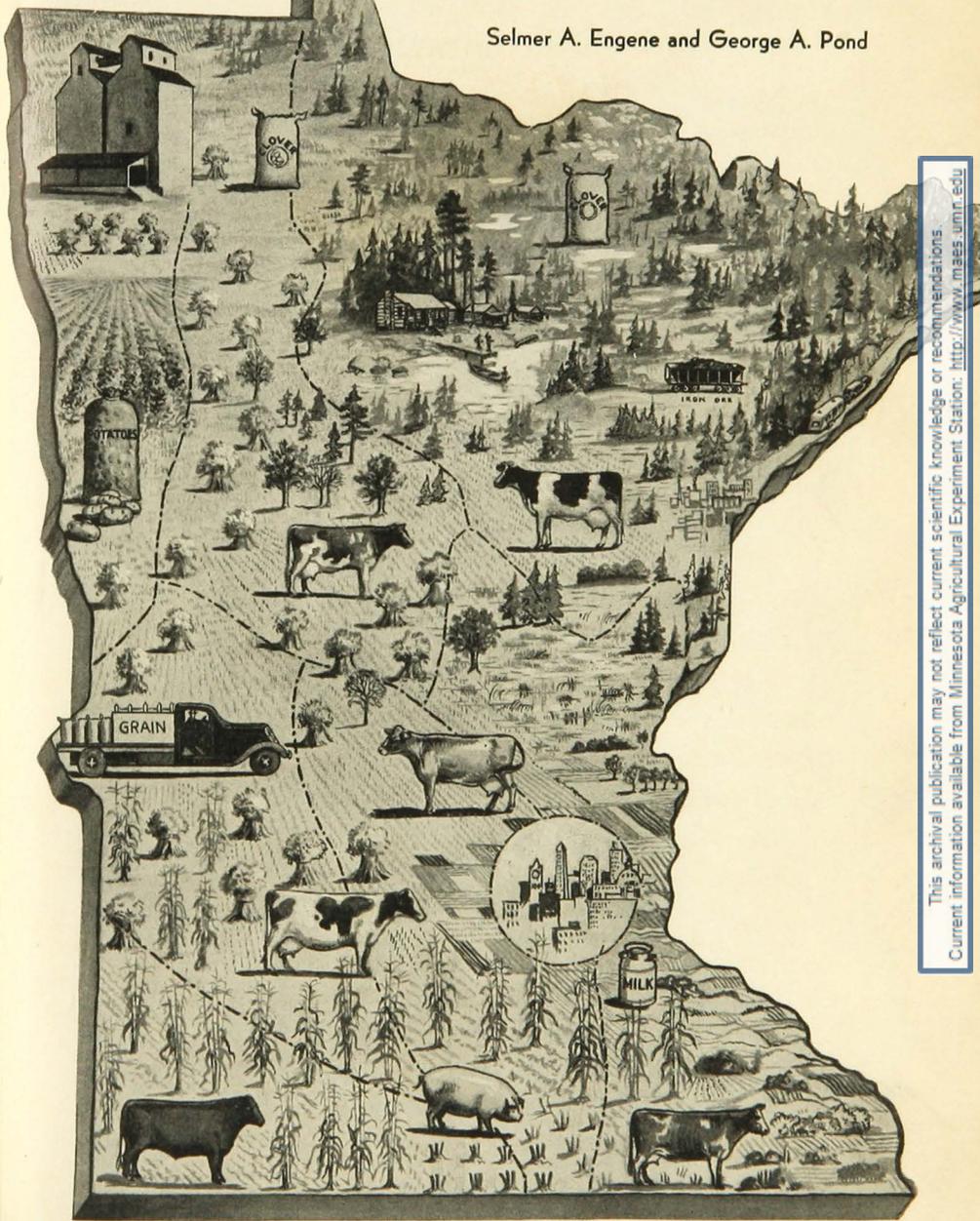


# AGRICULTURAL PRODUCTION AND TYPES OF FARMING IN MINNESOTA

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# Agricultural Production and Types of Farming in Minnesota<sup>1</sup>

S. A. ENGENE AND G. A. POND<sup>2</sup>

## INTRODUCTION

THE AGRICULTURE of any area is the result of the combined judgments of the farmers as to the most effective utilization of the resources of that area. Since these judgments are based on continuing experience and on trial and error processes that are in constant operation, agricultural production is constantly shifting. These shifts are, in part, the result of the farmers' better understanding of crop and livestock adaptation to the more or less fixed characteristics of their environment and, in part, the result of their efforts to adjust their production to changing elements in this environment.

Some natural environmental factors such as soil, climate, and topography are relatively fixed. Other natural factors such as plant and animal diseases, insect pests, and weed infestation are less fixed but may be at least

partially the result of climatic factors.

The economic environment is less fixed than the natural environment. Prices, marketing costs, competitive supply and demand conditions, and the availability of capital vary irregularly over both short- and long-time periods. Some of these economic factors, such as marketing costs, are affected by geographical location and hence have a certain degree of relative constancy within a given area.

The human or personal factors affecting the farmers' decisions vary among individual producers and from time to time for the same producer, but their net effect on the agriculture of any given area changes only slowly.

The environmental factors in any agricultural area, therefore, tend to mold the agriculture of that region into a characteristic pattern representing the resultant of these factors and differing from the pattern of any other area where a different set of factors obtain.

<sup>1</sup>Many of the data used in this study were assembled and tabulated as a part of the Regional Agricultural Planning Project conducted cooperatively by the Minnesota Agricultural Experiment Station, the Bureau of Agricultural Economics, and the Agricultural Adjustment Administration, United States Department of Agriculture, in 1935.

Assistance in the preparation of this material was furnished by the personnel of the Work Projects Administration, Official Project Number 65-1-71-140. Sponsor: University of Minnesota.

<sup>2</sup>Acknowledgement is made of the generous aid of F. J. Alway, Chief of the Division of Soils, Minnesota Agricultural Experiment Station, in the preparation of the material relating to soils, and of M. R. Hovde, Meteorologist, Minnesota Section, United States Weather Bureau, in the preparation of the sections relating to climate.

## PURPOSES

The purposes of this bulletin are (1) to describe the important factors affecting agricultural production in Minnesota, (2) to present a factual picture of the agricultural production patterns in the state that have resulted from the operation of these factors, and (3) to delineate and describe the more or less distinct type-of-farming areas in the state at the present time.

The material is presented graphically as far as possible with only a limited discussion of the causal factors. The more significant statistical data are presented in a separate publication, "Statistical Supplement to Agricultural Production and Types of Farming in Minnesota," for those who wish to make a more thorough analysis of any of the factors involved.

This material should prove useful to farmers in obtaining a more thorough understanding of the relation of their farm or community to the remainder of the state and a greater appreciation of the important differences in the physical and economic environment in different parts of the state.

Lending agencies and purchasers of land need this type of information in evaluating the agricultural adaptation and prospective earning capacities of different farms or areas. Owners and managers of many tracts of land, such as insurance companies and other loan agencies, may find it useful in determining the best utilization of this land.

Teaching and research programs may be oriented more effectively in the light of the description of the agriculture of the state that is presented here. This type of information should prove

especially useful as a basis for forming agricultural policies and programs for a state either as a separate undertaking or as a part of the planning of a national program. It may also serve as a basis for predicting the probable effect of any particular program upon the state as a whole or upon any area within the state.

## SOURCES OF MATERIAL

The principal source of material for this study is the agricultural reports of the Bureau of the Census of the United States Department of Commerce. These have been supplemented with reports of the cooperative crop and livestock reporting service of the Bureau of Agricultural Economics of the United States Department of Agriculture and the Minnesota State Department of Agriculture, Dairy, and Food, and data from other public agencies collecting information pertinent to the study. Unless otherwise indicated, the data on crop and livestock production, farm receipts, and types of farming were taken from the 1930 census.

The severe drouth in 1934 and to a lesser extent the agricultural adjustment program just getting under way resulted in abnormal shifts in both crops and livestock. The low prices of the depression years, 1931 to 1933, also have resulted in some disturbances from what might be considered the normal pattern of agricultural production. The data in the 1930 census reflect the farmers' reactions to conditions that had been relatively stable for several years as compared with the extremely variable situation that preceded the 1935 census.

## FACTORS AFFECTING AGRICULTURAL PRODUCTION IN MINNESOTA

### NATURAL FACTORS

**N**ATURAL factors determine or limit the physical possibilities of production within an area. These natural factors may be divided into the fixed or constant physical factors and the more variable biological factors. The principal physical factors are topography, soil, and climate. Topography and soil may vary widely within a limited area and even upon a given farm. The boundaries of soil types and elevations may be sharply defined and yet very irregular in outline. Climate, on the other hand, varies only gradually from one part of the state to another. Climate varies widely from year to year, whereas soil and topography remain constant. Biological factors may vary widely from area to area and from year to year in their effect on crop and livestock production.

#### Topography

Elevation is a minor factor determining the choice of crops in Minnesota. The extreme range is from 602 feet above sea level at Lake Superior to 2,230 feet in Cook county. Much of Lincoln county ranges from 1,750 to 2,000 feet and an area in Hubbard, Clearwater, and Becker counties ranges from 1,500 to 1,750 feet. There are limited areas ranging from 615 to 1,000 feet along the Mississippi, Minnesota, and Red rivers. Most of the remainder of the state lies between 1,000 and 1,500 feet above sea level.

The land surface of the state is relatively smooth. The Red River valley

is quite level. Most of north-central Minnesota is level and poorly drained with large swamp areas. The north-eastern corner is quite rough. The central part of the state is level to rolling with only limited areas of rough land, but it has many lakes. Southern Minnesota is similar in topography but contains fewer lakes and swamps. In the southeastern corner of the state, the land along the Mississippi river and some of its tributaries is sufficiently rough to create a serious erosion problem. Here topography plays a fairly important part in influencing the choice of crops. In other parts of the state, topography influences choice of crops principally through its relationship to drainage.

#### Soils

Minnesota soils present a wide range of productivity and physical characteristics ranging from some of the most productive soils in the country to some which are unsuitable for agricultural production. According to estimates of the Bureau of Chemistry and Soils, United States Department of Agriculture, 23 per cent of the land of the state is excellent land for the production of general crops. Only two states, Iowa and Illinois, have a higher proportion of excellent land. Twenty-four per cent of the area is classed as good land, 15 per cent as fair, 13 per cent as poor, and 25 per cent as unfit for agricultural use. A portion of this latter group could be made usable by drainage.<sup>3</sup>

<sup>3</sup> Nat. Resources Board Report, Part II, p. 127, 1934.

