranging from 8 to 15 per cent higher than that of the adjoining counties.

There are only two other groups of counties which have yields higher than the average of the State—one is a group of counties lying to the west and south of the group just mentioned, and the other in the northwestern part of the State and along the Missouri River. The former group comprises Sargent, Richland, Ransom, Dickey, Stutsman, Wells, Foster, Eddy, Nelson, Benson, and Towner Counties. The latter group includes Ward, Mountrail, Burke, Di-

vide, and Williams in the northwest, and Dunn, Mercer, and Oliver along the Missouri River to the south.

The counties through the central part of the State from north to south are next in relative productiveness, as shown by this index. They range from 25 to 35 per cent below the more productive counties in the Red River Valley. They have yields, however, which range from 10 to 15 per cent higher than do the yields in the counties in the southwestern part of the State. These latter counties,

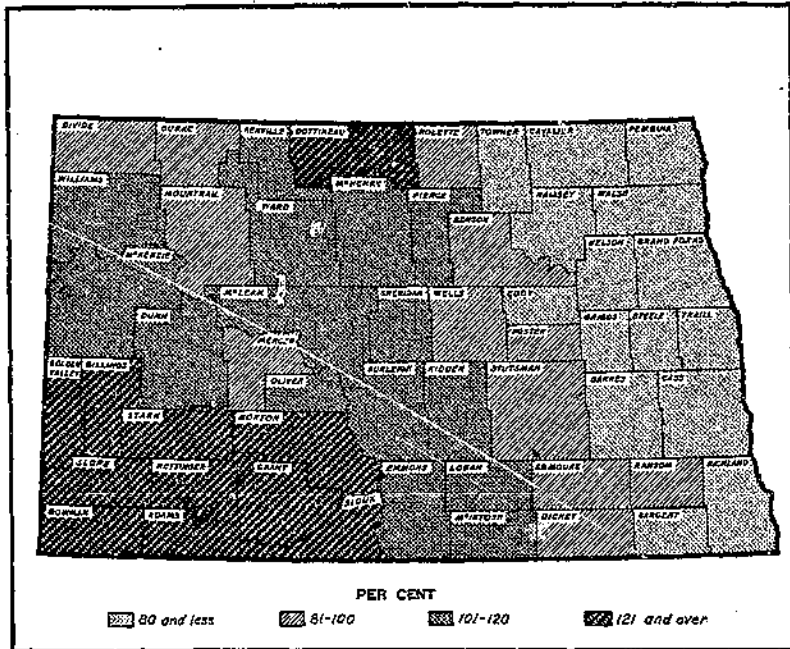


FIG. 7.—INDEX OF THE VARIABILITY IN YIELDS OF WHEAT, FLAX, RYE, BARLEY, AND OATS FOR 16 YEARS IN NORTH DAKOTA

Crop yields are most variable in those counties having relatively low average yields. Crop production in the area south and west of the Missouri River is more hazardous than in the eastern third of the State

including Sioux, Grant, Adams, Bowman, Slope, Billings, Stark, and Hettinger, according to this index, are the least productive in the State. McHenry and Bottineau Counties along the northern border are two other counties in which yields are relatively low. The low yields in these two counties are to be accounted for by the prevalence of a very sandy type of soil. The 16-year average yields per acre of wheat, flax, rye, barley, oats, and tame hay are shown, for the various type of farming areas, in Table 1.

TABLE 1.—Average yields per acre for 16 years of the important crops in the different type of farming areas¹

Area	Average yield per acre of—					
	Wheat	Flax	Rye	Barley	Oats	Tame hay
	<i>Bushels</i>	<i>Bushels</i>	<i>Bushels</i>	<i>Bushels</i>	<i>Bushels</i>	<i>Tons</i>
1.....	10.0 to 12.0	7.5 to 8.5	12.0 to 16.0	19 to 23	25 to 29	1.3 to 1.4
2.....	11.0 to 12.0	7.5 to 9.0	12.0 to 16.0	19 to 22	25 to 28	1.3 to 1.5
3.....	13.0 to 13.5	8.5 to 9.5	15.0 to 17.0	20 to 22	28 to 30	1.2 to 1.4
4.....	10.0 to 12.0	7.7 to 8.6	11.0 to 14.0	16 to 20	21 to 27	1.2 to 1.5
5.....	8.0 to 9.0	7.0 to 8.0	10.0 to 11.0	19 to 20	22 to 24	1.1 to 1.3
6.....	9.5 to 10.5	6.5 to 7.0	11.0 to 12.0	18 to 20	23 to 25	1.0 to 1.4
7.....	8.0 to 9.0	6.0 to 6.5	9.5 to 10.5	15 to 17	20 to 22	1.1 to 1.3
8.....	9.0 to 11.0	6.5 to 7.5	11.5 to 13.0	17 to 20	21 to 25	1.1 to 1.3
9.....	10.0 to 11.5	6.0 to 7.5	11.5 to 12.5	15 to 21	21 to 27	1.0 to 1.2
10.....	8.0 to 8.5	5.5 to 6.0	9.5 to 10.5	17 to 18	18 to 20	.8 to 1.0
11.....	8.0 to 9.0	5.0 to 6.5	9.0 to 12.0	16 to 15	20 to 22	.9 to 1.1
12.....	8.0 to 8.5	5.0 to 6.0	10.5 to 11.5	15 to 17	20 to 22	.8 to 1.0
13.....	9.0 to 11.0	6.0 to 7.5	11.0 to 13.0	18 to 21	23 to 26	1.1 to 1.2
14.....	12.0 to 12.5	6.5 to 7.5	12.0 to 13.0	19 to 21	26 to 28	1.1 to 1.3

¹ Because only a small proportion of the corn is harvested for grain, adequate data on corn yields either for grain or stover are not available.

NATURE OF CROP AND LIVESTOCK ORGANIZATIONS

The second group of factors taken into consideration in determining the type-of-farming areas in North Dakota has to do with the nature of the crop and livestock organizations handled in the different areas. Counties having about the same proportion of the farm acreage in the various crops and about the same proportionate amounts of the different classes of livestock were considered to have the same type of farming and consequently were grouped together.

In considering the similarity of crop and livestock organizations in the different counties several bases may be used. For example, the relative importance of the various crops may be determined by relating the area in each crop to (1) total land area, (2) total area in farms, (3) area in all crops, or (4) area in crops and pasture. Likewise, the importance of the various classes of livestock may be determined by relating the numbers of each to the same bases.

In considering the relative merits of these different bases it is important to keep in mind the twofold purpose of the analysis. The first objective is to determine the relative importance of the different lines of crop and animal production in the various parts of the State. The other is to get the data for all counties onto a comparable basis so that the counties may be grouped into type-of-farming areas in which there is similarity in crop and livestock organizations.

A close analysis of the results from the use of these bases indicates that so far as the type areas are concerned it does not make a great deal of difference which base is used, as the different bases give approximately the same grouping. In determining the counties which go together to make up the type-of-farming areas, therefore, the choice of the particular base to use need not occasion much difficulty, as one will be about as satisfactory as another.

From the standpoint of indicating the relative importance of the particular crops and classes of livestock in the different parts of the State, however, the use of some of the bases are more satisfactory for certain circumstances than others. None of the bases under con-

sideration are by any means ideal for all purposes. Under certain circumstances each of them has advantages which may warrant its use, but for some objectives there are important disadvantages in the use of either base by itself.

The individual farmer organizes his farm with the view of utilizing all of the land in his farm to the best advantage in so far as possible. In studying his farm and hundreds of others similar to it the utilization of the whole farm area must be shown if a complete picture of the type of organization followed is to be obtained. The base finally selected, therefore, should show the exact situation obtaining on the farms as a whole in so far as possible, and at the same time should indicate the relative importance of each enterprise in the different parts of the State or region.

If the crop area is used as the base, for example, the importance of a particular crop or class of livestock is overemphasized in those counties or areas in which the crop acreage makes up only a small portion of the farm area or total land area, especially where a large portion of the farm area is in pasture. This is illustrated in Figures 8 and 9. In Figure 8 the acreages of each crop and numbers of each class of livestock are related to the area in crops, whereas in Figure 9 the farm area is used as the base. Because of the relatively larger areas of pasture in the western part of the State the importance of both crops and livestock in the western counties as compared with the eastern counties is somewhat overemphasized in Figure 8.

A more complete picture of the relative importance of all lines of production in the different parts of the State is given in Figure 9 because it shows the relative importance of the pasture area in relation to crops and it relates livestock to both crop and pasture area. In an area like much of the territory south and west of the Missouri River, where a large portion of the farm area is in pasture, it is obvious that data showing the number of livestock in relation to the acres in crops are not strictly comparable with data arrived at in the same way in other parts of the State where a much larger percentage of the land area is in crops. In a State where the crop area constitutes a more uniform proportion of the farm area this difference, due to the two bases, would not be so important.

The same difficulty arises under certain conditions if farm area is used, particularly in a range country where the area in farms is considerably short of the total land area. Either crops or livestock figured on a farm basis under such conditions will not be comparable with figures calculated in the same way in areas where the farm area is more nearly equal to the total land area.

Under such conditions it may be well to shift from the farm area basis and use crop area plus pasture or total land area instead. However, total land area is not a reliable base under most conditions since it includes land in cities, streams, roads, swamps, bluffs, etc. There obviously is no point in including land used for such purposes in determining relative importance of different lines of agricultural production. In some areas, especially where there are large acreages of unutilized woodland or cut-over woodland in farms, the total crop and pastures area may be a more satisfactory basis than either total farm area or crop area alone. In a State where conditions are fairly homogeneous, however, as was pointed out above, it does

not make a great deal of difference which base is used as they will give essentially the same results, especially so far as the delimitation of type-of-farming areas is concerned.

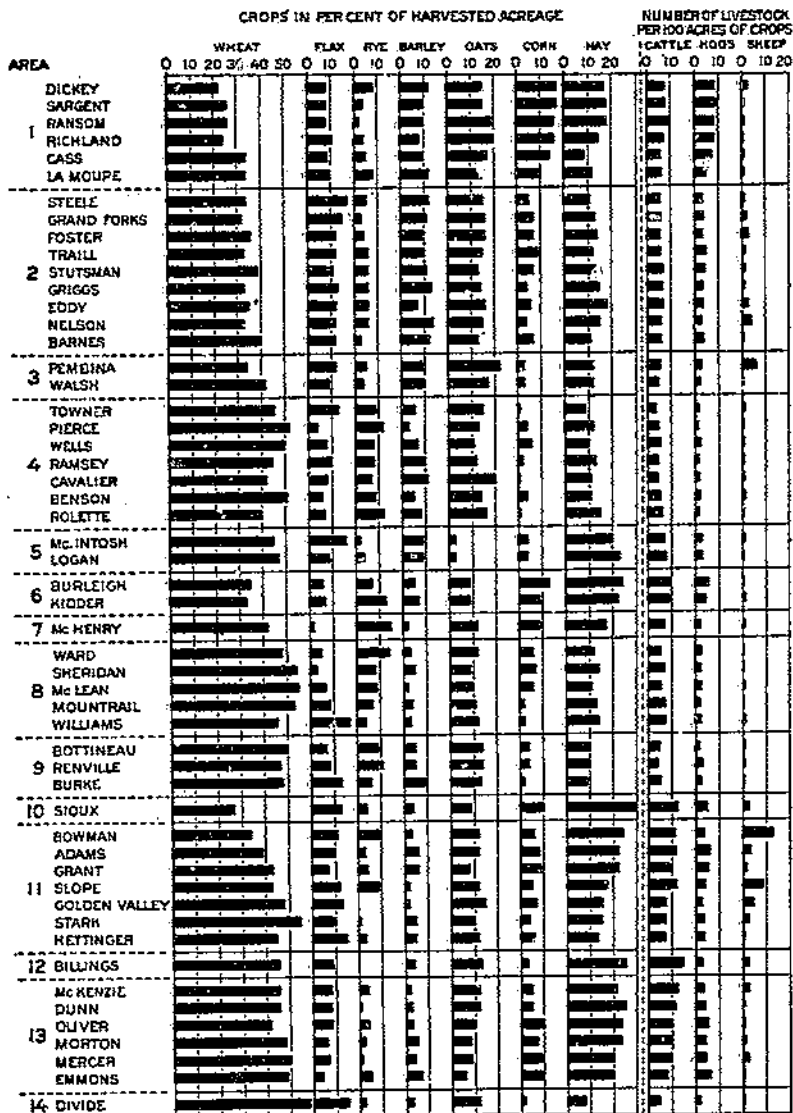


FIG. 8.—DISTRIBUTION OF THE CROP AREA AND CLASSES OF LIVESTOCK BY COUNTIES AND TYPE-OF-FARMING AREAS IN NORTH DAKOTA

The same enterprises are found in all sections of the State but in different proportions. Wheat, oats, flax, and hay make up a large proportion of the crop acreage in all sections. Corn is important in area 1.

TRENDS IN ACREAGE OF CROPS AND NUMBERS OF LIVESTOCK

The third group of factors considered in determining the type-of-farming areas in the State relates to trends in production. Shifts

in the acreage of crops and numbers of livestock are taking place constantly in most farming areas. A knowledge of the nature of these changes and of the direction in which the farming types are

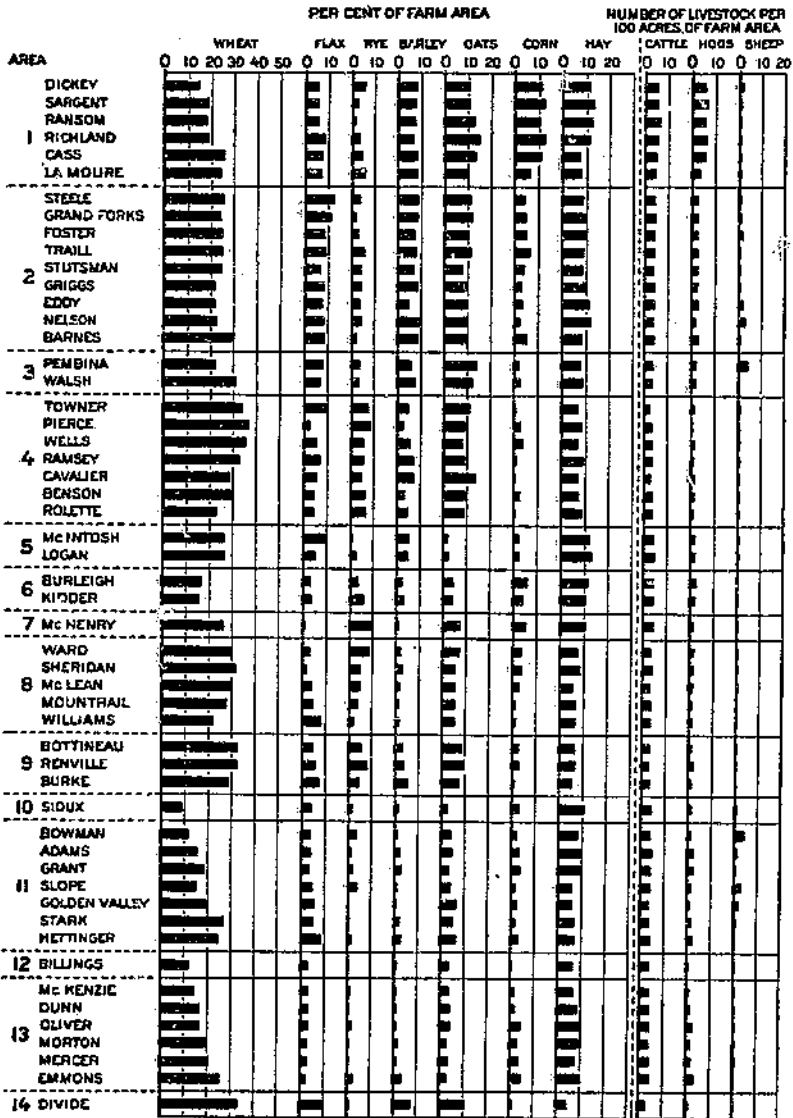


FIG. 9.—DISTRIBUTION OF THE FARM AREA AND CLASSES OF LIVESTOCK BY COUNTIES AND TYPE OF FARMING AREAS IN NORTH DAKOTA

When the distribution of the entire farm area is considered, pasture is an important item, especially in the southwestern part of the State

moving in the different parts of a State is essential to correct delineation of type areas.

Determining such areas on the basis of similarity in physical conditions or in present crop and livestock organizations alone is likely to

be misleading, since the trends in these organizations in the counties so grouped may be diametrically opposed to each other. The farmers in adjoining counties, for example, may happen to have the same percentage of their farm area in the same crop or crops at any particular time, yet may be moving toward different types of farming.

On the other hand the two groups may be moving in the same direction yet one group may be lagging considerably behind the other. Thus in almost any farming community a small minority of farmers will be found who are considerably in advance of their neighbors both in the adoption of new methods and practices and in the selection and proportioning of the different crops and livestock enterprises.

With the view of determining to what extent differences in trends exist, the trend in acreage of each crop, as shown by data from the

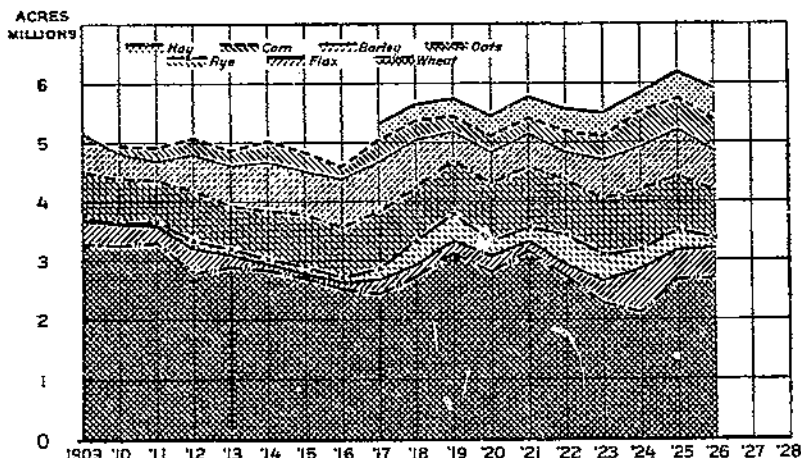


FIG. 10.—ACREAGE OF THE IMPORTANT CROPS IN NORTH DAKOTA, AREAS 1 AND 2; 1909-1926

The downward trend in wheat acreage in these areas has been accompanied by an upward trend in the acreage of corn, oats, barley, and hay. Because of the difference in the size of the different areas, the acreages shown in Figures 10, 11, 12, and 13 are strictly comparable only with respect to trend

Division of Crop and Livestock Estimates of the Bureau of Agricultural Economics of the Department of Agriculture was determined for the various counties in the State. The results of this analysis for the years 1909 to 1926 are shown in Figures 10-13. The counties having similar trends in acreage were grouped into areas.

VARIATION IN CROP ACREAGE TRENDS

The trend in the acreage of the different crops has varied considerably in the different parts of the State. This is particularly noticeable in the case of the acreage of wheat, the most important crop grown in the State. The trend in acreage of this crop from the standpoint (both of direction and of rapidity of change) has been directly opposite in some areas. In general the trend in acreage has been downward in the eastern part of the State and upward in the

western part. The most pronounced downward trend has been in the southern part of the Red River Valley in the half-dozen counties located in the southeastern part of the State. In the counties just

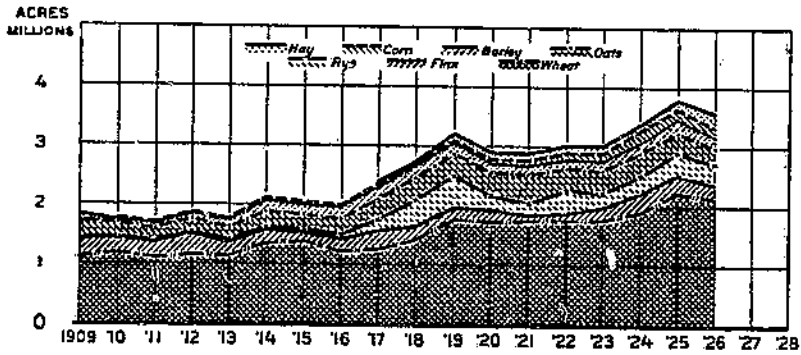


FIG. 11.—ACREAGE OF THE IMPORTANT CROPS IN NORTH DAKOTA, AREAS 6, 8, 8, AND 14; 1909-1928

The acreage of wheat and all crops has tended upward in these areas for the entire period. Year-to-year changes in the acreage of certain crops have sometimes been at the expense of other crops

to the north and extending as far west as Stutsman and Eddy Counties the same tendency downward in the acreage of wheat is to be noted although it has been much less rapid.

In these two areas, particularly in the former, the trend away from wheat has been accompanied by a trend toward the feed crops, such

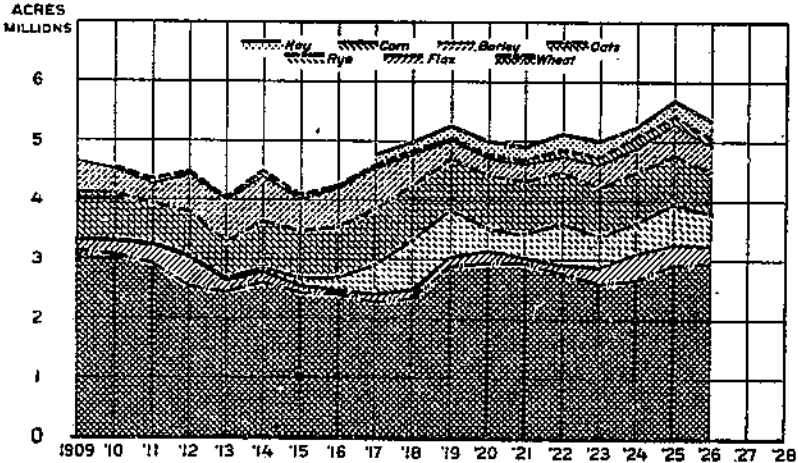


FIG. 12.—ACREAGE OF THE IMPORTANT CROPS IN NORTH DAKOTA, AREAS 3, 4, 7, AND 9; 1909-1928

In contrast to areas 1 and 2 wheat acreage in these areas has been relatively constant. Rye and flax acreage have increased slightly as have the acreages of the feed crops

as corn and hay, and to a somewhat lesser extent toward barley and oats. Since 1921 there has been an increase in the flax acreage in both areas.

In the counties to the north, adjoining the Canadian border and extending over to the central part of the State, the acreage of wheat has fluctuated rather widely from year to year, but there has been no pronounced trend upward or downward for the years for which data are available. Changes in wheat acreage from year to year in these areas have been offset almost entirely by opposite changes in the barley, rye, and flax acreages.

In the counties south and west of the Missouri River, as well as in the counties just to the east and north of the river, and in Divide County, in the extreme northwestern corner of the State, there has been a pronounced upward trend in the total acreage of wheat and a still more pronounced increase in the acreage grown per farm. The up-and-down fluctuations from year to year have been counter-balanced by opposite changes primarily in rye or flax. Corn and barley, in addition, have been important alternative crops in the counties in the southwestern corner of the State.

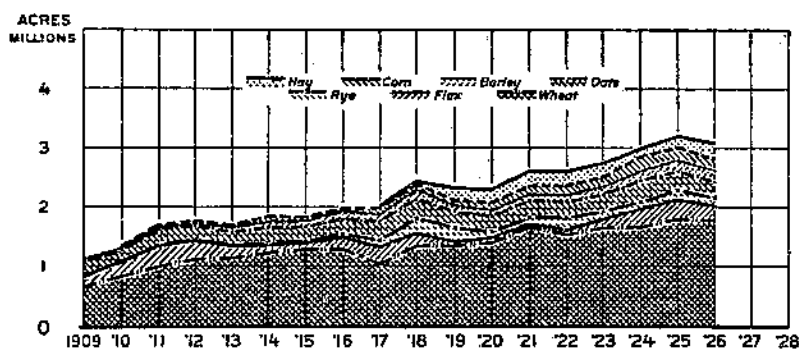


FIG. 13.—ACREAGE OF THE IMPORTANT CROPS IN NORTH DAKOTA, AREAS 10, 11, 12, AND 13; 1909-1928

There has been a pronounced upward trend in the acreage of all crops in these areas in the southwestern part of the State

REASONS FOR ACREAGE CHANGES

A thorough analysis of the factors causing both long-time and year-to-year changes in the acreage of the important crops has not been made. A number of correlation studies were made, however, in the different type-of-farming areas in the State in an attempt to get at the factors determining the fluctuation in the acreage of wheat in each of them. Largely because of the poor character of the data relating to acreage the results of these correlation studies are not considered conclusive.⁴ Their chief value at present lies in indicating what more detailed studies, based upon more adequate data, subsequently may establish as the more important factors instrumental in causing both long-time and year-to-year shifts in acreage.

Because of the differences in trend in acreage in the different areas, and also because of more homogeneity in organizations and conditions in specific areas, the analysis was made by type-of-farming areas. Farmers tend to shift the acreages of particular crops in response to changes in price relationships and other factors according to the

⁴The coefficients of multiple correlation (R) varied from 0.66 to 0.92 in these areas.

peculiar conditions prevailing on their farms. By localizing the analysis as much as possible, the chance that compensating factors will enter to smooth out the significant variations and relationships is lessened.

The results of the analysis of changes in wheat acreages in the different areas point to the conclusion that the most important factors determining both long-time and year-to-year changes in wheat acreage are as follows: The price of wheat; the ratio of the acre value of wheat to the acre value of alternative grains; and climatic conditions at seeding time. Another factor which probably has had some effect in certain areas, though not subject to statistical measurement, is the damage from black stem rust and the presence of noxious weeds such as wild oats, quack grass, and sow thistle. The growing infestation of these weeds unquestionably has been a factor in causing the shift from wheat toward intertilled crops in parts of the Red River Valley.

When the ratio of the acre-value of wheat to the acre-value of alternative grains is high (in favor of wheat), at time of seeding, apparently farmers in all areas of North Dakota tend to increase the acreage of wheat seeded. The amount of the increase, however, varies in different parts of the State, a given change in the ratio resulting in greater changes in acreage in certain areas than in others.

This is particularly true in those areas such as southeastern North Dakota, in which alternative opportunities in the production of feed crops are so readily available. In years in which wheat prices are low in comparison with the prices of livestock and livestock products, farmers apparently tend to reduce their acreage of wheat considerably and replace it with increased acreages of the feed crops such as corn, barley, and hay, which are marketed through livestock. On the other hand, when wheat prices are relatively high they again increase their wheat acreage and cut down on the feed crops. Much the same relationships are to be noted between changes in wheat and other cash-crop acreages, such as flax and rye.

Farmers apparently are more influenced by relative than by actual wheat prices at time of seeding, but changes in actual wheat prices previous to seeding time seem to have an influence upon the acreage seeded. When prices received for the previous year's crop of wheat have been high, farmers have tended to increase the acreage of wheat seeded in the spring of the current year.

The other factor, climatic conditions at seeding time, also apparently has some influence upon the acreage seeded. This influence varies considerably in the different parts of the State. In the Red River Valley, particularly in the southern part, the acreage of wheat seeded decreased somewhat when there was heavy March and April rainfall. In this area, with its level terrain and heavy type of soil, it does not take a great deal of rainfall to keep farmers out of the field; if this loss of time is prolonged it will obviously cause a reduction in the acreage seeded.

The effect of this factor upon acreage seeded in other parts of the State is of much less importance, and such effect as it has is directly opposite to the effect in the area just cited. In the areas in the western part of the State the analysis shows that increases in early spring rainfall were accompanied by increases in acreage of wheat

seeded and vice versa. This direct relationship between changes in early spring rainfall and changes in acreage seeded is to be expected in areas such as these where the total rainfall verges on the minimum for successful crop production. Furthermore, in these dry areas, it may be that the amount of rainfall in the late summer and fall months will affect acreage seeded the next spring as much or more than does the rainfall at time of seeding. The amount of moisture which can be stored the previous year is often an important determinant of the next year's crop.

Under ordinary conditions the effects of these climatic factors are more directly related to year-to-year changes in acreage than they are to the trend in acreage. Yet they are not unimportant even in influencing the trend. Probably the most important effect in this direction is due to the influence of climate upon yield of crops and the relation of this, in turn, to the profitableness of the crop. In a semiarid country a succession of dry years may have a discouraging influence not only upon the expansion of the acreage of a particular crop but even in the maintenance of that acreage. Under such conditions, if at all prolonged, there is likely to be a rather wholesale migration away from the particular area either toward the city or toward more humid agricultural areas. Such movements obviously may have a pronounced influence upon the trend in the acreage of one or all crops.