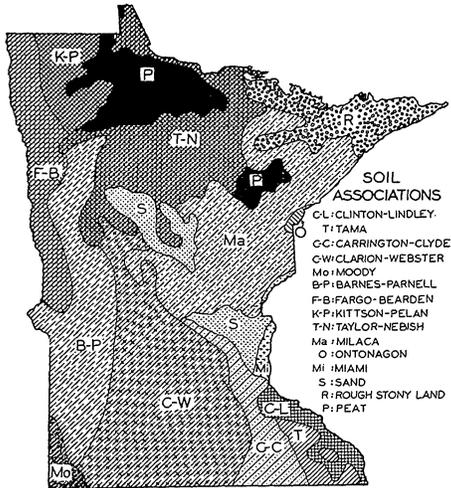


FIG. 1. SOIL ASSOCIATIONS OF MINNESOTA, GROUPED ACCORDING TO DOMINANT SOIL TYPES

Adapted from Map in *Soils and Men*, Yearbook of Agriculture, 1938, U. S. Department of Agriculture.

Soil characteristics are important factors influencing the adaptability of different crops and cultural methods. The principal soil associations in Minnesota are presented in figure 1. The map has been copied and the descriptions adapted from "Soils of the United States" in *Soils and Men*, Yearbook of Agriculture, 1938, United States Department of Agriculture. The associations shown on the map represent types of landscape, defined according to the character of the soils that compose them and the pattern of their distribution. Local details have been submerged in order to present a general view of the features of broad significance on a small map. Many different soils occur in each of these areas, but one or two may be considered characteristic, associated with many minor soil types.

Thus in the report of the soil survey of Mille Lacs county<sup>4</sup> while 18 of the soil types are shown on the soil map the Milaca soils—very fine sandy loam, fine sandy loam, loam and silt loam—occupy 39 per cent of the area of the county and form the dominant as well as the characteristic soils.

### 1. Clinton-Lindley Association (C-L.)

—These soils are developed along the valley slopes of the Mississippi river and for a short distance along its tributaries. The surface varies from gently to sharply rolling land, with no large areas of flat land. The cultivated acreage is comparatively small. Clearings, irregular in shape and size, are interspersed among the hilly wooded areas. The soils are light colored, well-drained silt loams with heavy subsoils, mostly free of stone and very susceptible to erosion where cultivated. They respond readily to lime and manure.

### 2. Tama Association (T.)

—The surface is undulating to gently rolling. Comparatively small areas may be almost level, but drainage is adequate everywhere. The steepness of the slopes prevents cultivation on only a very small part of the land. About 90 to 96 per cent of the land is tillable. The soils are dark grayish brown silt loams with heavy subsoil, free of stones and well drained. These soils erode rapidly under cultivation. They are unexcelled for corn production by any other soils in the United States.

### 3. Carrington-Clyde Association (C-C.)

—This occupies undulating to gently rolling uplands with intervening flat

<sup>4</sup>G. B. Bodman and others, Soil Survey of Mille Lacs county, Minn., 1927.

areas in narrow depressions and shallow valleys where drainage was formerly deficient. On the uplands the soils are brown silt loams with heavy subsoil carrying some stone on the surface and below; on the flat lands the soils are black. From 60 to 90 per cent of the land is used for cultivated crops. The upland soils rank among the most productive soils of the Corn Belt and the flatter lands also, where drainage is adequate, produce large yields of corn.

**4. Clarion-Webster Association (C-W).**—The undulating to gently rolling higher land is interlaced with more nearly level tracts. Nearly all the land is cultivated. On the former the soils are very dark grayish brown loams with heavy subsoil carrying a small amount of stone while on the lower land the surface is black and heavier. These areas are unsurpassed by any others of equal size in the production of corn.

**5. Moody Association (Mo.)**—The surface ranges from undulating to sharply rolling. The soils have a dark grayish black to almost black surface with heavy subsoil, are free of stone, and are very susceptible to water erosion. They compare favorably with the best corn lands.

**6. Barnes-Parnell Association (B-P.)**—This occupies a succession of smooth, nearly level glacial till plains and low rounded morainic hills and ridges with occasional enclosed lakes or marshy areas. These soils have a darker surface layer than any other upland soils in the United States. Associated with these well-drained black loams with a

heavy subsoil carrying a small amount of stone, there are numerous water-logged depressions used for hay and pasture.

**7. Fargo-Bearden Association (F-B.)**—This occupies what is known as the Minnesota portion of the Red River valley which, together with the adjacent portions in North Dakota and Manitoba, forms one of the largest bodies of level land in the world. Instead of this being a river valley it is really the filled-in basin of glacial Lake Agassiz. The lake deposits of the Red River valley are in three belts. In the lower part along the Red River is a belt of clays and clay loams; next a belt of silt loams; and on the outer or eastern edge a belt of sandy loams. The surface soils are black and both surface and subsoil are free of stone except in a few places where the lake deposit is very shallow. Associated with the sandy soils of the eastern belt are poorly drained areas and gravelly ridges, the beaches of the glacial lake. This association is noted for its production of small grains, but the natural productivity of the soils is reduced by damage from drouths and occasionally in a wet season by lack of adequate drainage. In extremely rainy seasons the surplus water can be drained from the land only very slowly. A large acreage of poorly drained land is used for hay.

**8. Kittson-Pelan Association (K-P.)**—Like the preceding association, this lies within the basin of glacial Lake Agassiz and is part of the level plain formed by the old lake bed. The native vegetation was mixed grassland and woodland, the tree growth being low and in clumps with aspen and willow

dominant. Bog areas are numerous, part open and part timbered with tamarack and spruce. The soils are complexly intermixed, for the most part dark-colored, owing to poor natural drainage and grass vegetation. They commonly have a heavy subsoil and carry much stone. There is a limited area of black silt loams fairly well drained like that in the central belt in the preceding association and considerable light colored sand subject to wind erosion.

#### 9. Taylor-Nebish Association (T-N.)

—This includes the undulating to rolling timbered plains of the north-central part of the state. A few areas are sharply irregular or hilly. It does not have a definitely developed drainage system, there being many ponds, lakes, and bogs. Originally it was densely timbered with pine and hardwoods. The dominant soils of the better drained lands have a gray surface loam and a heavy subsoil with stones in both varying widely in amount. Only a small proportion of the land is cleared and cultivated.

10. Milaca Association (Ma.)—This occupies the east-central portion of the state and like the preceding association was originally densely timbered with conifers and hardwoods. The surface features range from nearly level plains to morainic ridges and bare rocky knobs with many lakes and bogs. The characteristic soils are light gray sandy loams with a heavy subsoil of pink or light red color. Boulders and cobbles occur on the surface and below in widely varying amounts. Stoniness handicaps the profitable use of much

of the land for crops. Settlement is largely in local communities on the better soils.

11. Ontonagon Association (O.)—Bordering the head of Lake Superior, this association is very inextensive occupying the Minnesota portion of the lake plain of glacial Lake Duluth. It was originally occupied by white pine and hardwoods. The surface soil is gray or grayish red, mostly heavy, and the subsoil is a pale red clay.

12. Miami Association (Mi.)—The surface consists of roughly rolling or hilly moraines, undulating till plains with marked depressions, nearly level outwash plains, and old lake beds. There are numerous lakes, ponds, and bogs. While the soil pattern is generally complex, the characteristic, although not the dominant, well-drained soil is a grayish brown loam with a heavy subsoil, carrying a variable amount of stone both on the surface and below. The well-drained soils, such as this, are only moderately fertile but are generally responsive to good management.

13. Sand Association (S.)—The surface features are variable, ranging from nearly level plains to roughly broken or choppy moraines. Except for a few small prairies the native vegetation was forest with oaks dominant in the south and jack pine and red pine in the north. The surface soil varies from a loamy sand to a fine sandy loam, light colored except on the prairie portions where it is grayish brown, while the subsoil consists of sand or gravel. Associated with these drouthy soils are numerous bogs, partly open and partly timbered with tamarack and black spruce.

**14. Rough Stony Land (R.)**—This is rough or mountainous with shallow stony soils and a native cover of forest, mostly conifers. Patches of bare rock are exposed in many places, and in some places they occupy a large part of the land. Only a few comparatively small areas are suitable for cultivation; on these the soils are similar to those of the Milaca Association.

**15. Peat (P.)**—Peat is an organic material consisting of an accumulation of plant remains in varying degrees of preservation or decomposition. It has developed from the vegetation of marshes, bogs, and swamp forests. The crops grown on these soils are more subject to frost damage than are the crops grown on mineral soils, and the use of fertilizers is usually necessary.

### Climate

The mean annual temperature in Minnesota ranges from a low of 37° Fahrenheit along the northern border to a high of 46° in the southeastern corner. The zones of approximately equal temperature, presented in figure 2, are fairly regular, for the influence of large bodies of water or large differences in elevation are apparent only in limited areas. January is the coldest month of the year, and July is the warmest. The difference in temperature between these months is about 60 degrees in all parts of the state.

The growing season of Minnesota is extremely variable as is shown in figure 3. Along the Mississippi Valley southward from Minneapolis the season between the last killing frost in the spring and the first killing frost in

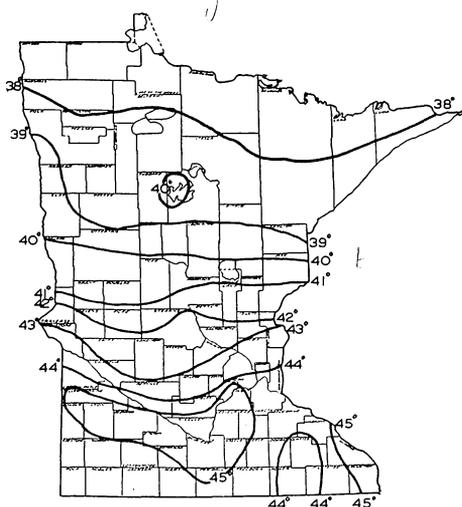


FIG. 2. MEAN ANNUAL TEMPERATURE, DEGREES FAHRENHEIT

Based on U. S. Weather Bureau's reports of normal temperatures at 77 stations.

the fall averages 160 days or more. It is less than 110 days in the northern part of the state. The exact length of the growing season in the sparsely settled northeastern corner is uncertain because weather stations are few and their records cover a short period. From the available records, however, it appears probable that it is not more than 100 days, and it may fall as low as 80 or 90 days in certain localities. The length of the season varies from year to year. It will range up to 20 days longer or 20 days shorter in about two thirds of the years and will deviate from the average by more than 20 days but rarely more than 40 days in the other years. This variation is quite similar in all parts of the state.