Another factor, which has not been taken into account, includes the introduction of new varieties of crops, adoption of new methods and practices, and use of improved machinery. All of these things may have a great deal of influence in causing new lands to be brought into cropping or in causing one crop to expand faster than another.

No doubt there are other factors that have an influence upon acreage changes, some of which are not susceptible to statistical measurement. The factors which have been discussed have been found to have an influence. Until more accurate data are available and a more thorough analysis is made, however, these results should be considered as tentative.

TYPICAL FARMING SYSTEMS IN EACH TYPE-OF-FARMING AREA IN NORTH DAKOTA

The dominant types of farming in the various major type-of-farming areas are different. The dominant type of farming, however, is not found to the exclusion of all other types in any of these type areas, for in each area a considerable variation is found in the kinds of farming carried on by individual farmers.

In area 1, for example, the dominant type of farming includes some dairy or beef cattle, some hogs, and crops grown primarily for feed as well as the cash grain crops wheat, rye, or flax. But many farms in this area are devoted almost entirely to cash-grain production—to the practical exclusion of feed crops and livestock. On other farms feed crops and livestock are of primary importance and little or no attention is given to cash-grain production.

A number of important factors are responsible for the differences in the kinds of farming carried on by different farmers in the same

area who are operating under very similar conditions. One of the most important reasons is the fact that some farmers act more promptly than others in adjusting their farming business to changing conditions that affect the selection of profitable enterprises. In southeastern North Dakota, for example, there is a distinct trend toward mixed grain and livestock farming. Nevertheless, some farmers in this area are still operating on a straight cash-grain basis, similar to the type of farming generally followed a decade or more ago. Thus the present differences in the organization of farms in this area are due in part to the slow response of some farmers to the conditions which have favored the growth of mixed grain and livestock farming as contrasted with the pioneer type of cash-grain production.

Other factors are also partly responsible for the differences in the kinds of farming carried on by farmers operating in the same general type-of-farming area. The available supply of family labor often has an important bearing upon the relative importance of enterprises on different farms in the same area. The production of butterfat, for example, requires more labor throughout the year than the production of beef. Thus some farmers, who have ample assistance in the way of family labor, may keep dairy or dual-purpose cows whereas other farmers who lack such assistance keep beef cattle. The available supply of family labor or of regular hired labor is an important factor affecting the reaction of different farmers to the same general economic and natural conditions.

Local differences in soil type, topography, or other natural conditions are often responsible for rather wide differences in the organization of farms in the same locality. The presence of areas of good farming land in some of the range territory of the southwestern part of the State, for example, accounts for the fact that moderate-sized mixed grain and livestock farms are found alongside of the ranches.

The size of farms from the standpoint of total acreage included also reflects the influence of many factors. During a period of settlement the size of farms reflects to a large degree the land policy with respect to the acreages sold. Thus, much of the land in North Dakota was settled in quarter-section homesteads. In 1900 about three-fourths of the farms in McHenry, McLean, Ward, Williams, and Bottineau Counties were approximately one-quarter section in size, thus indicating the effect of the homestead policy upon size of farms. Twenty-five years later, however, less than one-fifth of the farms in these counties were of the original homestead size. This change in the size of farms took place because most farmers found it necessary to operate farms of one-half to three-quarters of a section or larger in order to operate at a profit.

After the settlement period is passed the prevailing size of farms tends to approximate the size which most farmers can handle most effectively considering the type of farming commonly followed. Thus the half-section farm has come to be rather typical in most sections of North Dakota. There are many farmers who operate larger areas, but, on the other hand, some smaller farms are found in all sections of the State. These smaller farms often represent the division of a larger farm among the several heirs of the former

operator, or the continued operation of the farm that was settled as a homestead.

The most common systems of crop and livestock organization on farms in the various type-of-farming areas are shown in Figure 14. The 320-acre farms were most common in all but two of the localities for which detailed data were obtained as to size of farms, and crops and livestock grown on individual farms. In one of these areas, in Logan County, the 480-acre farms were most numerous; in the other, in Mountrail County, the 160-acre farms were most numerous.⁶

A comparison of the most common farming systems on half-section farms in the various parts of the State illustrates in a general way the differences in the dominant farming types in the different areas. The data as to crops and livestock on typical farms in Towner and Sargent Counties, for example, show the difference between the cash-

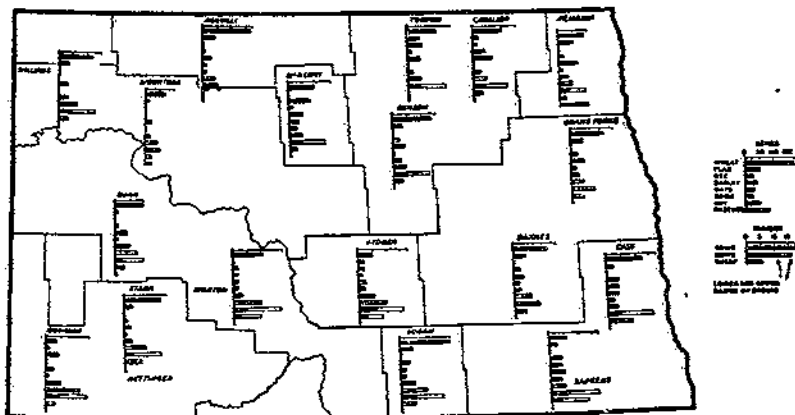


FIG. 14.—MOST COMMON FARMING SYSTEMS IN SELECTED AREAS IN NORTH DAKOTA

Half-section farms are most common in eastern North Dakota, with the exception of area 5, where three-quarter section farms are most numerous. Wheat is the outstanding crop in all sections. Corn is a close second in area 1 but is not so important in the other areas. Pasture area on typical half-section farms south of the Missouri River is about twice as great as on farms of the same size in the northwestern part of the State. Rye is an important crop in McHenry County.

grain farming that is fairly typical of the northern part of the State and the mixed grain and livestock farming which is more typical of the southern and particularly the southeastern parts of the State. (Fig. 14.) In Towner County, 190 of the 255 acres in crops on the typical 320-acre farms are devoted to wheat, flax, and rye, whereas in Sargent County only 85 acres are devoted to these crops. On the other hand, 165 acres of feed crops, oats, barley, corn, and hay are grown in Sargent County, as contrasted with 65 acres of these crops in Towner County. From 4 to 9 cows, but practically no hogs, are kept on the Towner County farms, whereas 5 to 12 cows and 3 to 10 sows are kept on the typical half-section farms of Sargent County.

⁶ The area in Mountrail County is located in the hill section where probably a considerable amount of "free" grazing is done with the quarter-section farms actually reported representing only the headquarters of owned or leased land operated. The farms in this locality therefore are not typical of the strictly farming sections of the area.

METHOD OF SELECTING TYPICAL FARMS

The typical systems of farming which are presented for each of the important type-of-farming areas in the State are the result of a detailed analysis of special tabulations of census data for 1924. Representative subareas comprising from four to eight contiguous townships were selected in each type area, and the detailed organization of all the farms therein were analyzed and used as a basis for generalization respecting the organizations of the total number of farms. With one exception the number of farms in the selected areas was between 150 and 400. This number represents a sample which is large enough to be reliable under conditions usually obtaining in this State, especially for the more common types of organization. The extreme farms, however, are not quite so reliable. They represent unusual conditions and must be considered as such.

The method of analyzing these data to find the typical farm organization in area 1 is discussed below. The same method was used in the other areas.

In area 1 detailed information was obtained on approximately 500 farms, in two subareas, one in Sargent County and one in Cass County.

SIZE OF FARM

Distribution by size groups of the farms in the selected areas of Cass and Sargent Counties is shown in Table 2. There are more farms in the 241-400-acre group than in any other. Since most of the farms in this group are approximately 320 acres in size the half section farm may be regarded as the most common size of farm in this area. About one-third of the farms in Cass County and over two-fifths of the farms in Sargent County are of this size. A relatively larger proportion of the Sargent County farms, however, are 240 acres or less, whereas the three-quarter section farms or larger are more common in Cass County.

TABLE 2.—Distribution of farms by size groups in selected areas in Cass and Sargent Counties, N. Dak., 1924

Size group (acres)	Percentage of all farms in each size group in the selected areas in—		Size group (acres)	Percentage of all farms in each size group in the selected areas in—	
	Cass County	Sargent County		Cass County	Sargent County
	Per cent	Per cent		Per cent	Per cent
240 and under.....	16.0	31.6	721 to 880.....	2.6	1.9
241 to 400.....	34.0	44.5	881 to 1,040.....	4.6	1.4
401 to 500.....	20.6	13.2	1,041 and over.....	4.0	.8
501 to 720.....	18.0	6.5			

Census data indicate that since 1900 there has been an upward tendency in the number of farms of 320 and 480 acres. The number of 160-acre farms during this same period has been declining. For the very large farms there has been but little change, although the relative importance of these larger farms has decreased somewhat.

VARIATION IN ORGANIZATIONS ON FARMS OF DIFFERENT SIZES

There is considerable variation in the organization of farms of the same size as well as in groups of farms of different sizes. An important indication of the type of farming followed is the proportion of the crop area devoted to the production of the cash-grain crops—wheat, rye, and flax. The proportions of the farms in the different size groups having various percentages of their crop area in cash crops are shown in Figure 15.

Approximately two-thirds of the farms are in the three size-groups ranging from 241 to 720 acres, most of these being half section, three-quarter section and section farms. The distribution of the farms in these three size groups according to the proportion of the crop area in cash crops is very similar. (Fig. 15.) From 60 to 75 per cent of the farms in each of these groups have 31 to 60 per cent of the crop area in cash crops. On the half section and section farms from 31 to 40 per cent of the crop area in cash crops is most common. On the three-quarter section farms, 41 to 50 per cent in cash crops is most common although there are nearly as many farms having 51 to 60 per cent of their crop area in cash crops.

The farms in the 240 and under and 721-acre and over groups are distributed somewhat differently. For example, in the under 240-acre group, most of the farms of which are 160 acres in size, the greatest number of farms are found in the 20 and 20-30 per cent cash-crop groups and approximately three-fourths of the farms have less than 40 per cent of their crop area in cash crops. In the larger groups, on the other hand, the farms have considerably more of their crop area in cash crops and are distributed more irregularly. These larger farms tend either to differ very widely in the proportion of their crop area in cash crops or to be grouped into two or three common groups. This irregularity in grouping is to be accounted for largely by the small number of farms found in these large groups. Only 4 per cent of the total number of farms are found in the groups ranging above 721 acres in size. Because of this and because the conditions on very large farms are likely to be divergent even in the same area, it is difficult to select an organization which will represent accurately what the group as a whole follows.

The frequency distribution of the farms in the selected area in Cass County is similar to that in the selected area in Sargent County and for that reason is not presented here. There is this one difference, however, to which attention should be called—the farms as a whole in Cass County have a higher percentage of their crop area in cash crops. As a result, a larger proportion of the farms are found in the classes having 40 per cent or more of their crop area in cash crops; hence the peak of the distribution is shifted somewhat to the right though its shape is still essentially the same. It is largely because of this fact that typical farming systems have been set up separately for each of these localities in area 1.

A classification of all the farms on the basis of the most important enterprise indicates how the farms of different sizes distribute themselves and whether the same organization tends to persist throughout the different size-groups. But it does not show how the other crop and livestock enterprises are distributed, nor does it show in what

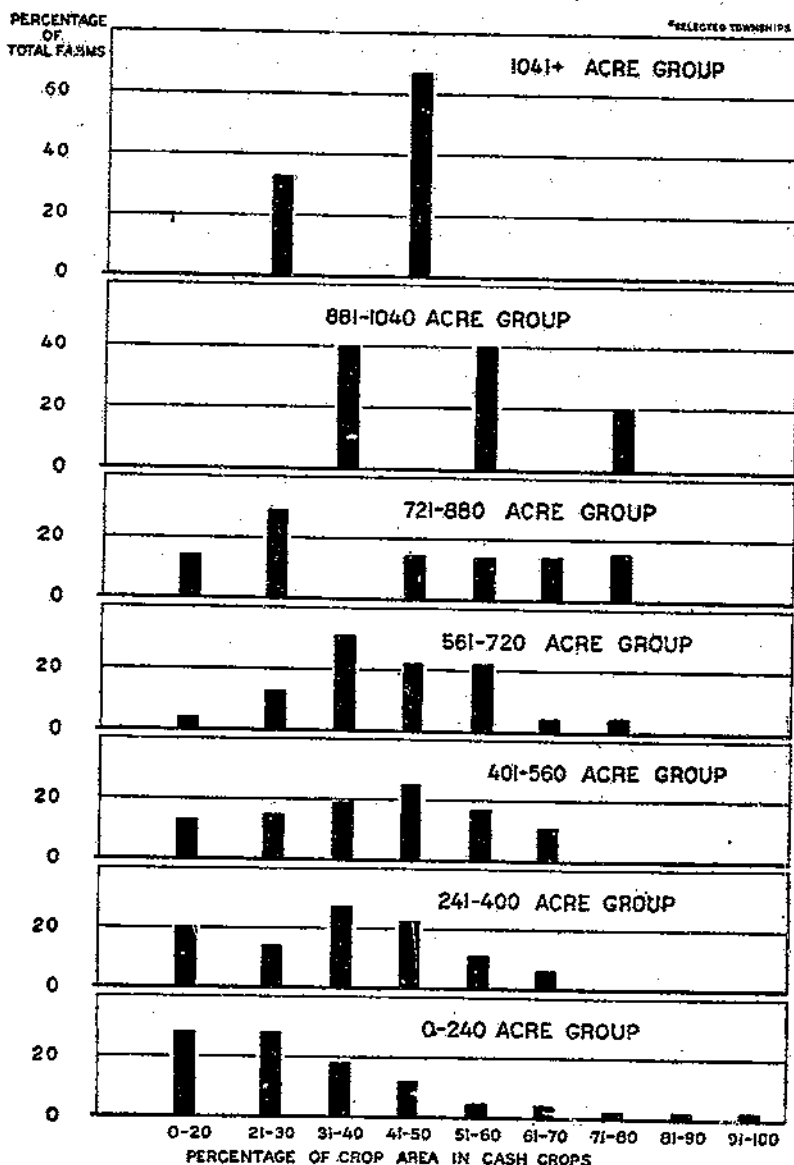


FIG. 15.—FREQUENCY DISTRIBUTION OF FARMS OF DIFFERENT SIZES ACCORDING TO PERCENTAGE OF CROP AREA IN CASH CROPS IN SELECTED TOWNSHIPS IN SARGENT COUNTY, N. DAK.

Distribution of farms according to the percentage of the crop area in cash crops is very similar for the three important size-groups, the half section, three-quarter section, and section farms

varying combinations the cash and other crops and livestock are found. A more detailed analysis of the complete organization of the individual farms of the several size-groups is necessary to obtain this information or to find which organizations are most common.

Figure 16 suggests a way of determining what is the more common organizations on farms of a particular size and further indicates something of the various combinations of enterprises which may be found on farms such as these, producing under similar conditions. The organization of each of the 320-acre farms in the selected locality in southeastern North Dakota is indicated in Figure 16. The half-section farm is the most common size of farm in this locality. There are 90 farms of this size, but only 78 were used since 12 of them were not representative because of crop failures in 1924.

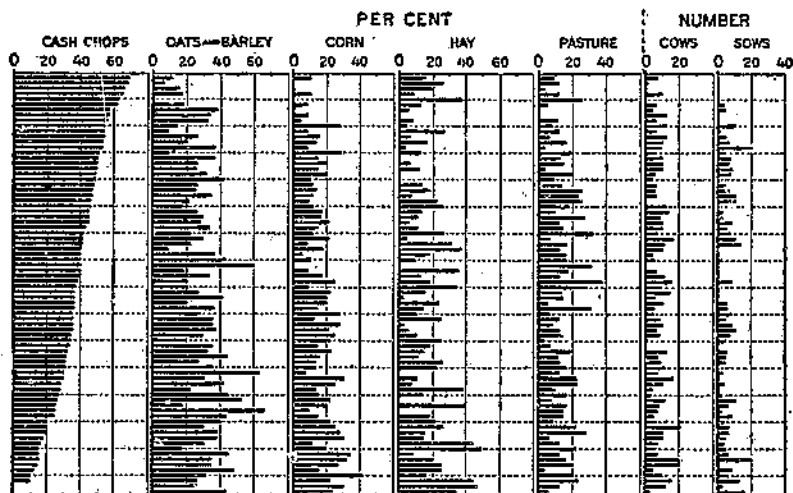


FIG. 16.—ORGANIZATION OF SEVENTY-EIGHT 320-ACRE FARMS IN A SELECTED LOCALITY IN SOUTHEASTERN NORTH DAKOTA

There obviously is no such thing as a so-called "average" 320-acre farm. There are on the contrary at least three distinct groups, one with a very high proportion of the crop area in cash crops, another, which is the most common with medium acreage of cash crops, and a third with a low acreage of cash crops. There is a tendency for the smaller acreage of cash crops to be offset by larger acreages of oats, barley, corn, and hay

There is a marked variation in the organizations on these farms; yet each farm is not distinctive or in a class by itself. In fact, there is an apparent tendency for the farmers to divide themselves into fairly distinct groups. To facilitate the grouping, the data regarding the farms were first arrayed and plotted on the basis of total cash crops and then the data regarding the other crops and livestock handled on each of the farms were added to give an idea of the complete organization.

Considering the grouping first from the standpoint of total cash crops, the range in cash crops varies from none to as high as 70 per cent of the total crop area, and the array closely resembles the familiar ogive curve. The most common or representative organization found has from 30 to 50 per cent of its crop area in cash

crops.⁶ In this case it is desirable to divide this class into two subclasses in order that a somewhat narrower range in organization may be obtained.

Both above and below this modal group are found smaller groups of farms which have larger or smaller acreages of cash crops. These groups center around 60 per cent and 20 per cent cash crops, respectively, and each comprises approximately 20 per cent of the total number of farms. The kind and amount of the other enterprises found with these different cash-crop groups were obtained by sub-sorting each group on the basis of the particular enterprises in question.

There is a fairly definite relationship between the acreage of cash crops and the acreage of the feed crops. Farms with a high per cent of the area in cash crops have a low per cent of their area feed crops, and vice versa. The chart does not show as close a relationship between the livestock and crops as would be expected. This is to be accounted for in part by the small number of livestock in the State as a whole and in part by the fact that only females used for breeding are shown here. Were the other classes of livestock included, the relationship might be more evident. Moreover, the females on hand on January 1, as shown by the census figures, do not give the true situation with respect to the total livestock handled on these farms. The census data, taken as of January 1, obviously may not reckon with these numbers at all. In a livestock section it is necessary to supplement the census data with other data to cover this situation.

An additional fact which may also partially account for the lack of closer agreement between crops and livestock is to be found in the sale of certain of the feed crops such as barley and oats. When this is the case the empirical designation of oats and barley as feed crops as against wheat, rye, and flax as cash crops, is obviously of doubtful value. Were data available to show the exact situation under all these conditions, it is likely that the relationship between all the feed crops, including hay and pasture, would be much closer and more clear-cut. The fact that the crops grown primarily for feed are about as dominant, and are nearly equal to the cash crops in importance, in this locality makes the complementary relationship between the two less distinct and more difficult to show.

That the complementary relationship is more distinct in a locality where the cash crops dominate the farming more completely is illustrated by the way in which the most common size of farms in a selected locality in north-central North Dakota distribute themselves. (Fig. 17.) In this locality the compensation between the cash crops and crops grown primarily for feed is evidently much more clear-cut and distinct.

Such a method of analysis as has been sketched above gives a basis for determining what are the typical farming systems in area 1 for the various sizes of farms. These as well as similar systems arrived at in the same way for other type-of-farming areas in the State are presented below.

⁶The most common or modal class in an ogive distribution always lies between the points of inflection on the curve, these being in this curve at 30 per cent and 60 per cent cash crops. That is, the modal class will always include the items within the limits of the flattest part of the curve.

TYPICAL FARMING SYSTEMS FOR FARMS OF DIFFERENT SIZES IN EASTERN NORTH DAKOTA

Within the eastern portion of North Dakota, which comprises the territory east of a line drawn from the western boundary of Rolette County south along the western edge of Pierce, Wells, Burleigh, Logan, and McIntosh Counties, lies the most important crop-producing region of the State. Conditions within this region are probably more homogeneous than for any other like area in the State, but there is considerable range in the character of the farming systems followed. There are, in fact, six distinct type-of-farming areas.

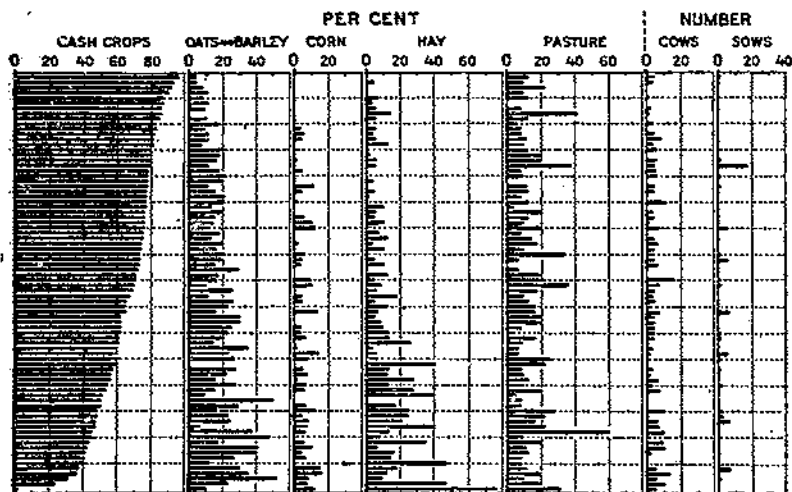


FIG. 17.—ORGANIZATION OF EIGHTY 320-ACRE FARMS IN A SELECTED LOCALITY IN NORTH-CENTRAL NORTH DAKOTA

The cash crops, wheat, rye, and flax, are much more important on half-section farms in north-central than in southeastern North Dakota. The complementary relationship between the cash and feed crops is apparently more distinct in this chart than in Figure 16

This divergence in organization is clearly indicated in Figure 18, which shows how the most common size of farms in the different type-of-farming areas are distributed with respect to the proportion of crop area planted to cash crops. The farms in certain of the type-of-farming areas, notably 2, 4, and 5, have, on the whole, a larger proportion of their crop area in cash crops than do some of the others. The shape of the distribution also varies considerably in the different areas as it is more nearly normal in some than in others. Were the other important size groups presented, such as the 160, 480, and 640 acre farms, the same general distribution would appear. In the larger-sized groups, however, there would be less regularity, since the number of farms found in them is not large enough to give much stability to the distribution.

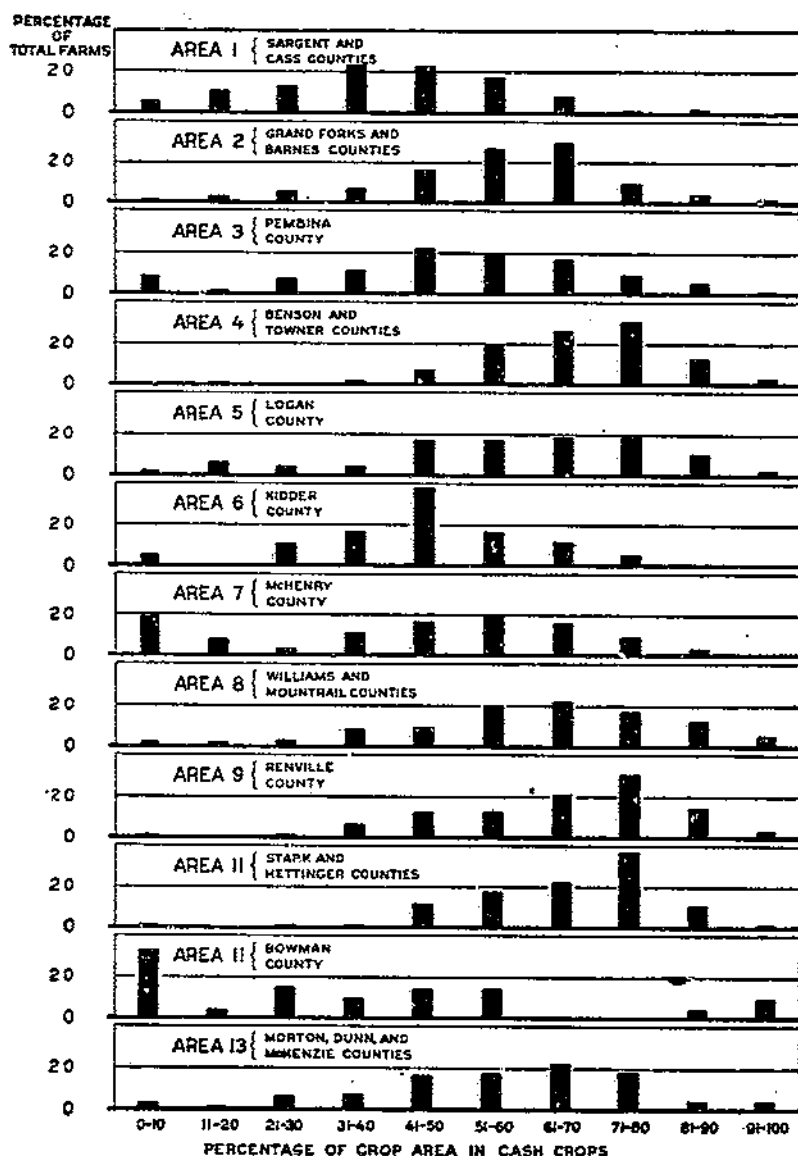


FIG. 18.—FREQUENCY DISTRIBUTION, BY TYPE-OF-FARMING AREAS, OF THE MOST COMMON SIZE OF FARMS (320 ACRES), CLASSIFIED ACCORDING TO PERCENTAGE OF TOTAL CROP AREA IN CASH CROPS

Farms with relatively small proportion of cash crops are most numerous in areas 1 and 7. In areas 4, 9, and 11 almost half of the farms have over 70 per cent of the crop areas in wheat, rye, and flax

TABLE 3.—Typical farming systems for farms of different sizes in Sargent County, N. Dak.

Crop or livestock enterprise	160-acre farms ¹ — Most common	320-acre farms ¹				480-acre farms ¹ — Most common
		Small acreage in cash crops	Most common	Medium acreage in cash crops	Large acreage in cash crops	
All crops.....	Acres 125	Acres 240	Acres 250	Acres 250	Acres 265	Acres 365
Wheat.....	20	25	60	75	120	110
Flax.....	12	25	25	30	40	45
Rye.....	0	0	0	15	0	0
Barley.....	18	35	40	30	15	35
Oats.....	25	50	40	35	50	60
Corn.....	30	60	50	35	25	55
Hay.....	20	45	35	30	15	60
Pasture.....	25	60	50	60	35	65
Livestock:	Number	Number	Number	Number	Number	Number
Cows.....	6 to 10	9 to 12	5 to 12	5 to 12	5 to 10	8 to 12
Sows.....	2 to 5	6 to 12	3 to 10	3 to 10	2 to 5	2 to 10

¹ Farms of different size represent the following percentages of the total number of farms: 160 acres, 32 per cent; 320 acres, 45 per cent; 480 acres, 13 per cent.

TABLE 4.—Typical farming systems for farms of different sizes in Cass County, N. Dak.

Crop or livestock enterprise	160-acre farms ¹ — Most common	320-acre farms ¹			480-acre farms ¹ — Most common	640-acre farms ¹ — Most common
		Small acreage in cash crops	Most common	Large acreage in cash crops		
All crops.....	Acres 135	Acres 275	Acres 275	Acres 285	Acres 410	Acres 560
Wheat.....	60	55	125	140	135	180
Flax.....	15	15	20	45	60	85
Rye.....	10	15	0	30	30	45
Barley.....	8	30	37	10	35	50
Oats.....	15	55	37	25	65	90
Corn.....	20	55	36	25	65	70
Hay.....	7	50	20	10	20	40
Pasture.....	20	30	30	20	50	50
Livestock:	Number	Number	Number	Number	Number	Number
Cows.....	3 to 8	7 to 14	4 to 12	4 to 5	10 to 16	5 to 12
Sows.....	0 to 6	0 to 10	0 to 8	0 to 3	0 to 10	0 to 20

¹ Farms of different size represent the following percentages of the total number of farms: 160 acres, 16 per cent; 320 acres, 33 per cent; 480 acres, 20 per cent; 640 acres, 18 per cent.