The average annual precipitation, as presented in figure 4, ranges from 20

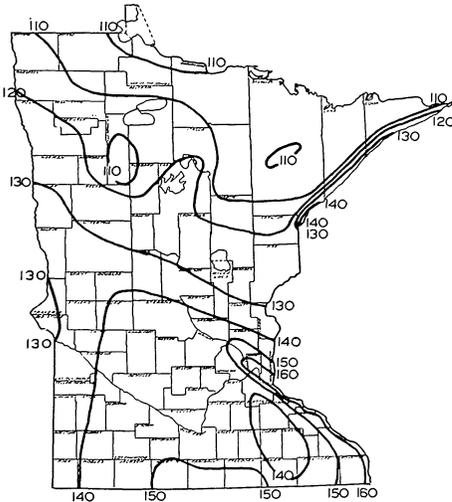


FIG. 3. AVERAGE GROWING SEASON, DAYS

Based on records at 97 stations through 1937, as reported by U. S. Weather Bureau.

inches in the northwestern corner of the state to 32 inches in the southeastern corner. The seasonal distribution is quite similar for the different parts of the state. Approximately 55 per cent of the total precipitation falls during the four principal crop-growing months of May through August. About 20 per cent falls during the period from early September until the ground freezes, a period of slight plant growth when moisture can be readily added to the reserves in the soil. In most parts of the state less than 15 per cent falls during the winter months when a considerable part is lost through direct evaporation from the snow and through runoff from melting on frozen ground. In general, the precipitation is sufficiently high for satisfactory crop production although moisture-conserving practices are of some importance in the northwestern counties.

### Biological Factors

Biological factors are more difficult to measure or to evaluate than the physical factors. Rust has been an important factor affecting the production of small grain especially wheat. Flax wilt has had an important bearing on flax production. Other plant diseases have at one time or another been factors limiting the production of certain crops. Control measures and the development of disease resistant strains may offset, wholly or in part, the effect of plant diseases. The livestock industry has been affected by such diseases as tuberculosis, Bang's disease, and hog cholera. Even though remedies and preventive practices may be developed, the extra costs involved serve as definite limitations to the class of livestock affected.

Insects that have seriously damaged crops in Minnesota from time to time include grasshoppers, army worms, chinch bugs, the Hessian fly, and in the southeastern part, white grubs. Insect invasions have been periodic and often associated with certain weather conditions. Control methods may necessitate shifts in the cropping system.

Weed infestations likewise may make changes in the cropping system necessary or may involve control methods that reduce the comparative advantage of a particular crop. Both annual and perennial weeds increased rapidly in the Red River valley when small grains dominated the cropping system and made necessary the recourse to cultivated crops and summer fallow. Quack grass has increased the number of tillage operations required, especially in southern Minnesota, and has encouraged the use of intertilled crops. Field

bindweed has proven especially troublesome in areas where a large proportion of the land is in corn, but as yet it has not resulted in appreciable shifts in crop choice.

Biological factors affect both the yield and the quality of crops. Since these are also affected by numerous other factors, it is impossible to measure the effect of any one of them. Most of the biological factors may be controlled wholly or in part, and their influence on the choice of enterprises depends largely on the cost of this control.

### Crop Yields

The level of the yields of the various crops is one of the most important factors influencing the extent to which an area will be developed for agricultural use, the crop combination which will be adopted, the size of a farm that will constitute an economical unit for operation, and many of the other factors that characterize the agricultural pattern of the state. The natural factors that have been discussed influence the farmer's choice principally through their effect upon the yield of crops. Many other factors, such as differences in varieties and in cultural practices, affect the level of yields but only to a lesser extent.

Average yields by counties for corn, oats, barley, spring wheat, winter wheat, rye, flax, and potatoes have been reported annually for Minnesota beginning in 1917 and for tame hay and

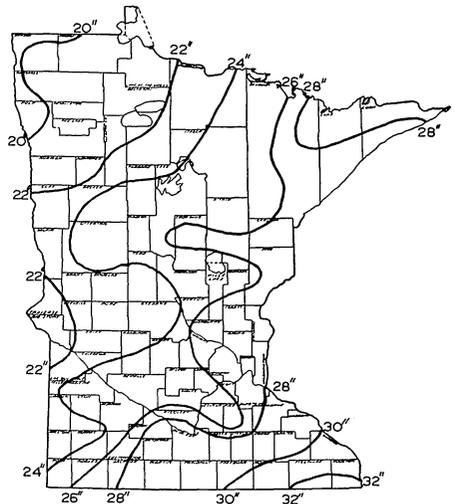


FIG. 4. MEAN ANNUAL PRECIPITATION, INCHES

Based on U. S. Weather Bureau's reports of normal precipitation at 86 stations.

wild hay beginning in 1920. These ten crops occupy approximately 90 per cent of the crop land of the state. An index combining the average yields of these crops, excluding wild hay, is presented in figure 5. Each crop is weighted according to the acreage in the county, and the combined average yields of these crops is expressed as a percentage of the average for the state. An index of 112 thus represents an average of 12 per cent above the average for the state.<sup>5</sup>

The highest yields occur in the south-central part of the state where the combined yields of the nine crops are more than 15 per cent above the average for the state. The lowest crop

<sup>5</sup> The index of crop yields was calculated as follows: For each crop, 1929 acreage for the county x 1917-36 yields for the county = estimated production;

$$\frac{\frac{\text{Estimated production}}{1917-36 \text{ yields for state}} = \text{estimated acreage}}{\frac{\text{Sum of estimated acres for the nine crops}}{\text{Sum of 1929 acres for the nine crops}}} \times 100 = \text{Index of crop yields.}$$

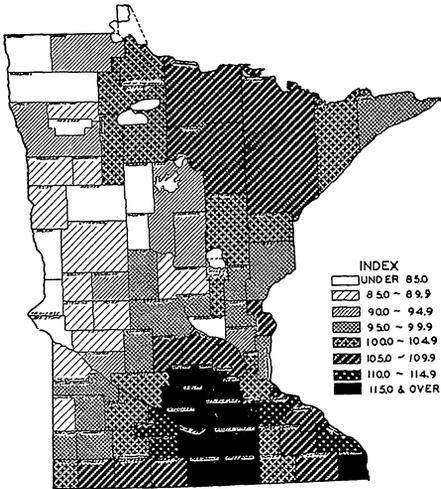


FIG. 5. INDEX OF COMBINED YIELDS OF NINE CROPS, 1917-36

yields occur along the western border of the state. The highest yields are obtained in Carver County, with an index of 133 while the lowest, an index of 82, are obtained in Sherburne County, only about 25 miles farther north. This sharp difference primarily is due to soil differences.

**Variability of Crop Yields**—The selection of crops and other enterprises for farms is affected not only by the average yields of crops but also by the variability of those yields. When crop yields vary considerably from year to year, incomes also fluctuate. Problems of maintenance of livestock are increased because the feed supply is not constant. Either rations must be changed materially from year to year, the numbers of livestock must be changed, or large quantities of feed

must be carried from the years of high yields to the years of low yields. Losses which result from these changes tend to reduce earnings.

The coefficient of variation is used as a measure of the variability of the crop yields.<sup>9</sup> This coefficient expresses the average of the year-to-year fluctuations as a percentage of the long-time average yield. One characteristic of this measure is that in approximately one third of the years the yield will differ from the long-time average by a percentage greater than that expressed by the coefficient of variation. For example, the coefficient of variation of corn in Meeker County is 27.5, indicating that in about one year out of three the yield of corn in that county deviates from the long-time average of 32.8 bushels per acre by at least 27.5 per cent.

The average variability of crop yields, combining the nine crops, is presented in figure 6. There is a distinct tendency for the concentration of either high or low variabilities in certain areas. Yields are most variable in the west-central counties where the coefficient of variation is 34 or more, that is, in one year out of three, the yields of crops in that area deviate from the long-time average yields by 34 per cent or more. This is the area which has been most severely affected by drouths. Another area of relatively high variability extends eastward across the central part of the state. The variability is least in the south-central part of the state with a coefficient of less than 22.

<sup>9</sup> The formula used for the calculation of the coefficient of variation was:

$$\sigma = \sqrt{\frac{\sum X^2}{N} - M^2}$$

where  $\sigma$  is the standard deviation,  $X$  the observed yield in any year,  $N$  the number of years for which yield estimates were available, and  $M$  the average yield.

$$\text{Coefficient of variation} = \frac{\sigma}{M} \times 100.$$

In general, the coefficient of variation tends to be high in those regions where the average yields are low. In the regions of low average yields, therefore, not only must a large acreage be farmed in order to secure a satisfactory volume of business, but also the total production from that farm tends to be less dependable than is that from a farm in the area of high yields.

### ECONOMIC FACTORS

Economic factors influence the farmer's choice of the enterprises that will contribute the most to his earnings from among the ones adapted to the physical and biological conditions in the state. Modern commercial agriculture is highly specialized. Many of the commodities and services that are used are purchased or hired. A large share of the production is sold. According to the 1930 census, approximately 86 per cent of the value of Minnesota farm products is sold and only 14 per cent is used in the farm home.

### Market Outlets

The prices received for farm products sold depend largely on the extent and location of the available market outlets. In Minnesota only 35 per cent of the population lives on farms. The principal concentration of population in Minnesota is in St. Paul, Minneapolis, and Duluth, all of which are located along the eastern edge of the state. Even after the needs of the other 65 per cent have been satisfied, a large share of the production of the state remains to be sold in other markets.

Most of these markets are east of Minnesota. The largest share of the

domestic market for farm products is in the northeastern states. In 13 states lying east of Minnesota are located 49 per cent of the total population of the nation but only 22 per cent of the farm population. The largest foreign market for Minnesota's export commodities, hog products and wheat, is in Europe. Farmers living along the eastern edge of the state, therefore, have a slight advantage in the marketing of their products because they are nearer the centers of consumption.

### Transportation Facilities

A good network of railroads and highways covers the entire state with a principal concentration point at the Twin Cities and a secondary point at Duluth. Both rail and highway connections with the East are good, providing rapid and efficient transportation. Water transportation is available eastward on the Great Lakes and southward on the Mississippi river.