TYPICAL ORGANIZATION IN AREA 1

The more common systems of farming found on the different sizes of farms in the two selected localities in Cass and Sargent Counties are shown in Tables 3 and 4. The most common size of farm in each locality is 320 acres. In each of these tables the organization which more farmers (on a given size of farm) follow than any other is designated as the "most common." In other words, it is the typical or most representative organization in the locality for that size of farm. On either side of this most common organization are shown other organizations which vary significantly from it. These are designated as low cash, medium cash, and high cash crop

farms, as the case may be. For the size groups other than for the most common size of farm only the most common organization is shown for each.

SARGENT COUNTY

The most common organization in the selected area in Sargent County on the half-section farms has from 31 to 40 per cent of the crop area in cash crops. Table 3. The cash crops are mostly wheat and flax. The other crops grown—barley, oats, corn, and hay—are of about equal importance, except that the acreage of hay is slightly smaller than that of the other crops. About one-fourth of the farms of this size in Sargent County have this organization, but there are almost as many (22 per cent) that have from 41 to 50 per cent of their crop area in cash crops. Still other organizations in which cash crops occupy both a smaller (21 to 30 per cent) and a larger percentage (51 to 60 per cent) of the area are found. These comprise respectively 14 and 11 per cent of the half-section farms.

Similar organizations are found on the other sizes of farms. About one-fourth of the crop area is in cash crops in the most common organization on the 160-acre farms. On the 480-acre farms cash crops run somewhat higher, occupying between 40 and 45 per cent of the crop area. In each case, from one-fourth to one-third of the farmers follow an organization which varies little from that designated as most common.

In this as well as in all the other areas in the State it was found that the livestock organizations varied considerably on farms that have the same crop organization. For this reason the range in the usual numbers of livestock are shown instead of specific numbers. Further, on different sized farms it was not at all uncommon to find more livestock on the smaller farms than on the larger farms, even when the same proportions of crops were grown on each. There does not appear to be any very good reason why this situation should exist other than that some farmers make a better utilization of their resources than do others. It may be that the farmers on the smaller farms are driven to a more intensive type of farming by the sheer necessity of maintaining their income from a relatively small acreage.

CASS COUNTY

The most common organization both on the dominant and other size groups of farms in Cass County has a higher proportion of the crop area in cash crops than does the same organization in Sargent County. On the 320-acre farms there is a range in cash crops from 30 per cent on the low cash crop farms to 75 per cent on the high cash crop farms. The most common organization has from 51 to 60 per cent of the crop area in cash crops in Cass County. About one-third (34 per cent) of the farms of this size have this type of organization.

The farming systems in these two selected localities in Sargent and Cass County typify fairly well the kind of farming that is carried on in the other contiguous counties in the area. This whole area has been tending rapidly toward a mixed cash-crop and livestock type of farming. This is particularly true in the counties in the

southern part of the area of which Sargent is representative. The same tendency is found in Cass and La Moure Counties, but the shift has not been so rapid. Although the majority of farmers in area 1 are tending toward a more diversified type of farming there are still a number of farmers who follow a strictly cash-crop type of farming.

TYPICAL ORGANIZATIONS IN AREA 2

Immediately to the north of area 1 are found the nine counties comprising area 2. Here again, two samples were taken in separate localities. One of these is in Barnes County in the southern part of the area and the other in Grand Forks County in the north. The organization of approximately 440 farms were analyzed in the two selected localities as a basis for determining the prevailing farming systems in this area.

The more common systems of farming found in each locality are shown in Tables 5 and 6. The half-section farm is again the most common size of farm, comprising about one-third (34 and 35 per cent) of the total number of farms in each county. On this size of farm the most common organization is practically the same in the two counties. The chief differences are a somewhat higher pasture and oats area and lower crop acreage in Barnes County. In both counties about 61 to 70 per cent of the crop area is in cash crops. Approximately 45 per cent of the half-section farms in these counties follow this organization.

TABLE 5.—Typical farming systems for farms of different sizes in Barnes County, N. Dak.

Crop or livestock enterprise	160-acre farms ¹ — Most common	320-acre farms ¹ —			480-acre farms ¹ — Most common	640-acre farms ¹ — Most common
		Small acreage in cash crops	Most common	Large acreage in cash crops		
	Acres	Acres	Acres	Acres	Acres	Acres
All crops.....	115	240	245	260	380	500
Wheat.....	60	105	120	130	185	170
Flax.....	10	25	40	45	45	75
Rye.....	0	0	0	25	0	25
Barley.....	10	25	20	5	35	50
Oats.....	15	40	30	30	55	75
Corn.....	5	20	15	10	30	35
Hay.....	15	25	20	15	50	70
Pasture.....	40	65	60	45	80	120
Livestock:	Number	Number	Number	Number	Number	Number
Cows.....	3 to 9	0 to 9	0 to 9	0 to 3	0 to 12	8 to 15
Sows.....	0 to 4	0 to 4	0 to 4	0 to 2	0 to 4	3 to 5

¹ Farms of different size represent the following percentages of the total number of farms: 160 acres, 13 per cent; 320 acres, 34 per cent; 480 acres, 18 per cent; 640 acres, 15 per cent.

TABLE 6.—*Typical farming systems for farms of different sizes in Grand Forks County, N. Dak.*

Crop or livestock enterprise	160-acre farms ¹		320-acre farms ¹			480-acre farms ¹		640-acre farms ¹	
	Medium acreage in cash crops	Large acreage in cash crops	Medium acreage in cash crops	Most common	Large acreage in cash crops	Medium acreage in cash crops	Most common	Small acreage in cash crops	Most common
	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres
All crops.....	120	130	255	260	275	410	410	520	510
Wheat.....	36	60	65	116	150	125	185	130	205
Flax.....	12	20	50	40	55	140	70	45	75
Rye.....								29	15
Barley.....	15	10	35	20	15	55	40	100	40
Oats.....	20	25	35	45	30	85	65	105	80
Corn.....	17	5	30	15	10	25	20	40	40
Hay.....	20	10	40	25	15	70	50	80	55
Pasture.....	25	30	45	40	25	40	40	80	90
Livestock:	Number	Number	Number	Number	Number	Number	Number	Number	Number
Cows.....	0 to 7	0 to 7	2 to 10	0 to 8	0 to 8	3 to 10	3 to 10	6 to 10	6 to 10
Sows.....	0 to 3	0 to 2	0 to 6	0 to 4	0 to 2	0 to 5	0 to 5	2 to 7	0 to 5

¹ Farms of different size represent the following percentages of the total number of farms: 160 acres, 25 per cent; 320 acres, 35 per cent; 480 acres, 22 per cent; 640 acres, 12 per cent.

² Rye or flax.

A comparison of this organization in these two counties with the most common organization on the half-section farms in Cass County shows considerable agreement between the two. So far as the acreage of wheat is concerned they are almost the same—the Cass County organization, however, has only about one-half as much flax. On the other hand, it is considerably greater in feed crops, particularly in corn and barley, and in cattle and hogs.

In the other size groups there is a greater difference in the most common organizations both as between Barnes and Grand Forks and between either of them and Cass County. On the 480-acre farms, for example, the most common organization in Barnes County has only 380 acres in crops, 165 acres of which are in wheat and 45 acres in flax. In Grand Forks County, on the other hand, there are 410 acres in crops, 185 acres of which are in wheat, and 70 acres in flax or rye. On the 640-acre farms, however, the most common organizations are similar, each area having between 54 and 58 per cent of the crop area in cash crops.

Among the 160-acre farms, which comprise about twice as many of the total number of farms in Grand Forks County as in Barnes County the most common organization is one having from 61 to 70 per cent of the crop area in cash crops. In Grand Forks County there is a rather distinct bimodal distribution on farms of this size—one group had around 40 per cent of its crop area in cash crops and the other between 60 and 70 per cent.

In both of these counties the same organization persists throughout the different size groups. Thus the most common organization on the 160-acre farms has 61 per cent of its crop area in cash crops. On the 320-acre farms it has 60 per cent in cash crops, in the 480-acre group it has 62 per cent in cash crops, and in the 640-acre group it has 58 per cent in cash crops.

TYPICAL ORGANIZATIONS IN AREA 3

There are only two counties in area 3—Pembina and Walsh. The organizations of 242 farms in a locality in Pembina County were used in determining the prevailing farming systems throughout the area. The more common systems of farming found in this area are shown in Table 7. The half-section farm is still the most common size, but there are almost as many quarter-section farms, the proportion of the total of each being 35 and 32 per cent respectively.

On the half-section farms the most common organization is one having from 50 to 55 per cent of the crop area in cash crops. From one-fourth to one-third of the farmers on the half-section farms follow this organization. The wheat acreage in this organization is considerably lower than is found in the comparable organization in the counties in area 2. (Compare Table 7 with Tables 5 and 6.) The corn acreage is also lower. The oats acreage on the other hand is considerably higher, as is the hay acreage. There is not a great deal of difference in the livestock organization except that sheep are found to be much more important in Pembina County. This county, in fact, has more sheep than any other county in the State.

There are other farmers on this same size farm who follow organizations with both higher and lower acreages of cash crops, ranging from 95 acres on the farms having small acreages of cash crops to 195 acres on the farms with large acreages of cash crops. Approximately one-fourth of the farmers on the half-section farms follow these organizations,

TABLE 7.—Typical farming systems for farms of different sizes in Pembina County, N. Dak.

Crop or livestock enterprise	160-acre farms ¹		320-acre farms ¹			480-acre farms ¹	
	Small acreage in cash crops	Most common	Small acreage in cash crops	Most common	Large acreage in cash crops	Small acreage in cash crops	Medium acreage in cash crops
	<i>Acres</i>	<i>Acres</i>	<i>Acres</i>	<i>Acres</i>	<i>Acres</i>	<i>Acres</i>	<i>Acres</i>
All crops.....	125	135	270	260	270	400	410
Wheat.....	30	60	65	90	120	80	125
Flax.....	15	20	30	50	70	40	60
Rye.....						20	35
Barley.....	10	10	30	15	15	50	40
Oats.....	45	35	70	65	55	100	90
Corn.....	5	5	15	10	0	20	10
Hay.....	20	5	60	30	10	90	60
Pasture.....	30	20	55	45	35	55	45
Livestock:	<i>Number</i>	<i>Number</i>	<i>Number</i>	<i>Number</i>	<i>Number</i>	<i>Number</i>	<i>Number</i>
Cows.....	2 to 6	0 to 4	4 to 7	3 to 6	2 to 4	3 to 8	3 to 7
Sows.....	0 to 3	0 to 2	0 to 2	0 to 2	0 to 1	0 to 2	0 to 2
Sheep.....	0 to 5	0 to 5	0 to 5	0 to 10	0 to 2	0 to 14	0 to 11

¹ Farms of different size represent the following percentages of the total number of farms: 160 acres, 32 per cent; 320 acres, 35 per cent; 480 acres, 19 per cent.

² Flax or rye.

The nature of the organizations on the other sizes of farms may be seen from Table 7. On the 160-acre farms the farmers who follow the most common organization have about 60 per cent of their crop area in cash crops. There is also another organization, which about

15 per cent of the farmers follow, in which only 30 to 40 per cent of the crop area is in cash crops. On the 480-acre farms there are two organizations which are about of equal importance so far as numbers of farmers following each is concerned. One of these has about 35 per cent of the crop area in cash crops; the other has between 50 and 55 per cent in cash crops.

TYPICAL ORGANIZATIONS IN AREA 4

The most common organizations found in area 4 are shown in Tables 8, 9, and 10. The organization of approximately 560 farms in three localities were used as a basis for determining the prevailing organizations throughout this area. These localities were in Cavalier, Benson, and Towner Counties.

The primary differences between the farming systems in this area and those found in areas 1, 2, and 3 are a somewhat higher acreage of cash crops (particularly for wheat and rye) and a lower acreage in corn. In fact, in Cavalier and Towner Counties there is no corn except on a very few farms. In Benson County, which is a little farther south, there are a few acres of corn on most of the farms. There are a smaller number of hogs on the farms in this area.

The organizations in Towner County on a whole have larger acreages of cash crops than do the organizations in the other two selected areas. In fact this county is one of the most important cash-crop areas in the State. Pierce, Ramsey, and Wells Counties are probably more nearly like it than are any of the other counties in the area.

TABLE 8.—Typical farming systems for farms of different sizes in Cavalier County, N. Dak.

Crop or livestock enterprise	160-acre farms ¹ — Most common	320-acre farms ¹ —			480-acre farms ¹ — Most common	640-acre farms ¹ — Most common
		Small acreage in cash crops	Most common	Large acreage in cash crops		
	Acres	Acres	Acres	Acres	Acres	Acres
All crops.....	135	250	255	266	380	535
Wheat.....	65	75	100	105	150	215
Flax.....			15	65	40	25
Rye.....	7	15	10			
Barley.....	13	35	45	15	65	85
Oats.....	40	90	65	65	95	160
Corn.....	0	0	0	0	0	0
Hay.....	10	35	25	15	30	50
Pasture.....	15	50	45	35	60	60
Livestock:	Number	Number	Number	Number	Number	Number
Cows.....	0 to 4	4 to 9	4 to 8	0 to 6	4 to 8	4 to 7
Sows.....	0 to 1	0 to 3	0 to 3	0 to 2	0 to 2	0 to 2

¹ Farms of different size represent the following percentages of the total number of farms: 160 acres, 15 per cent; 320 acres, 34 per cent; 480 acres, 23 per cent; 640 acres, 16 per cent.

² Rye and flax.

TABLE 9.—Typical farming systems for farms of different sizes in Benson County, N. Dak.

Crop or livestock enterprise	100-acre farms ¹		320-acre farms ¹			480-acre farms ¹		640-acre farms ¹
	Small acreage in cash crops	Most common	Small acreage in cash crops	Most common	More cash crops	Most common	Large acreage in cash crops	Most common
	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres
All crops.....	115	115	250	255	290	375	375	535
Wheat.....	50	65	120	135	170	190	235	375
Flax.....	14	20	20	30	25	35	45	55
Barley.....	10	0	20	20	10	40	10	20
Oats.....	17	15	45	40	30	50	50	50
Corn.....	7	0	10	5	0	20	10	10
Hay.....	17	15	35	25	25	40	25	25
Pasture.....	30	30	50	45	40	70	70	75
Livestock:	Number	Number	Number	Number	Number	Number	Number	Number
Cows.....	5 to 10	5 to 10	4 to 9	4 to 9	0 to 6	5 to 10	3 to 8	7 to 9
Sows.....	0 to 2	0 to 2	0 to 3	0 to 3	0 to 3	0 to 3	0 to 3	0 to 2

¹ Farms of different size represent the following percentages of the total number of farms: 100 acres, 22 per cent; 320 acres, 34 per cent; 480 acres, 24 per cent; 640 acres, 11 per cent.

² Flax or rye.

TABLE 10.—Typical farming systems for farms of different sizes in Towner County, N. Dak.

Crop or livestock enterprise	320-acre farms—			480-acre farms ¹ — Most common	640-acre farms ¹ — Most common	800-acre farms ¹ — Most common
	Small acreage in cash crops	Most common	Large acreage in cash crops			
	Acres	Acres	Acres	Acres	Acres	Acres
All crops.....	255	255	255	360	490	590
Wheat.....	90	100	130	200	240	225
Flax.....	35	40	35	35	60	85
Rye.....	40	50	50	55	95	110
Barley.....	10	10	0	0	10	45
Oats.....	50	40	30	55	55	65
Corn.....	0	0	0	0	0	0
Hay.....	30	15	10	15	20	30
Pasture.....	40	40	30	50	80	125
Livestock:	Number	Number	Number	Number	Number	Number
Cows.....	4 to 9	4 to 9	0 to 4	2 to 5	4 to 6	0 to 12
Sows.....						0 to 2

¹ Farms of different sizes represent the following percentages of the total number of farms: 320 acres, 27 per cent; 480 acres, 29 per cent; 640 acres, 16 per cent; 800 acres, 8 per cent.

The organizations in Benson County, on the other hand, are probably more typical of the organizations in Rolette and Cavalier. Rolette County does not fit very well with the other counties in this area, but fits rather better than with the counties in the adjoining area, area 9. In many respects the organizations in this county parallel those in McHenry County, but since the two counties are not contiguous they are kept separate.

TYPICAL ORGANIZATION IN AREA 5

Logan and McIntosh Counties in the south-central part of the State comprise area 5. The most common farming systems, as shown by an analysis of the organizations of 203 farms in a selected locality in Logan County, are shown in Table 11.

The farms on the whole are larger than those in the areas just discussed. The most common size of farm is 480 acres, as compared with 320 acres for the other area. Approximately 85 per cent of all the farms in this selected locality in Logan County are from 320 to 880 acres in size.

Typical farming systems are presented for four different sizes of farms. On the 480-acre farms, which are the most common size, the organizations range from 160 to 260 acres in cash crops. The primary variation is in the acreage of wheat. The acreage of flax and rye, most of which is flax, is about the same in the different organizations.

TABLE 11.—*Typical farming systems for farms of different sizes in Logan County, N. Dak.*

Crop or livestock enterprise	320-acre farms ¹			480-acre farms ¹			640-acre farms ¹ — Most common	800-acre farms ¹ — Large acreage in cash crops
	Small acreage in cash crops	Medium acreage in cash crops	Large acreage in cash crops	Most common	More cash crops	Large acreage in cash crops		
	<i>Acres</i>	<i>Acres</i>	<i>Acres</i>	<i>Acres</i>	<i>Acres</i>	<i>Acres</i>	<i>Acres</i>	<i>Acres</i>
All crops.....	220	220	220	320	390	380	375	480
Wheat.....	75	100	190	110	175	205	170	240
Flax.....	25	35	35	50	45	55	35	60
Barley.....	25	20	15	30	80	16	25	35
Oats.....	15	10	10	15	15	10	20	20
Corn.....	15	5	5	20	15	5	20	20
Hay.....	65	50	25	95	50	40	105	105
Pasture.....	70	70	70	100	90	90	200	220
Livestock:	<i>Number</i>	<i>Number</i>	<i>Number</i>	<i>Number</i>	<i>Number</i>	<i>Number</i>	<i>Number</i>	<i>Number</i>
Cows.....	7 to 11	6 to 11	4 to 10	7 to 11	5 to 10	5 to 10	10 to 19	10 to 20
Sows.....	0 to 3	0 to 3	0 to 3	0 to 4	0 to 5	0 to 5	3 to 5	3 to 8

¹ Farms of different size represent the following percentages of the total number of farms: 320 acres, 26 per cent; 480 acres, 31 per cent; 640 acres, 17 per cent; 800 acres, 11 per cent.

² Flax and rye.

In the other size groups the most common organizations have about the same proportion of the crop area in cash crops. Most of the farms of all size groups seem to range in organization from 40 to 80 per cent of the crop area in cash crops, being remarkably uniform throughout. That is, there are about an equal number of farms in each 10 per cent class interval between these ranges. (Fig. 18.)

The chief differences between the organizations in this area and those in the other areas discussed are a considerably lower oats acreage and a higher acreage of pasture. The hay acreage is also considerably larger in this area than in the others, with the exception of area 1. Although this area is in the same latitude as area 1 the corn acreage is very much lower. The cash crops, particularly wheat and flax, make up a large proportion of the crop area; in this respect this area is quite similar to the counties in area 4.

TYPICAL ORGANIZATIONS IN AREA 6

Just to the north of area 5 are found Burleigh and Kidder Counties, which comprise area 6. The most common organization in this area is shown in Table 12. Since data for only 80 farms of all sizes

were obtained in the selected area in Kidder County the most common organization in this instance is not quite so reliable as are similar organizations in the other areas. There were enough 320-acre farms, however, to give fairly reliable data as to organization for this size of farm. The primary difference between this most common organization and that in the preceding area is a lower acreage in wheat, flax, and barley, and a somewhat higher acreage in rye and oats. There were not enough farms in the other size groups to group.

All the way from 0 to 100 per cent of their crop areas were devoted to cash crops. Additional data are needed before organizations for these other groups can be determined.

TABLE 12.—*Typical farming systems for farms of different sizes in Kidder County, N. Dak.*

Crop or livestock enterprise	320-acre farms — Most common	Crop or livestock enterprise	320-acre farms — Most common
	<i>Acres</i>		<i>Acres</i>
All crops.....	200	Pasture.....	100
Wheat.....	50	Livestock:	<i>Number</i>
Flax.....	20	Cows.....	8 to 1
Rye.....	20	Hogs.....	2 to 6
Barley.....	10		
Oats.....	28		
Corn.....	20		
Hay.....	55		

¹ See discussion.

² Farms of 320 acres constituted 24 per cent of the total number of farms.

TYPICAL FARMING SYSTEMS FOR FARMS OF DIFFERENT SIZES IN NORTHWESTERN NORTH DAKOTA

All of the area north of the Missouri River and west of a line running south from the western boundaries of Rolette, Pierce, and Wells Counties to Burleigh County comprises northwestern North Dakota, as the term is used in this bulletin. The agriculture of this region on the whole is more strictly a cash-grain type of farming than is true of eastern North Dakota as a whole. It is also a region of lower rainfall, and crop yields are somewhat more variable than in the eastern part of the State. This region was settled somewhat later than the area to the east. Because of variations in crop and livestock organizations and in the soil and climatic conditions under which crops are produced, the region is divided into four type-of-farming areas.

TYPICAL ORGANIZATIONS IN AREA 7

Because of the peculiarity of the organizations and conditions in McHenry County, it was placed alone to comprise area 7. The more common organizations in this county for the different sizes of farms are shown in Table 13. These organizations are based on an analysis of 165 farms in selected contiguous townships in the county.

TABLE 13.—*Typical farming systems for farms of different sizes in McHenry County, N. Dak.*

Crop or livestock enterprise	160-acre farms ¹		320-acre farms ¹		480-acre farms ¹	
	Most common	Large acreage in cash crops	Medium acreage in cash crops	Most common	Small acreage in cash crops	Large acreage in cash crops
	Acres	Acres	Acres	Acres	Acres	Acres
All crops.....	110	125	290	270	340	380
Wheat.....		45	55	50	45	90
Flax.....					15	
Rye.....		30	55	75	55	125
Barley.....			15	10		
Oats.....	15	30	50	45	65	55
Corn.....	55	15	45	30	75	50
Hay.....	40	5	40	20	85	40
Pasture.....	40	25	60	40	120	100
Livestock:	Number	Number	Number	Number	Number	Number
Cows.....	0 to 3	2 to 5	3 to 12	4 to 8	6 to 14	10 to 15
Sows.....	0 to 4	0 to 2	1 to 7	0 to 2	2 to 6	1 to 4
Sheep.....					3 to 8	

¹ Farms of different size represent the following percentages of the total number of farms: 160 acres, 23 per cent; 320 acres, 33 per cent; 480 acres, 18 per cent.

The half-section farm is the most common size. The most common organization on this size of farm has 165 acres in cash crops as against 105 acres in feed crops. The distinctive fact about this organization is the high percentage of the crop area which is in rye. This county is the greatest rye center of the State. The large acreage of rye in this as well as in all of the other organizations in the county are to be accounted for by the sandy type of soil. Rye does better on sandy soil than do the other small-grain crops and is grown for this reason. Corn and oats are the most important of the feed crops. The corn acreage in this county is higher than in any other part of the State, with the exception of area 1.

About one-third of the farmers on the half-section farms follow the organization designated most common. On the same size of farm approximately 20 per cent of the farmers follow an organization with smaller acreages of cash crops and correspondingly larger acreages of feed crops, particularly of corn and hay. The remainder are rather scattered, having both lower and higher acreages of cash crops.

On the 160-acre farms the most common organization is one which has no cash crops at all. In this organization, of the 110 acres in crops, 55 acres are in corn and 40 acres are in hay; the other 15 acres are in oats or barley, with oats predominating. The next most important organization on this size farm is one which has a very high percentage of cash crops, running as high as 60 per cent of the crop area.

On the 480-acre farms there is no clearly defined model group. The two most common organizations have either large or small acreages of cash crops. On those having the small acreages of cash crops only 115 of the 340 crop acres are in cash crops, whereas on those having the high cash crop organization 215 of the 360 acres in crops are in cash crops. In both organizations rye is the most important of the cash crops.

TYPICAL ORGANIZATIONS IN AREA 8

Area 8 includes McLean, Sheridan, Mountrail, Williams, and most of Ward Counties. About 330 farm organizations from two special localities in this area were analyzed. One of these localities is in Mountrail County and the other in Williams on the extreme western boundary of the State.

The more common farming systems in each of these counties are shown in Tables 14 and 15. The most common size of farm in Mountrail County is 160 acres; in Williams County it is 320 acres. The locality in Mountrail County is the only one among the selected localities in the State in which 160-acre farms were found to be more common than any other size.⁷ About 38 per cent of the total number of farms are of this size; 30 per cent are 320 acres, and 17 per cent are 480 acres in size. The most common organization has 75 of the 110 acres in cash crops, 65 of which are in wheat. Another organization which is next to the most common in importance as determined by number of farmers following it, has 55 acres, or just one-half of the crop area, in cash crops. No corn is found in either of these organizations.

On the half-section farms the most common organization has 120 of the 200 acres in cash crops, 90 acres of which are in wheat. This means about 60 per cent of the crop area is in cash crops as compared with 70 per cent in the most common organization on the 160-acre farms and 65 per cent on the 480-acre farms. From one-fourth to one-half of the farms in each size group follow this most common organization.

TABLE 14.—Typical farming systems for farms of different sizes in Mountrail County, N. Dak.

Crop or livestock enterprise	160-acre farms*		320-acre farms*		480-acre farms*— Most common
	Medium acreage in cash crops	Most common	Small acreage in cash crops	Most common	
	Acres	Acres	Acres	Acres	Acres
All crops.....	110	110	160	230	300
Wheat.....	45	65	50	90	120
Flax.....	10	10	10	10	10
Rye.....	0	0	0	30	45
Barley.....	5	0	15	10	30
Oats.....	30	20	40	40	45
Corn.....	0	0	0	0	0
Hay.....	20	15	45	30	30
Pasture.....	40	40	100	100	120
Livestock:	Number	Number	Number	Number	Number
Cows.....	3 to 9	0 to 5	7 to 13	8 to 12	6 to 15
Sows.....	0 to 2	0 to 2	0 to 2	0 to 2	0 to 2
Sheep.....	0 to 4	0 to 2			

* Farms of different size represent the following percentages of the total number of farms: 160 acres, 38 per cent; 320 acres, 30 per cent; 480 acres, 17 per cent.

⁷ Flax or rye.

⁸ See footnote 5.

TABLE 15.—Typical farming systems for farms of different sizes in Williams County, N. Dak.

Crop or livestock enterprise	160-acre farms ¹ — Most common	320-acre farms ¹			480-acre farms ¹		640-acre farms ¹ — Most common
		Medium acreage in cash crops	Most common	Large acreage in cash crops	Most common	Large acreage in cash crops	
	Acres	Acres	Acres	Acres	Acres	Acres	Acres
All crops.....	110	290	215	215	300	320	400
Wheat.....	55	85	120	136	135	175	240
Flax.....	25	30	35	40	60	85	70
Rye.....	0	0	0	0	0	0	0
Barley.....	0	0	0	0	10	0	0
Oats.....	20	40	30	20	35	40	60
Corn.....	0	0	0	0	0	0	0
Hay.....	10	45	30	20	60	20	30
Pasture.....	35	80	65	65	100	80	130
Livestock:	Number	Number	Number	Number	Number	Number	Number
Cows.....	0 to 5	4 to 10	4 to 9	4 to 9	5 to 9	3 to 9	6 to 14
Sows.....	0 to 1	0 to 2	0 to 3	0 to 2	0 to 2	0 to 1	0 to 4

¹ Farms of different size represent the following percentages of the total number of farms: 160 acres, 21 per cent; 320 acres, 42 per cent; 480 acres, 21 per cent; 640 acres, 12 per cent.