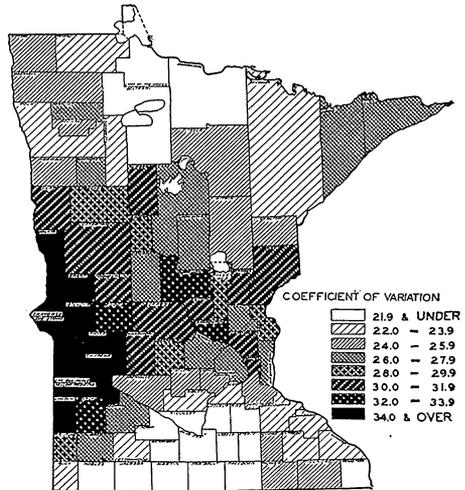


FIG. 6. AVERAGE VARIABILITY OF YIELDS OF NINE CROPS, 1917-36

Table 1. District Weighted-Average Prices for 13 Agricultural Commodities, 1924-1933 Averages\*

	Districts						State
	South-east	South-west	East central	West central	North-east	North-west	
Wheat .....	1.04	1.04	1.09	1.06	1.02	.98	1.04
Corn .....	.62	.57	.72	.62	.....	.78	.58
Oats .....	.35	.32	.35	.32	.39	.30 <sup>7</sup>	.33
Barley .....	.52	.45	.53	.48	.53	.45	.47
Rye .....	.76	.70	.69	.71	.71	.79	.73
Flax .....	1.98	1.89	2.01	1.95	1.85	1.85	1.92
Potatoes .....	.89	.73	.65	.74	.71	.60	.69
Hogs .....	7.86	7.69	7.60	7.66	8.00	7.51	7.73
Cattle .....	6.54	7.04	5.56	6.67	5.27	5.66	6.43
Lambs-sheep .....	7.90	7.89	7.82	7.76	7.82	7.66	7.82
Chickens .....	.148	.151	.132	.138	.161	.129	.141
Eggs .....	.202	.192	.198	.191	.216	.186	.197
Butterfat .....	.38	.36	.38	.37	.37	.35	.38

\* Waite, W. C. and Garver, W. B., "Variation in Agricultural Prices Among Different Sections of Minnesota," Minnesota Farm Business Notes, Agricultural Extension Division, University of Minnesota, No. 167, page 2.

### Prices

The economic factors affect the farmers principally through prices. A comparison of the prices received for each of the major agricultural commodities in different sections of the state is presented in table 1. For this purpose the state has been divided into six areas. Considerable variation will be observed in the price received in different parts of the state. Some of the causes of these differences are (1) differences in the types of markets in which the products are sold, (2) differences in transportation costs, (3) differences in kind or quality of products, and (4) differences in the extent to which commodities must be shipped into or out of the area.

In ordinary years reported prices of grain tend to be somewhat higher in the eastern part of the state than in the western part and are usually relatively high in the northeastern district which is largely a deficit area. Thus, the southeastern and northeastern districts are likely to be relatively high and

the southwestern and northwestern relatively low. The differences amount to around 5 to 10 cents in the case of wheat, corn, rye, and flax; 5 cents or less for oats; and 10 cents or more for barley. Potatoes vary widely between years with differences as large as 50 cents a bushel, but ordinarily the two southern, the west-central, and the northeastern districts are above the east-central and northwestern districts in price. The differences in hogs and cattle are more marked and are a result in a large part of differences in types of animals sold and degree of finish. Hogs show a variation of from 80 cents to a dollar a hundredweight with prices relatively high in the southeastern and low in the east-central and northwestern districts. Cattle often vary by as much as two dollars a hundredweight with the highest prices generally reported from the southwestern and the lowest prices from the east-central and the two northern districts. The variation is small in the case of sheep, usually amounting to

only 10 cents per hundredweight. Butterfat varies by about 4 cents or less per pound with the higher prices ordinarily reported in the southeastern and east-central districts. With chickens and eggs, the differences amount to 5 cents or less with higher prices reported in the southeastern and north-eastern districts.<sup>7</sup>

## SOCIAL FACTORS

A large number of factors that influence the development of the various types of farming can best be classified as social factors. Important among these is the effect of custom which is frequently associated with nationality

differences. Where certain areas have been settled by immigrants from the same nation, the customs and practices of that nation have frequently been transferred to this new community and have influenced the development of agriculture in that community. Local or personal skills or preferences have led to the adoption of types of organization on some farms considerably different from that of the surrounding areas. The leadership of farmers, extension workers, teachers, or others have often influenced the adoption of certain enterprises or practices in local areas. In general, these social factors tend merely to cause the development of local variations in types of farming.

## AGRICULTURAL DEVELOPMENT

THE ENTIRE agricultural development of Minnesota has occurred within the last century. The first section opened to settlement was the territory lying between the Mississippi and St. Croix rivers north to the mouth of the Crow Wing river. This territory was obtained from the Indians by a treaty negotiated in 1837 and ratified in 1838. Lumbering developed rapidly during the next few years, but farming developed slowly at first. Less than 200 farms had been established by 1850. Two treaties negotiated with the Indians in 1851 opened to settlement approximately the southern half of the state. Most of the remainder of the state was opened within the next 15 years.

The settlement of the state started along the Mississippi river and spread toward the west and northwest (fig. 7). The territory along the Mississippi was accessible by river steamer. After landing on the banks of the river, the settlers moved through the valleys of its tributaries into the hills and prairies to the west. Settlement of the southwestern part of the state did not begin until after 1870 and of the northwestern part until after 1880. The settlement and improvement of the land in southeastern Minnesota were practically complete by 1880. The settlement and improvement of the land in the southwestern section and the open lands of the Red River valley of the northwest were practically complete by 1900 or about 20 years later than the southeastern corner. Most of the development of the northeastern part of the

<sup>7</sup> Adapted from Waite, W. C. and Garver, W. B., "Variation in Agricultural Prices among Different Sections of Minnesota," Minnesota Farm Business Notes, Agricultural Extension Division, University of Minnesota, No. 167, page 2.

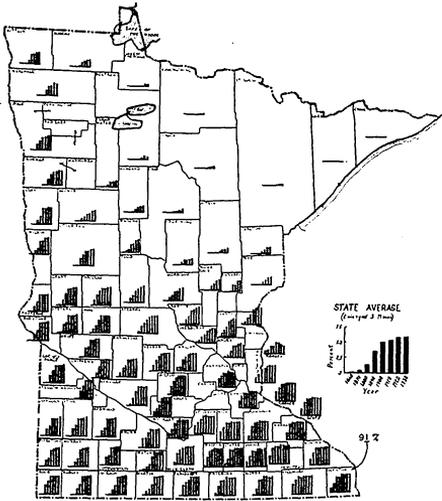


FIG. 7. PROPORTION OF TOTAL LAND IN FARMS, 1860-1930

state, the territory originally covered by coniferous forests, occurred after 1900 and has been rather limited up to the present time. Costs of clearing have been high, and large areas with soils of low productivity have been encountered.

The number of farms in the state has increased from less than 200 in 1850 to 185,255 in 1930 and 203,302 in 1935. A little more than half (60 per cent in 1930) of the land area of the state is now in farms. In 42 counties the land in farms constitutes more than 90 per cent of the land area while in 9 northeastern counties it constitutes less than 25 per cent. In Cook and Lake counties less than 2 per cent of the land is in farms.

## UTILIZATION OF LAND IN FARMS

**T**HERE ARE wide variations among the different sections of the state in the manner in which farm land is utilized. These variations are determined to a large extent by differences in physical features, such as topography, soil type, and climate. They are modified to some extent by variations in the economic factors. The land in farms may be divided into the following five major groups: (1) tillable land, (2) wild hay, (3) permanent pasture, (4) woodland not pastured, and (5) other land.<sup>8</sup> The proportion of the land

in farms devoted to each of those uses is presented in figures 8 to 12.

The tillable land is the most important of these five groups. It occupies about three fifths of all farm land in the state. It is usually the most productive, yielding the largest income per acre. Many alternative uses for this land are usually open to the farmer enabling him to adapt his operations to the economic conditions which he encounters. Because of its importance, the utilization of this land will be discussed in more detail in the next section of this bulletin.

Only a small part of the land in farms is used for the production of wild hay (6 per cent in 1929). A small proportion of this is land that is too rocky to be cultivated, or draws and

<sup>8</sup> For 1929 "Plow Land Used for Pasture" from the Minnesota State Farm Census has been substituted for "Plowable Pasture" from the U. S. Census. The data from the Minnesota State Farm Census represent more closely the acreage of pasture on land that has been plowed. Permanent pasture is the remainder of "Total Pasture" as reported in the U. S. Census.

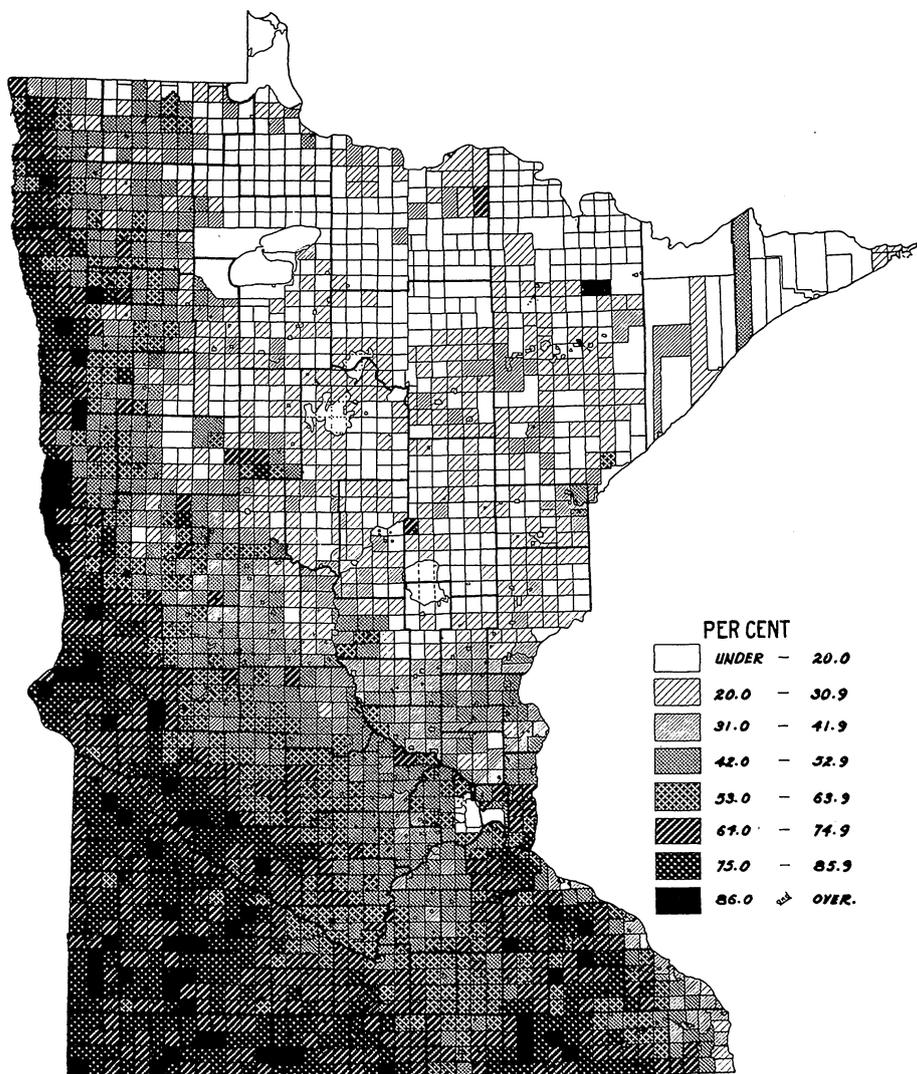


FIG. 8. PROPORTION OF LAND IN FARMS THAT WAS TILLABLE, 1929

The lands of the west and southeast are relatively level, with few swamps or stony soils. Poorly drained areas are numerous in the central counties. Poorly drained, stony, or sandy soils and forest land not yet cleared occupy much land in the northeastern counties.