In Williams County about 42 per cent of the total number of farms are 320 acres in size. (Table 15.) On this size of farm the most common organization is one which has about 155 of the 215 crop acres in cash crops. About 70 per cent of the total crop area is in cash crops as compared with 60 per cent on the same size of farm in Mountrail County. There are other organizations on this same size of farm with both lower and higher acreages in cash crops, ranging from 115 to 175 acres.

In the other size groups the most common organizations range from 75 to 80 per cent on the 160 and 640-acre farms down to 65 per cent on the 480-acre farms. In all cases wheat is the most important of the cash crops. Corn is not found on any of the farms and barley on only a few of them. Oats is the most important feed crop.

In both Mountrail and Williams Counties wheat, flax, and oats are the predominant crops. These, together with hay, are the only crops grown. From these typical organizations it is apparent that this area is predominantly a cash-grain area. Livestock production is not of a great deal of importance on the general farms, although there are some ranches. Cattle are by far the most important of the livestock kept.

TYPICAL ORGANIZATIONS IN AREA 9

There are three counties in area 9—Renville, Bottineau, and Burke, and part of Ward County. About 275 farms in a selected area in Renville County were taken as representative of the total number of farms. The most common size of farm is the half section; 37 per cent of the total number are of this size.

The organizations which are most commonly found are shown in Table 16. Farms of the most common size, the 320-acre farms, have from 105 to 210 acres in cash crops out of a total of 255 to 260 acres in all crops. The most common organization is the one with the highest acreage of cash crops. This is also true of the 480 and 640

acre farms. On farms of the latter size the cash crops occupy as much as 82 per cent of the crop area. On those of the former size they occupy somewhat less of the crop area, namely 72 per cent. This is more nearly like the most common organization on the 160-acre farms, which has 70 per cent of the crop area in cash crops.

The differences between the organizations in this area and those in area 8 are primarily a higher acreage in barley, corn, oats, wheat, and hay, and a lower acreage in pasture.

No special tabulations were made for Divide County, which is area 14. This county is not included in either of the adjoining areas because of important differences in the proportion of the crop area devoted to cash crops, especially wheat. The average yields of wheat and other crops are in general substantially higher than in either Burke or Williams Counties. The proportion of cash crops in this county in 1924 was the highest of any county in the State.

TABLE 16.—Typical farming systems for farms of different sizes in Renville County, N. Dak.

Crop or livestock enterprise	160-acre farms—Most common	320-acre farms †			480-acre farms †		640-acre farms †	
		Small acreage in cash crops	Medium acreage in cash crops	Most common	Medium acreage in cash crops	Most common	Medium acreage in cash crops	Most common
	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres
All crops.....	125	255	265	280	400	390	510	535
Wheat.....	70	195	145	170	170	265	265	320
Flax.....	18	-----	15	40	40	60	120	120
Barley.....	7	15	10	5	20	15	20	15
Oats.....	18	60	50	25	70	55	65	50
Corn.....	3	25	10	10	20	10	20	10
Hay.....	9	60	35	10	80	25	80	20
Pasture.....	25	50	40	40	75	60	80	70
Livestock:	Number	Number	Number	Number	Number	Number	Number	Number
Cows.....	0 to 5	0 to 10	0 to 7	0 to 5	5 to 11	0 to 6	0 to 9	0 to 6
Sows.....	-----	0 to 2	-----	-----	0 to 4	-----	3 to 4	0 to 2

† Farms of different sizes represent the following percentages of the total number of farms: 160 acres, 21 per cent; 320 acres, 37 per cent; 480 acres, 22 per cent; 640 acres, 11 per cent.

‡ Flax or rye.

TYPICAL FARMING SYSTEMS FOR FARMS OF DIFFERENT SIZES IN SOUTHWESTERN NORTH DAKOTA

Southwestern North Dakota comprises the territory south and west of the Missouri River. Both in physical conditions and in farming systems this region is distinct from other parts of the State. Within this territory are the famous Bad Lands, which render a large proportion of Golden Valley, Billings, Dunn, and McKenzie Counties fit only for grazing purposes, and Slope, Bowman, Stark, and Hettinger Counties to a somewhat lesser extent. Such tillable land as is found is not as productive as that in most of the other sections of the State, as has been pointed out. (See p. 12.) Add to this a rather scanty rainfall, and it is readily apparent that this region is not as important agriculturally as either eastern or northwestern North Dakota.

Because of variations in organizations and physical conditions the region was divided into four type-of-farming areas. The dis-

tion between the farming types in each of these areas hinges largely on the variation in the proportion of the crops grown. Throughout the region wheat is the predominant crop, with hay second in importance. The pasture area, as would be expected, is very large. This is utilized mostly by cattle; sheep are of minor importance except in Slope and Bowman Counties. The more common farming systems found in the different type-of-farming areas are presented below.

No special tabulations were made for areas 10 and 12. A large part of Sioux County, in area 10, is an Indian reservation, and agriculture is not of much importance. The farms in the selected localities in Stark, Hettinger, and Dunn Counties are to some extent representatives of the farms in Billings County, but probably the organizations in Billings County are more nearly like those in Dunn and McKenzie Counties.

TYPICAL ORGANIZATIONS IN AREA 11

Area 11 comprises Bowman, Adams, Grant, Hettinger, Stark, and Slope Counties. Of these counties, Stark and Hettinger are the most important from the standpoint of crop production, in that they have more tillable farming land than the others. Special townships were selected in Stark, Hettinger, and Bowman Counties, and the organizations of all the farms therein were used for determining typical organizations throughout the area. The organizations of slightly over 400 farms were used in the selected townships in the three counties. The townships in Stark and Hettinger Counties were contiguous and were combined. The more common systems of farming are shown in Tables 17 and 18.

The most common size of farm in Stark, Hettinger, and Bowman Counties is the half-section farm. There is not a great deal of difference in the number of 320 and 480-acre farms in each county; there is a greater difference in the organizations. Stark and Hettinger have a considerably larger proportion of the crop area in cash crops than does Bowman.

TABLE 17.—Typical farming systems for farms of different sizes in Stark and Hettinger Counties, N. Dak.

Crop or livestock enterprise	160-acre farms ¹ — Most common	320-acre farms ¹				480-acre farms ¹		
		Small acreage in cash crops	Medium acreage in cash crops	Most common	Large acreage in cash crops	Small acreage in cash crops	Medium acreage in cash crops	Most common
		Acres	Acres	Acres	Acres	Acres	Acres	Acres
All crops.....	120	210	210	220	220	270	310	320
Wheat.....	70	85	100	130	145	110	170	190
Flax.....	10	20	30	30	45	40	40	60
Rye.....	0	0	0	0	0	0	0	0
Barley.....	5	15	15	10	5	15	15	15
Oats.....	15	25	20	20	10	40	30	30
Corn.....	0	10	10	5	0	15	10	5
Hay.....	20	55	35	25	15	50	45	30
Pasture.....	25	90	90	80	80	170	130	120
Livestock:	Number	Number	Number	Number	Number	Number	Number	Number
Cows.....	3 to 6	5 to 10	4 to 10	3 to 10	3 to 5	3 to 7	4 to 7	3 to 5
Sows.....	0 to 4	0 to 8	0 to 8	0 to 5	0 to 2	0 to 6	0 to 5	0 to 4

¹ Farms of different size represent the following percentages of the total number of farms: 160 acres, 11 per cent; 320 acres, 28 per cent; 480 acres, 20 per cent; 640 acres, 17 per cent; 800 acres, 8 per cent; 1,600 acres, 5 per cent; 1,280 acres, 5 per cent.

TABLE 17.—Typical farming systems for farms of different sizes in Stark and Hettinger Counties, N. Dak.—Continued

Crop of livestock enterprises	640-acre farms ¹		800-acre farms— Most common	1,000-acre farms— Most common	1,280-acre farms— Most common
	Medium acreage in cash crops	Large acreage in cash crops			
	<i>Acres</i>	<i>Acres</i>	<i>Acres</i>	<i>Acres</i>	<i>Acres</i>
All crops.....	380	400	500	560	480
Wheat.....	185	220	300	340	170
Flax.....	45	65	90	85	70
Rye.....	6	0	0	0	0
Barley.....	25	10	25	15	40
Oats.....	40	45	35	50	75
Corn.....	15	10	0	15	30
Hay.....	70	50	50	55	95
Pasture.....	180	160	160	400	700
Livestock:	<i>Number</i>	<i>Number</i>	<i>Number</i>	<i>Number</i>	<i>Number</i>
Cows.....	8 to 14	6 to 15	6 to 10	8 to 14	12 to 30
Sows.....	0 to 5	0 to 5	0 to 5	0 to 3	1 to 11

¹ Farms of different size represent the following percentages of the total number of farms: 160 acres, 11 per cent; 320 acres, 28 per cent; 480 acres, 26 per cent; 640 acres, 17 per cent; 800 acres, 8 per cent; 1,000 acres, 6 per cent; 1,280 acres, 5 per cent.

TABLE 18.—Typical farming systems for farms of different sizes in Bowman County, N. Dak.

Crop or livestock enterprise	320-acre farms— Most common	480-acre farms— Most common	640-acre farms— Most common	1,280-acre farms— Most common	2,000-acre farms— Most common
		<i>Acres</i>	<i>Acres</i>	<i>Acres</i>	<i>Acres</i>
All crops.....	170	180	260	490	510
Wheat.....	35	45	55	130	80
Flax.....	10	10	20	25	20
Rye.....	40	30	40	110	60
Barley.....	0	10	0	15	25
Oats.....	25	30	40	40	25
Corn.....	10	10	25	40	40
Hay.....	50	45	80	120	260
Pasture.....	120	240	320	720	1,400
Livestock:	<i>Number</i>	<i>Number</i>	<i>Number</i>	<i>Number</i>	<i>Number</i>
Cows.....	4 to 10	7 to 20	5 to 15	10 to 30	10 to 20
Sows.....	0 to 3	0 to 2	0 to 14	0 to 4	0
Sheep.....					25 to 175

¹ Farms of different size represent the following percentages of the total number of farms: 320 acres, 18 per cent; 480 acres, 16 per cent; 640 acres, 11 per cent; 1,280 acres, 15 per cent; 2,000 acres, 5 per cent.

The most common organization, for example, on the 320-acre farms in Bowman County has 50 per cent of its crop acreage in cash crops, whereas in Stark and Hettinger Counties the same organization has almost 75 per cent of the crop acreage in cash crops. On this same size of farm in Stark and Hettinger Counties the acreage in cash crops ranges from 105 to 190 acres, the total acres in all crops in each case being 210 and 220 acres.

On the other sizes of farms the most common organizations have about the same percentage of cash crops. Thus cash crops occupy 75 per cent of the crop area on the 480-acre farms, 60 to 70 per cent on the 640-acre farms, 75 to 80 per cent on the 800-acre farms, and 75 to 80 per cent on the 1,000-acre farms. On the 160-acre and 1,280-

acre farms the percentage is lower, being around 65 per cent on the former and 50 per cent on the latter.

In Bowman County, cash crops are of less importance in the crop area as they form about 50 per cent in the most common organization on all the different sizes of farms except on the very large farms where they form about 30 per cent.

TYPICAL ORGANIZATIONS IN AREA 13

Area 13 comprises the tier of counties along the Missouri River including, from east to west, Emmons, Morton, Oliver, Mercer, Dunn, and McKenzie Counties. About 625 farms from two representative localities in Dunn and Morton Counties were used for determining the prevailing farming systems. The more important organizations found in each of these counties are shown in Tables 19 and 20.

TABLE 19.—Typical farming systems for farms of different sizes in Dunn County, N. Dak.

Crop or livestock enterprise	160-acre farms ¹			320-acre farms ¹				480-acre farms ¹			640-acre farms ¹			800-acre farms ¹ —	960-acre farms ¹ —	1,040 to 1,400-acre farms ¹	
	Small acreage in cash crops	Most common	Large acreage in cash crops	Small acreage in cash crops	Most common	Medium acreage in cash crops	Large acreage in cash crops	Small acreage in cash crops	Most common	Large acreage in cash crops	Small acreage in cash crops	Most common	Large acreage in cash crops	Most common	Most common	Medium acreage in cash crops	Large acreage in cash crops
All crops.....	Acres 110	Acres 110	Acres 110	Acres 200	Acres 220	Acres 220	Acres 200	Acres 300	Acres 320	Acres 320	Acres 370	Acres 370	Acres 390	Acres 450	Acres 480	Acres 700	Acres 700
Wheat.....	38	55	65	50	190	115	120	120	160	190	135	180	240	210	240	315	455
Flax.....	7	5	18	10	10	15	30	0	25	30	20	30	40	45	25	70	70
Rye.....	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Barley.....	5	0	0	10	10	0	0	15	10	0	30	15	10	3	0	35	0
Oats.....	20	20	12	50	40	35	25	60	50	40	55	35	40	70	80	70	55
Corn.....	15	10	3	30	10	10	5	30	30	20	40	30	20	35	50	70	35
Hay.....	25	20	12	50	50	45	20	75	45	40	90	80	40	90	85	140	85
Pasture.....	40	40	40	80	75	75	85	140	120	120	220	220	200	320	400	560	560
Livestock:	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number ¹	Number	Number	Number
Cows.....	3 to 8	2 to 6	2 to 4	4 to 12	2 to 8	2 to 8	0 to 8	3 to 11	6 to 11	6 to 10	4 to 14	4 to 14	5 to 10	6 to 17	8 to 12	10 to 35	10 to 35
Sows.....	0 to 6	0 to 4	0 to 2	0 to 4	0 to 3	0 to 3	0 to 3	0 to 4	0 to 4	0 to 4	0 to 7	0 to 7	0 to 4	0 to 5	2 to 4	2 to 15	2 to 15
Sheep.....	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0 to 18	0	0

¹ Farms of different size represent the following percentages of the total number of farms: 160 acres, 24 per cent; 320 acres, 25 per cent; 480 acres, 20 per cent; 640 acres, 14 per cent; 800 acres, 6 per cent; 960 acres, 2 per cent; 1,040 acres, 6 per cent.

TABLE 20.—Typical farming systems for farms of different sizes in Morton County, N. Dak.

Crop or livestock enterprise	160-acre farms ¹			320-acre farms ¹			480-acre farms ¹			640-acre farms ¹		800-acre farms ¹ — Most common	960-acre farms ¹ — Most common	1,041 to 1,280 acre farms ¹	
	Small acreage in cash crops	Most common	Large acreage in cash crops	Medium acreage in cash crops	Medium high acreage in cash crops	Large acreage in cash crops	Medium acreage in cash crops	Most common	High acreage in cash crops	Medium high acreage in cash crops	Large acreage in cash crops			Medium acreage in cash crops	Large acreage in cash crops
All crops.....	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres
Wheat.....	115	115	120	200	200	200	240	260	280	360	360	420	440	560	640
Flax.....	60	70	90	90	110	130	95	145	195	215	245	255	240	250	385
Flax or rye.....	0	15	0	0	0	0	25	10	10	20	25	20	45	30	30
Rye.....	0	0	0	10	15	20		10	10						
Barley.....	10	5	5	15	15	12	15	15	20	20	20	25	25	40	40
Oats.....	15	10	10	20	15	12	25	20	15	20	25	25	20	40	30
Corn.....	5	5	0	20	15	6	25	20	10	20	15	25	20	55	30
Hay.....	25	20	15	45	30	20	55	40	20	65	30	70	90	145	125
Pasture.....	40	40	35	100	100	100	180	160	140	220	220	300	320	400	320
Livestock:	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number
Cows.....	3 to 7	2 to 7	2 to 6	5 to 12	5 to 12	5 to 12	6 to 12	6 to 12	5 to 10	5 to 13	5 to 13	5 to 14	5 to 14	6 to 25	6 to 20
Sows.....	2 to 4	2 to 4	0 to 3	2 to 8	2 to 8	2 to 8	2 to 7	3 to 8	2 to 8	3 to 9	3 to 9	2 to 8	2 to 8	0 to 8	0 to 5
Sheep.....									0 to 2						

¹ Farms of different size represent the following percentages of the total number of farms: 160 acres, 15 per cent; 320 acres, 27 per cent; 480 acres, 23 per cent; 640 acres, 12 per cent; 800 acres, 9 per cent; 960 acres, 5 per cent; 1,041 acres, 9 per cent.

² Flax or rye.

There is not a great deal of difference in the number of 160, 320, and 480-acre farms, each, respectively, representing 24, 28, and 20 per cent of the total in Dunn County and 15, 27, and 23 per cent in Morton County.

The organizations on the 320-acre farms (the most common in size) in Dunn County range from 60 to as high as 150 acres in cash crops, out of a total of 200 to 220 acres in all crops. The most common organization has 110 acres in crops, or 50 per cent of the crop area. Wheat constitutes about 90 per cent of the total cash crops. Oats and hay are the most important feed crops. On the other sizes of farms considerable range in cash crops is found: 40 to 75 per cent on the 160-acre farm, from 40 to 70 per cent on the 480-acre farm, from 40 to 75 per cent on the 640-acre farm, and from 55 to 75 per cent on the farms over 640 acres in size.

In Morton County, on the other hand, the most common organization (the group with large acreage in cash crops) on the 320-acre farms has 75 per cent of the crop area in cash crops. This is somewhat higher than is found in Dunn County. The percentages of cash crops on the other sizes is as follows: 160-acre farms, 65 per cent; 480-acre farms, 65 per cent; 640-acre farms, 75 per cent; 800-acre farms, 65 per cent; 1,280-acre farms, 65 per cent. It is apparent that the same organization persists to a large degree throughout the different size groups.

Barley, oats, and corn are about equally important in the Morton County organizations, whereas in the Dunn County organizations barley is practically negligible, and oats more important than corn. Hay is more important in Dunn County than in Morton County.

USES TO WHICH RESULTS MAY BE PUT

The results of these studies of typical farming systems may be used in several lines of important work, including the outlining of agricultural programs and determining profitable adjustments in production. They may also be used as a base in planning other studies.

USE OF RESULTS IN OUTLINING AGRICULTURAL PROGRAMS

In recent years a great deal of attention has been directed toward the development of State and regional agricultural programs. The ultimate objective of these programs, both from the research and from the extension viewpoints, is to determine the systems of farming in the various areas which will be most profitable to the farmers who follow them. Before much headway can be made in this direction, however, it is necessary to know the present situation in each area as to the systems of farming being followed.

The typical farming systems which have been presented indicate the varied responses of farmers in each area to the conditions which influence them in the selection of their farms and in planning their farming systems. Some of the variations found in these typical farming systems are no doubt justified by such factors as local differences in the character of the soil or topography, farmers' preferences,

and aptitudes in handling various enterprises, particularly the different classes of livestock. A considerable part of these differences, however, may be regarded as resulting from the failure of some farmers to adjust their systems of farming most wisely to economic and other conditions. The kinds of farming being done in the various areas having been outlined, the next step is to determine the systems of farming which are likely to be most profitable under the conditions most commonly found in each area.

The wide diversity in organization on farms of different sizes in the various areas and even on farms of the same size suggests the inadvisability of making "blanket" recommendations for farmers as a whole. The typical or representative farms provide, in part, a basis for testing out and appraising the profitableness of different types of farms as well as of long-time and year-to-year adjustments in different farming systems. Thus the typical farming systems, which are a part of the final product of the type-of-farming studies, may be taken as the starting point in other farm-management studies.

The way in which these typical farms can be used in determining the returns which will probably result from them under given yield and price conditions is shown in Table 21. The organization used in the illustration is the most common organization of half-section farms in Cass County, N. Dak. (See Table 4.)

In budgeting the receipts and expenses of the most common organization the yields of crops, production of livestock, and the amounts of labor and materials used for crops and livestock, are typical of this area as indicated by other farm-management studies.⁸ The prices of products and the expense items are also fairly typical of those prevailing in the area during the last few years.

TABLE 21.—Budget of receipts and expenses on a typical (most common¹) 320-acre farm in Cass County, N. Dak.

Crop	Acreage	Average yield per acre	Production	Requirements		Surplus for sale
				Feed	Seed	
	Acres	Bushels	Bushels	Bushels	Bushels	Bushels
Wheat.....	125	12.7	1,587	-----	150	1,431
Flax.....	20	8.5	170	-----	10	160
Barley.....	37	22.5	832	500	74	198
Oats.....	37	28.4	1,051	958	93	-----
Corn:						
For grain.....	25	27.5	688	683	5	-----
For forage.....	11	Tons 3	Tons 33	Tons 33	-----	-----
Hay.....	20	1.33	27	27	-----	-----

¹ This most common organization has from 40 to 50 per cent of its crop area in wheat and is followed by about 50 per cent of the farmers on the half-section farms in the area.

Crop sales:

Wheat, 1,431 bushels, at \$1.....	\$1,431
Flax, 160 bushels, at \$1.80.....	288
Barley, 198 bushels, at \$0.48.....	95

Total..... \$1,814

⁸ The factors to be considered in budgeting receipts and expenses are discussed in the following bulletin: HUTSON, J. B. FARM BUDGETING. U. S. Dept. Agr. Farmers' Bul. 1564.

Livestock sales:	
Hogs, 9,000 pounds, at \$0.08.....	\$720
Cattle, 2 cows, at \$50, and 5 veal calves, at \$15.....	175
Butterfat, 2,100 pounds, at \$0.35.....	735
Total.....	\$1,630
Total crop and livestock sales.....	3,444
Expenses:	
Hired labor.....	740
Twine.....	71
Threshing.....	199
Miscellaneous livestock expense (including supplementary feeds).....	110
Total.....	1,120
Returns above cash expenses which vary with changes in the organization.....	2,324

The indicated returns of \$2,324 above cash expenses for hired labor, threshing, twine, and the like represents the returns above those out-of-pocket expenses which vary most markedly as changes in the organization are made. In this and the following illustrations the primary objective is to show how the returns to the farm business as a whole are affected by the choice and combination of enterprises. For this purpose it is necessary to consider only those expenses which vary significantly with changes in the organization. In comparisons between organizations which include the same crops and livestock, but in somewhat different proportions, the cash expenses for such items as hired labor, threshing, twine, and feed are most important. In making comparisons between essentially different types of farming, however, other expense items must be considered. In comparing the returns on a cash-grain farm with those on a livestock farm, for example, the difference in the livestock, building, and equipment investment on the two farms may be an important item. Likewise, if the objective was to indicate whether the returns that could be expected from this farm were as large as might be obtained on a larger farm or in some alternative occupation, consideration would have to be given to other items, such as the amount of taxes that would have to be paid and the investment that would be required as well as many other things.

The probable returns from other typical farming systems on this size of farm in the area may be determined in the same way. On this size of farm in Cass County two other common organizations are found (Table 4) each of which is followed by about 20 per cent of the farmers on half-section farms. One of these organizations is high in cash crops, having more than 200 acres in cash crops. The other organization is more diversified, having less than 100 acres in cash crops.

If the same procedure is followed and the same yields and prices are used as in the above illustration (Table 21) the returns from the three organizations above expenses, which vary with changes in the organization, would be as follows:

Organization with large acreage of cash crops.....	\$2,240
Most common organization.....	2,324
Organization with small acreage of cash crops.....	2,400

For the particular set of price relationships used, this comparison suggests that with average yields the returns to the low cash crop organization are slightly higher, but the difference is not large. Despite the fact that some additional investment in livestock and possibly in buildings and equipment probably would be required for the organization with a small acreage of cash crops, there is, an important factor in favor of this organization. The larger acreages of cultivated crops and pasture and the additional livestock on the farms having relatively small acreage of cash crops will ordinarily result in higher-than-average yields on these farms. Wheat, flax, rye, and the other small-grain crops yield better in this area when grown in rotation with a cultivated crop, like corn and legume hay, and pasture crops, such as alfalfa and sweet clover.

In considering the probable returns from these alternative organizations over a period of years, therefore, the effect of the type of organization upon crop yields must be taken into account. With an increase of 20 per cent in the average yields of crops on the farm with a small acreage of cash crops owing to the production of legumes, cultivated crops, and livestock, the income above cash expenses would be approximately \$2,700 or from \$300 to \$400 greater than on either the most common organization or the one with a large area of cash crops.

Another factor to be considered is the distribution through the year of the labor requirements of the different organizations, especially as it affects the amount of labor hired and the amount done by the farmer and members of his family. On the farms that have more than the average amount of livestock the labor is more evenly distributed throughout the year, and a larger proportion of the work can ordinarily be done by the farmer or members of his family or by regular hired labor. It is only by taking into account all of these and other factors which affect the returns over a period of years that the relative profitableness of the various types of farms can be determined and the most desirable of the typical organizations selected for a particular set of conditions.

USE OF RESULTS IN DETERMINING PROFITABLE ADJUSTMENTS IN PRODUCTION

A farmer can not stop with the selection of a general system of farming to be followed over a period of years. Some short-time adjustments in the general scheme will usually be made because of such circumstances as the failure of a particular crop or the prospect of unusually high or low prices for one or more products in a given season. The typical farming systems may be used to good advantage in determining the short-time adjustments which can be made profitably. Changes in the relative prices of the products sold would change the returns from the different types of organization. This is illustrated in Table 22.

TABLE 22.—Returns from organizations of different types at various prices for different products

Item	Unit	Probable returns above cash expenses which vary with changes in organization, when prices are as follows—			
		Dollars	Dollars	Dollars	Dollars
Wheat.....	Bushel	1.00	1.00	1.20	1.40
Flax.....	do	1.80	1.80	2.00	2.00
Rye.....	do	.70	.70	.60	.80
Barley.....	do	.48	.48	.55	.55
Veal calves.....	Pound	.10	.15	.10	.10
Hogs.....	do	.08	.10	.08	.08
Butterfat.....	do	.35	.40	.35	.35
Organization with large acreage of cash crops.....		2,240	2,330	2,685	3,005
Most common organization.....		2,324	2,667	2,656	2,942
Organization with small acreage of cash crops.....		2,406	2,897	2,608	2,734

Under the price relationships in the first column of figures the returns to the farm having a small acreage of cash crops (with average yields) are higher than those for the other two. If the prices of hogs, veal calves, and butterfat should increase, as shown in the second column, the organization having the most livestock (small acreage of cash crops) would become even more profitable than the one with a large acreage of cash crops or the most common organization. On the other hand if prices of wheat and flax should increase, as shown in the third column of figures, the organization with the large acreage of cash crops would be the most profitable of the three and the organization with the small acreage of cash crops the least profitable. If the price of wheat should increase still further, as shown in the fourth column of figures, the advantage of the organization with the large area of cash crop would be even more pronounced.

When the annual agricultural outlook is issued at the beginning of the new crop year, these typical organizations afford a basis for determining what adjustments, if any, should be made on farms of different types in each area in the light of the prospective economic situation for the coming year. When the outlook information is considered from this point of view and is interpreted to the farmer in terms of a farm organization similar to the one he himself is following, its proper application will be more readily apparent.

USE OF RESULTS IN PLANNING OTHER STUDIES

The results of type-of-farming studies may be used in many other ways. The delineation of type-of-farming areas within which farming systems and conditions affecting farming are fairly similar, make it possible, for example, to use the results of local studies more broadly and with greater assurance that they are applicable than would be possible without a knowledge of the characteristics of the different areas. Standards as to methods and practices in handling particular enterprises can be set up with greater definiteness and therefore be more useful if made to apply to a specific type-of-farming area.

Income studies showing the returns obtained by farmers can be made more realistic and suggestive by the use of data by type-of-

farming areas showing the returns obtained on individual farms of different types and sizes in addition to the returns obtained by a composite group of farmers of all types and sizes.

Considerable attention is now being given to the supply and prices of particular farm products and especially to the ways in which farmers adjust their production to relative price changes. Studies of the response of farmers to price changes which have been made indicate that the type of farming followed is an important factor in this problem.^o The division of States and regions into areas of similar farming systems and conditions provides the basis for making such studies more realistic and trustworthy. The combination of data for adjoining areas of dissimilar conditions may, in fact, lead to inadequate or erroneous conclusions, for in this way significant differences in the response of different groups of farmers to price changes may be smoothed out or obscured.

^o See for example: ELLIOTT, F. F. ADJUSTING HOG PRODUCTION TO MARKET DEMAND. Ill. Agr. Expt. Sta. Bul. 293, pp. 503-507, illus. 1927.

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December 14, 1928

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This bulletin is a contribution from

<i>Bureau of Agricultural Economics</i>	NILS A. OLSEN, <i>Chief</i> .
<i>Division of Farm Management and Costs</i> ..	M. R. COOPER, <i>Senior Agricultural Economist, Acting in Charge</i> .

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