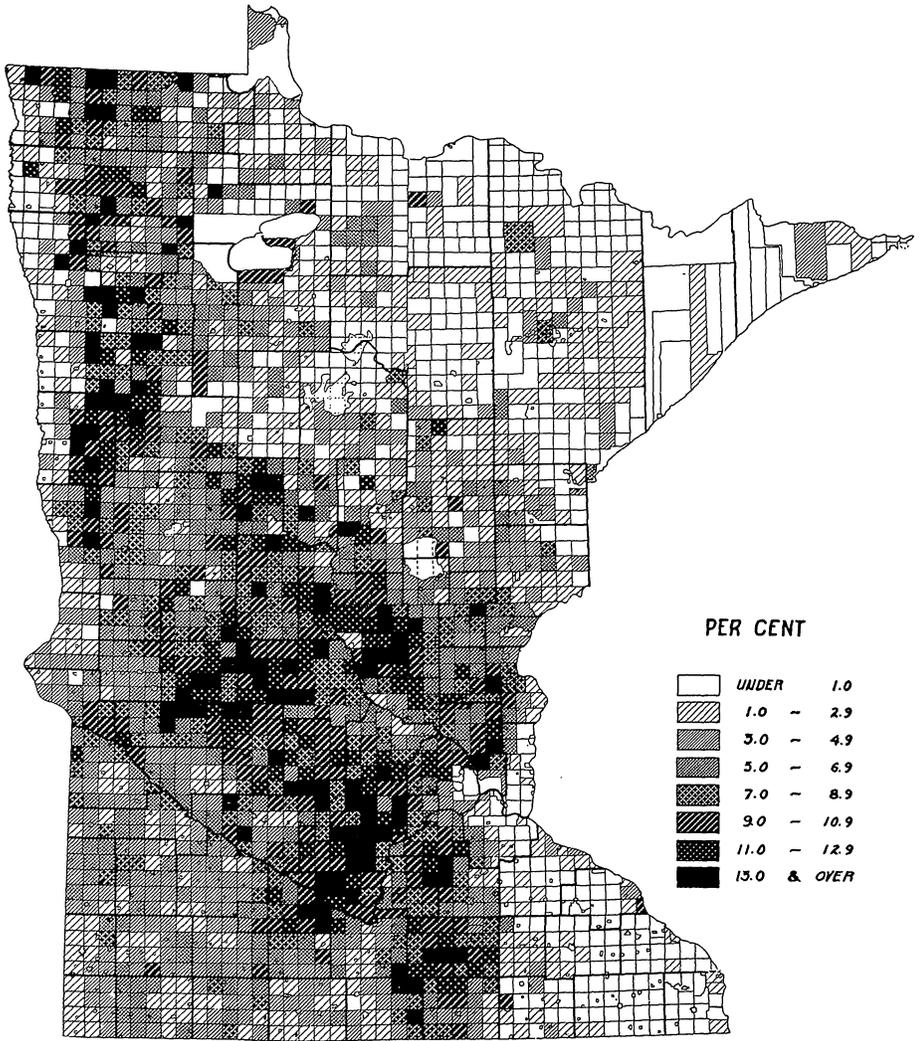


FIG. 9. PROPORTION OF LAND IN FARMS USED FOR WILD HAY, 1929

The proportion of wild hay land is largest in the areas of numerous poorly drained depressions.

ravines that must be kept in sod in order to prevent gullies from developing; but most of it is land that lack of adequate drainage makes unsatisfactory for other crops. Unless artificial

drainage is provided, the only alternative use for most of this land is pasture.

Permanent pasture occupies approximately one quarter of the farm land of

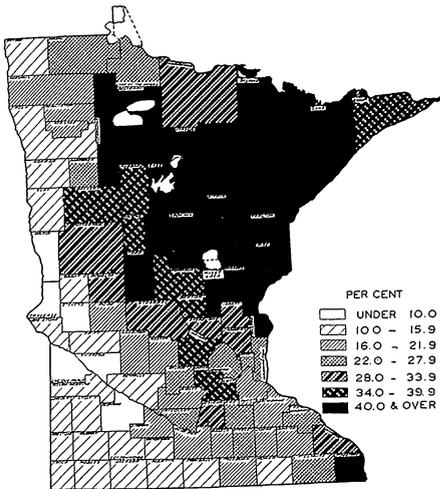


FIG. 10. PROPORTION OF LAND IN FARMS USED FOR PERMANENT PASTURE, 1929

The proportion of permanent pasture is high in areas where a small proportion of the farm land is tillable.

the state. Much of this is on land which is too stony, hilly, or wet to be tillable. In the northeastern quarter of the state a large proportion of this pasture is wooded. Some of this would be tillable if cleared. Much of this permanent pasture, as well as the wild hay land, can be used effectively only as a source of feed for livestock.

Slightly more than 3 per cent of the farm land in the state is woodland not pastured. Except for some areas in the southeastern counties, most of this woodland is in the northeastern counties. Practically all of this forest land is cutover, and its commercial value at the present time is limited.

Other land, including waste lands and land occupied by buildings, feed lots, farm yards, roads, and ditches, constitutes about 7 per cent of the land in farms. Most of this represents land which yields no direct income.

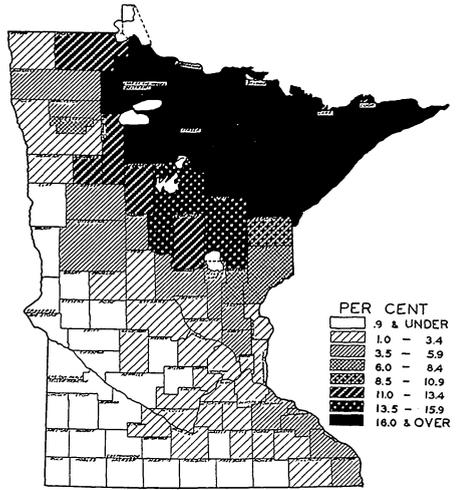


FIG. 11. PROPORTION OF LAND IN FARMS USED FOR WOODLAND NOT PASTURED, 1929

Woodland, pastured and not pastured, occupies about one half of the farm land in northeastern Minnesota where farms are still in the process of development.

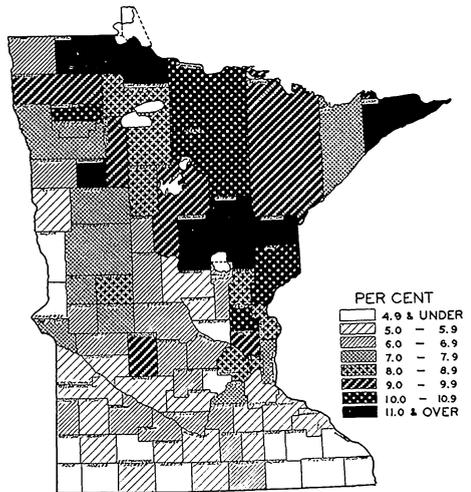


FIG. 12. PROPORTION OF LAND IN FARMS USED FOR OTHER PURPOSES, 1929

The proportion of waste land is high in the northeastern counties, where there are numerous small lakes, swamps, and rock outcrops.

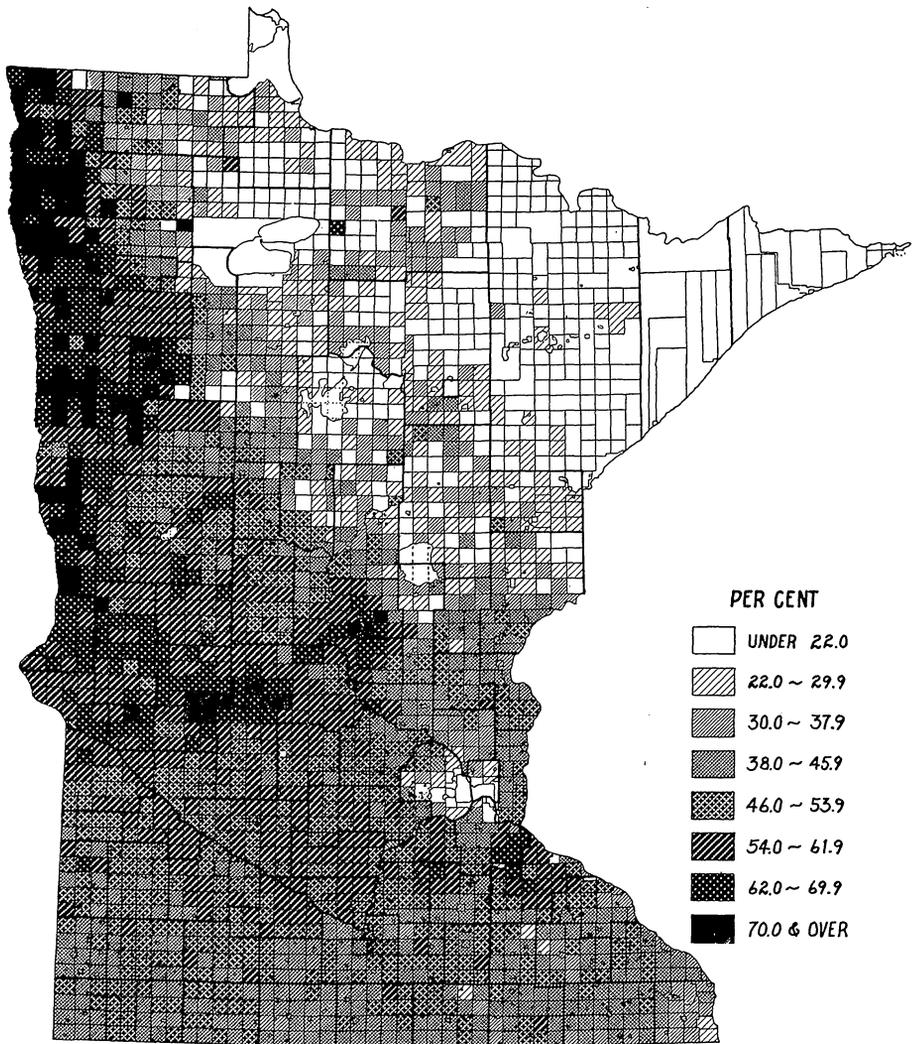


FIG. 13. PROPORTION OF TILLABLE LAND USED FOR SMALL GRAINS, 1929

The proportion of small grain is very large on the level lands of the northwest; it is small in the cutover forest area of the northeast and in the area immediately surrounding Minneapolis and St. Paul.

## UTILIZATION OF TILLABLE LAND

A WIDE VARIETY of crops is grown on the tillable land in all sections of the state. Certain crops or combinations of crops tend, however, to predominate. A large variety of factors influences this choice.

Soil characteristics and climate determine to a large extent the level of yields for each of the crops. Soil characteristics and topography strongly influence the costs of producing each of the crops, while prices influence both the costs of production and the value of the crops. The value of crops relative to the cost of producing them constitutes a major factor influencing the choice of crops.

The profitability of the farming operations may frequently be increased

by the use of certain combinations of crops, for these may (1) help to maintain or increase yields, (2) permit a more complete utilization of land, labor, and equipment, and (3) provide a more balanced supply of feed for livestock.

The crops grown on tillable land can be divided into three major groups—small-grain crops, intertilled crops, and hay and pasture crops.

### DISTRIBUTION OF SMALL GRAIN CROPS

Small-grain crops are grown on almost one half of the tillable land in the state, with wide variations among

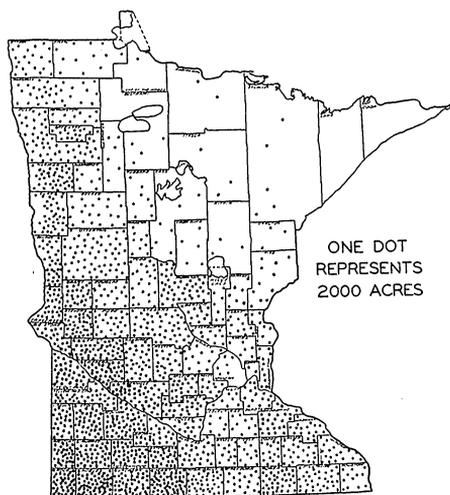


FIG. 14. ACREAGE OF OATS, 1929

The acreage of oats is largest in the south western counties, where it is the most important small grain crop. Wheat and barley displace oats in the northwestern counties.

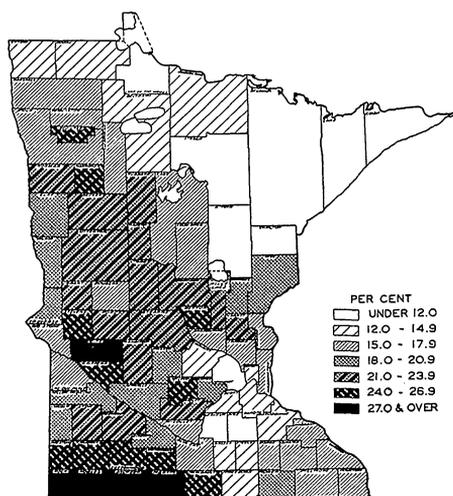


FIG. 15. PROPORTION OF TILLABLE LAND USED FOR OATS, 1929

The proportion of tillable land in oats is largest in the important corn region of the southwest and in the central counties.

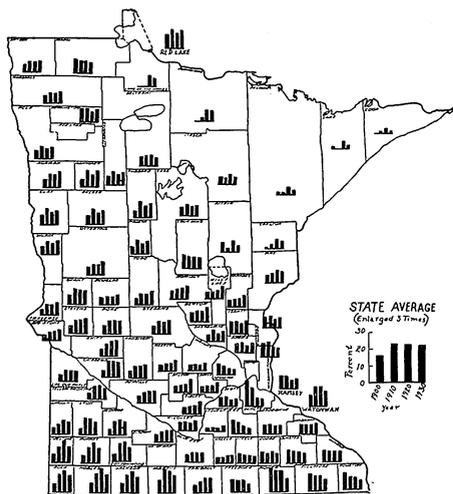


FIG. 16. PROPORTION OF TILLABLE LAND USED FOR OATS, 1899-1929

The proportion of tillable land in oats steadily increased in the central and north-western and decreased in the southeastern counties.

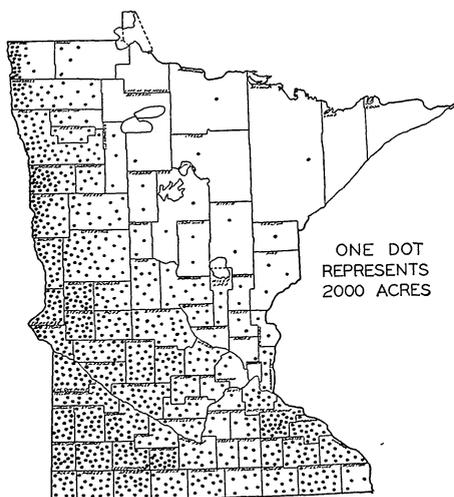


FIG. 17. ACREAGE OF BARLEY, 1929

The acreage of barley is largest in the western and southeastern counties.

the different sections of the state<sup>9</sup> (fig. 13). They occupied a very large proportion of the land during the early period of development of all sections of the state except the cutover forest area of the northeastern corner. Need for disease and weed control and larger returns from other crops have caused a reduction in the acreage of small grains in many regions. The sale of grain has decreased in importance, and the production of livestock and livestock products has increased in those areas. The proportion is large even now in the regions where the land is level and largely tillable and where the yields of other crops are relatively lower.

Oats occupies the largest acreage of the small-grain crops, accounting for one fifth of the tillable acreage and two fifths of the small-grain acreage of the state. The proportion varies considerably among the different parts of the state (figs. 14, 15, and 16). Although the yield of feed or the cash value per acre is somewhat lower than some of the other small-grain crops, it supplements intertilled and hay crops advantageously in the cropping system and can be grown under a wide variety of climatic and soil conditions.

Barley ranks next to oats in acreage, but it is concentrated in somewhat different areas (figs. 17, 18, and 19). Since its use in brewing is an important outlet for this crop, the introduction and later repeal of prohibition has seriously affected the acreages grown.

Wheat ranks third in acreage among

<sup>9</sup> The percentages presented in figure 13, and in the other maps on a township basis presenting crop acreages as a percentage of tillable land, are higher than those presented on other maps, in the discussion, or in the tables, for the acreage of idle and fallow land was not included in the base from which the percentages were calculated.

the small grains with most of it concentrated in the Red River valley and the counties bordering the Minnesota river (figs. 20, 21, 22, and 23). Wheat was the principal crop in the southern and western counties during the first few decades of development. Increase of weeds and diseases and need for crop rotations in order to maintain fertility forced an abandonment of one-crop farming. Livestock farming, with the production of some cash crops, proved to be more profitable, particularly in the southern counties.

Rye occupies a relatively small acreage. It is grown principally in a few limited areas of sandy soil (figs. 24 and 25).

Although Minnesota is one of the important flax producing states, flax occupies only a very small proportion of the tillable land (figs. 26 and 27). There has been a tendency for the acreage to decrease materially in the southeastern counties and to increase gradually in the west-central and sharply in the northwestern counties.

Grains are grown in mixtures in some areas (figs. 28 and 29). In some sections there has been a tendency for the yield of the mixed grains to exceed that of the grains grown separately.

### DISTRIBUTION OF INTERTILLED CROPS

Intertilled crops occupy about one quarter of the tillable land of the state, but the proportion differs greatly between the northern and southern counties (fig. 30). These crops yield a large return per acre either in the form of feed or cash income. They require, however, a larger amount of labor per

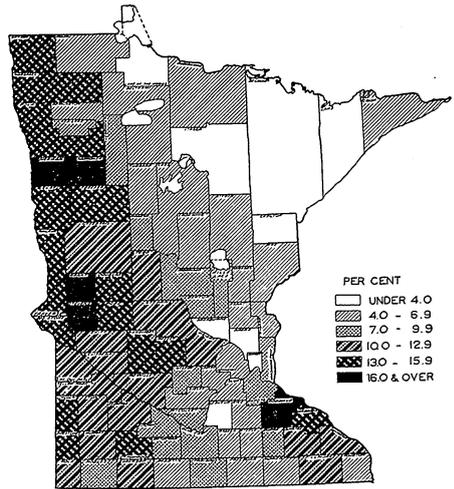


FIG. 18. PROPORTION OF TILLABLE LAND USED FOR BARLEY, 1929

The barley acreage has fluctuated greatly in most counties, with the largest acreages in the years around 1910 and 1930.

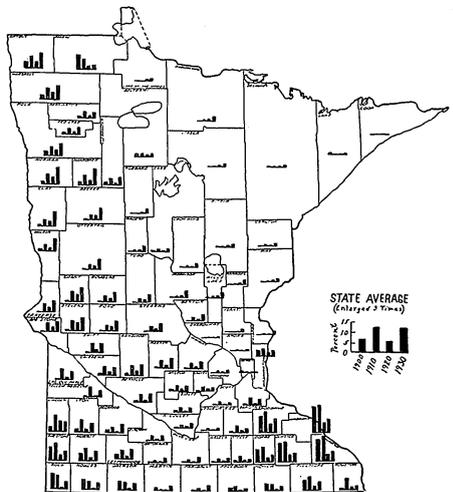


FIG. 19. PROPORTION OF TILLABLE LAND USED FOR BARLEY, 1899-1929

The trend in proportion of tillable land used for barley, although irregular, has been upward in the west-central and northwestern and downward in the southeastern counties.

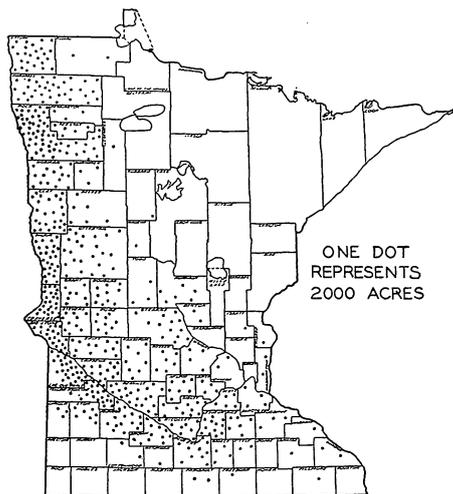


FIG. 20. ACREAGE OF SPRING WHEAT, 1929

One fifth to one half of the spring wheat is durum in the western counties.

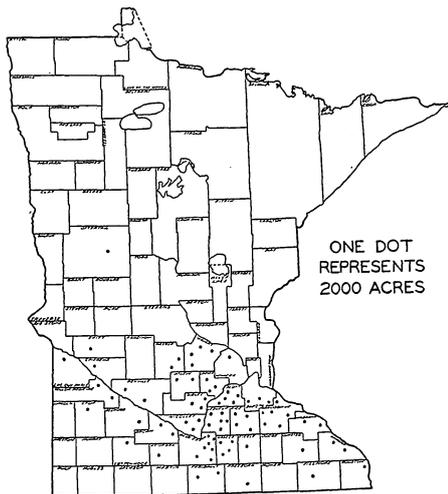


FIG. 21. ACREAGE OF WINTER WHEAT, 1929

Climatic conditions limit the growing of winter wheat to the southern third of the state.

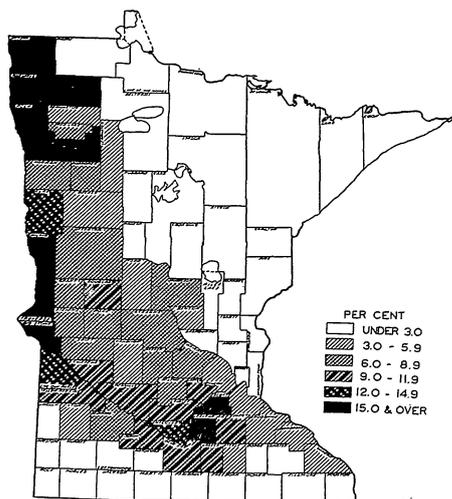


FIG. 22. PROPORTION OF TILLABLE LAND USED FOR WHEAT, 1929

The proportion of tillable land in wheat is high in the Red River valley. The highest proportion in the state, however, is in Le Sueur County—25 per cent of the tillable land.

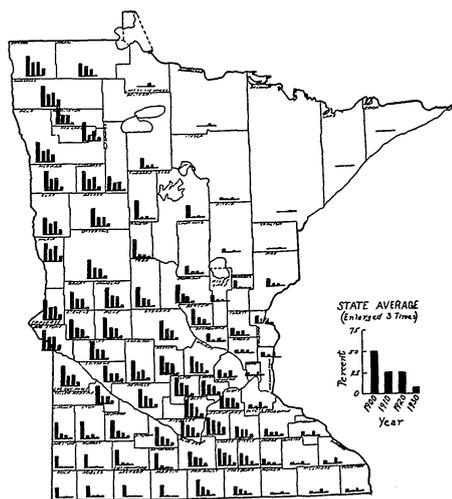


FIG. 23. PROPORTION OF TILLABLE LAND USED FOR WHEAT, 1899-1929

The proportion of tillable land in wheat has fallen rapidly in all areas, with the acreage becoming negligible in the southeastern and southwestern counties about 1900.

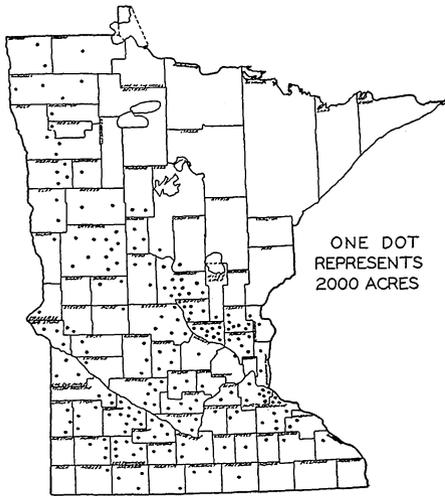


FIG. 24. ACREAGE OF RYE, 1929

Rye can be grown on soils of low productivity on which other crops would be unprofitable. It is a hardy crop and can be raised in a climate too severe for winter wheat.

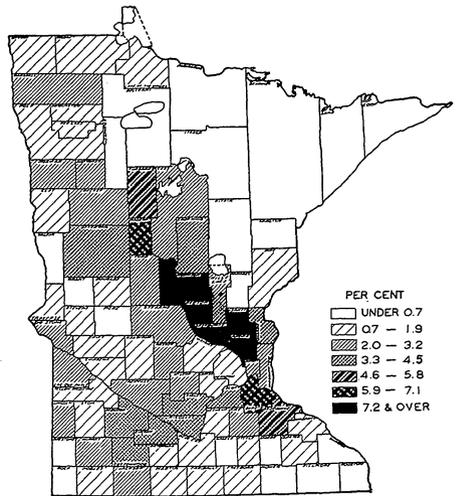


FIG. 25. PROPORTION OF TILLABLE LAND USED FOR RYE, 1929

The proportion of tillable land in rye is highest on the sandy lands of the east-central counties, although it is not of any great importance even there.

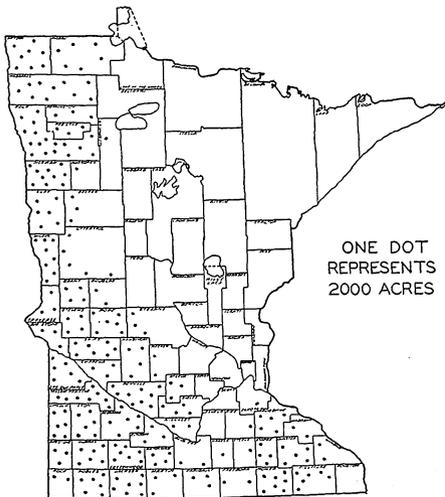


FIG. 26. ACREAGE OF FLAX, 1929

Very little flax is produced in the north-eastern and east-central counties.

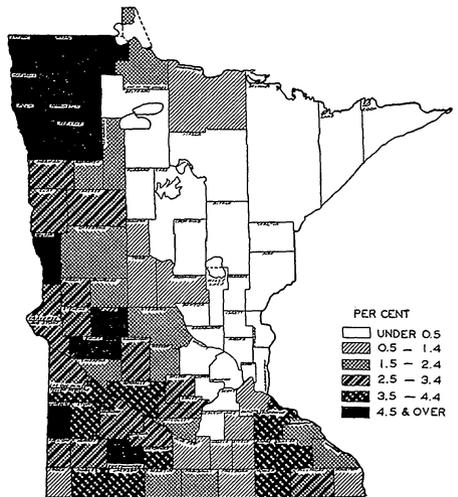


FIG. 27. PROPORTION OF TILLABLE LAND USED FOR FLAX, 1929

In no county does the flax acreage exceed 6 per cent of the tillable land.

acre than do most of the other crops. The intensive tillage that is needed for their production aids materially in the control or eradication of weeds.

Corn occupies most of the acreage of intertilled crops of the state. There is a wide difference in its importance among the different parts of the state (figs. 31, 32, and 33). The large yield of feed and the high value per acre give it an advantage over other crops in the southern counties. It is raised principally as a source of fodder and silage and as an aid to weed control in the northern counties.

Potatoes occupy only about 2 per cent of the tillable land of the state, but the proportions are quite high in some areas (figs. 34, 35, and 36). Since the labor requirements per acre are high and the income per acre is also high,

this crop has been of considerable importance in the northeastern counties where the farms are small, necessitating the raising of intensive crops.

Several other intertilled crops, occupying a small acreage, are grown in the state. Some sweet corn is grown in the southern counties, principally near canning plants. Sugar beets are grown in the Red River valley, near the sugar factory at East Grand Forks, Minnesota, and in the south-central counties near the factories at Chaska, Minnesota, and Mason City, Iowa. Soybeans have been increasing in the state although the acreage is still small. Root crops, principally rutabagas, are grown to some extent in the northeastern Minnesota area as cash and as feed crops.

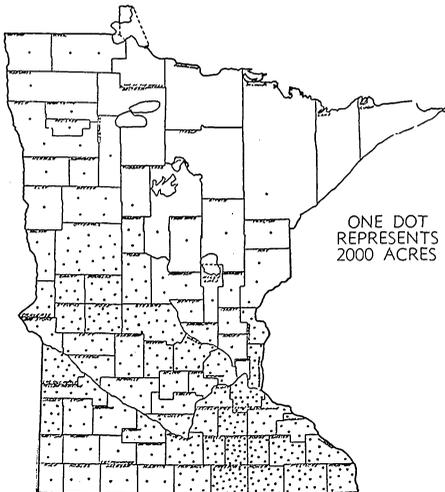


FIG. 28. ACREAGE OF MIXED GRAINS

The acreage of mixed grains is relatively large in the central and southeastern counties where grain is raised largely for feed, but small in the southwestern and northwestern counties where considerable grain is raised for sale.

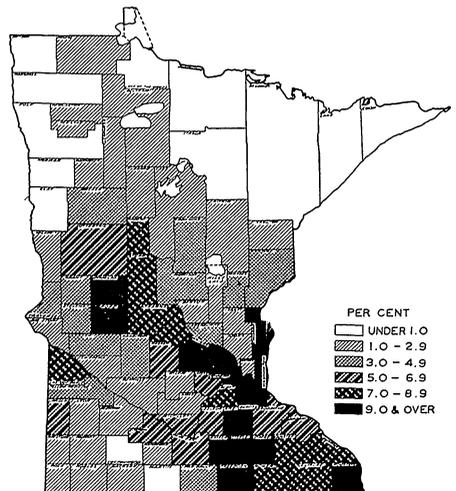


FIG. 29. PROPORTION OF TILLABLE LAND USED FOR MIXED GRAINS, 1929

Oats-barley and oats-wheat are the principal mixtures, with wheat-flax of some importance in the southeastern counties.

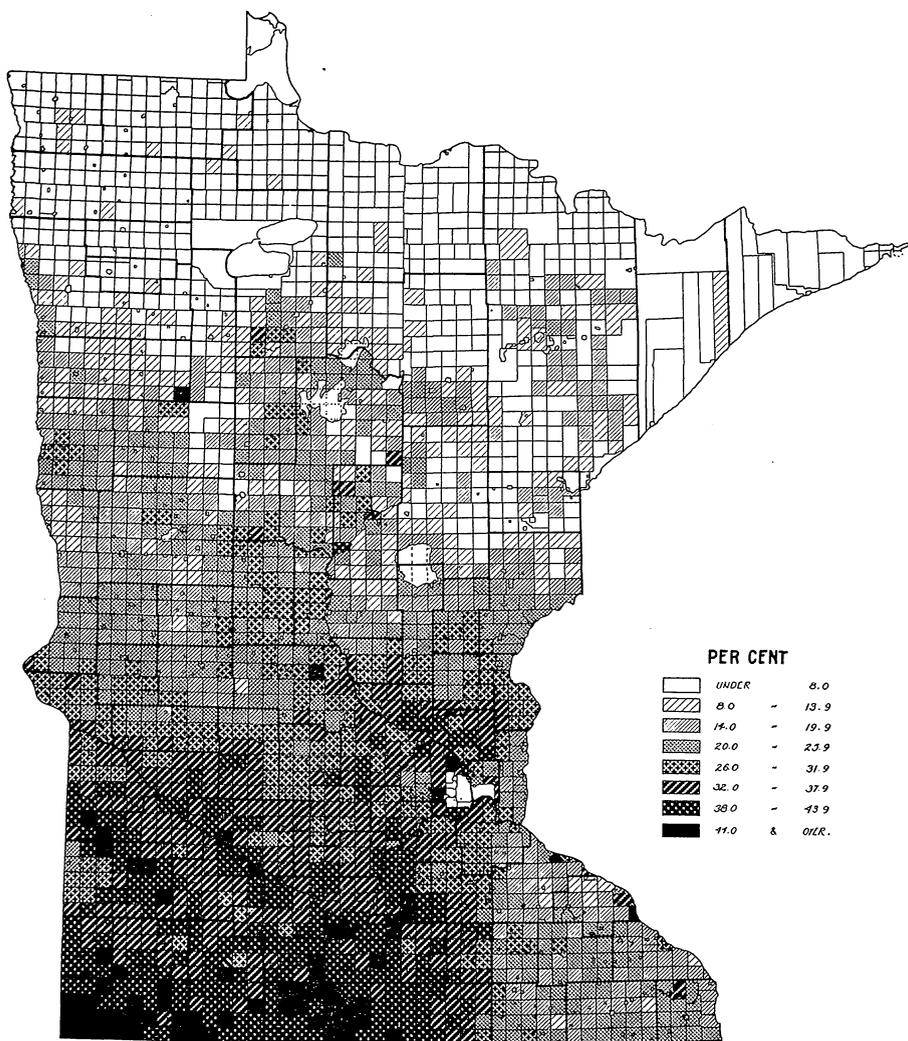


FIG. 30. PROPORTION OF TILLABLE LAND USED FOR INTERTILLED CROPS, 1929

The southwestern counties are a part of the corn belt of the United States. The low nitrogen content in the soil and the rough topography limit the acreage of corn in the southeastern counties. Climatic conditions are too unfavorable for profitable production in the northern two thirds of the state. Potatoes represent an important intertilled crop in some of the northern counties.

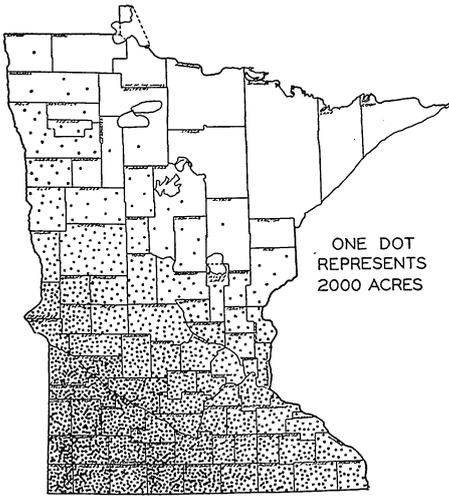


FIG. 31. ACREAGE OF CORN, 1929

The corn acreage is largest in the southwestern counties, particularly southwest of the Minnesota river. It is an important cash crop in these counties.

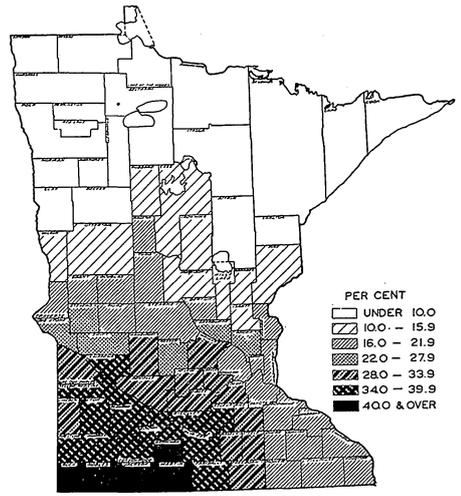


FIG. 32. PROPORTION OF TILLABLE LAND USED FOR CORN, 1929

Rolling topography and lower nitrogen content of the soil reduce the proportion of corn in the southeastern counties.

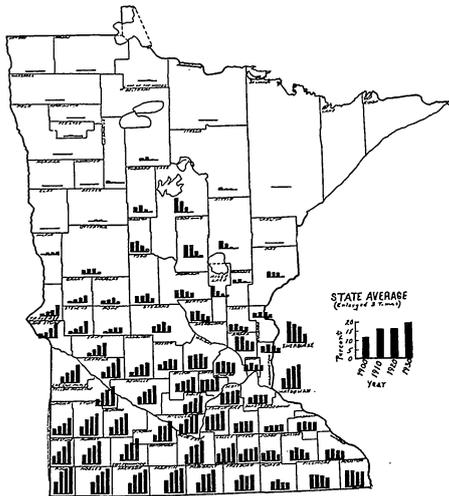


FIG. 33. PROPORTION OF TILLABLE LAND USED FOR CORN, 1899-1929

There has been a steady upward trend in corn in all southwestern counties.

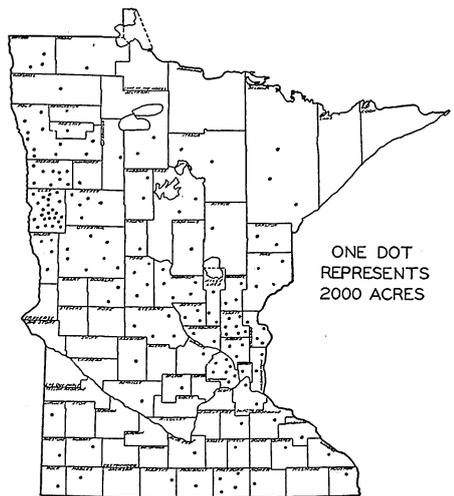


FIG. 34. ACREAGE OF POTATOES, 1929

Potatoes are of commercial value principally in the Red River valley and the east-central and northeastern counties.

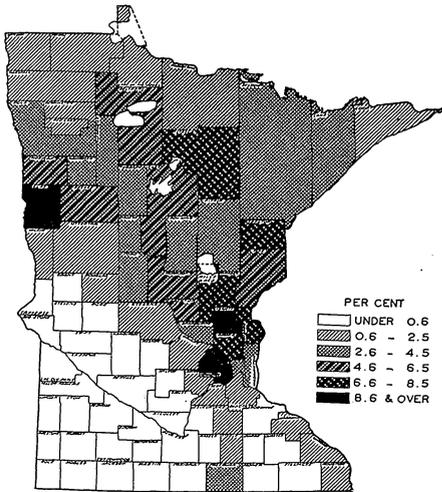


FIG. 35. PROPORTION OF TILLABLE LAND USED FOR POTATOES, 1929

Potatoes are produced for sale in most of the northern half of the state. This is an important source of income on many of the small farms in the northeastern counties.

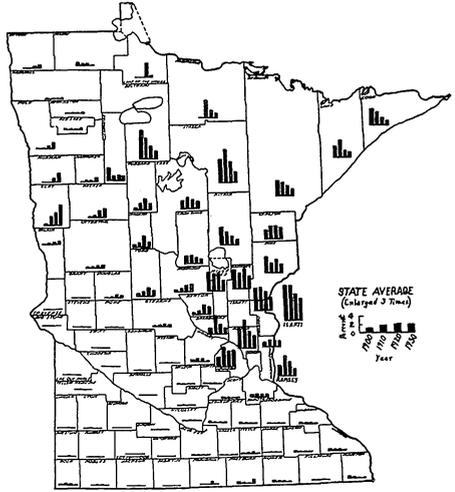


FIG. 36. PROPORTION OF TILLABLE LAND USED FOR POTATOES, 1899-1929

The proportion of tillable land used for potatoes has increased rapidly in Clay and the surrounding counties, and has decreased in most of the other counties.

### DISTRIBUTION OF HAY AND PASTURE CROPS

The hay and pasture crops occupy somewhat less than one quarter of the tillable land of the state or slightly less than the intertilled crops. They are distributed over the entire state. These crops are an important part of a sound long-time agricultural program.

Most of them, particularly alfalfa and the clovers, aid in the maintenance of soil productivity by storing nitrogen in the soil and by helping to maintain the humus content. Since most of these crops are fed to livestock, a large share of the mineral elements and organic matter removed by the harvesting of the crops are returned in the form of manure. They also aid in the control of weeds.

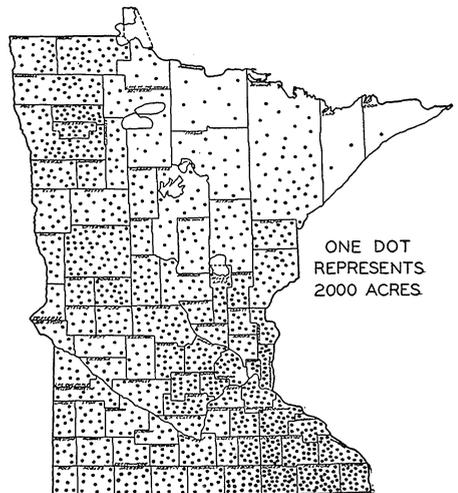


FIG. 37. ACREAGE OF TAME HAY, 1929

The heaviest concentration of tame hay is in the southeastern counties.

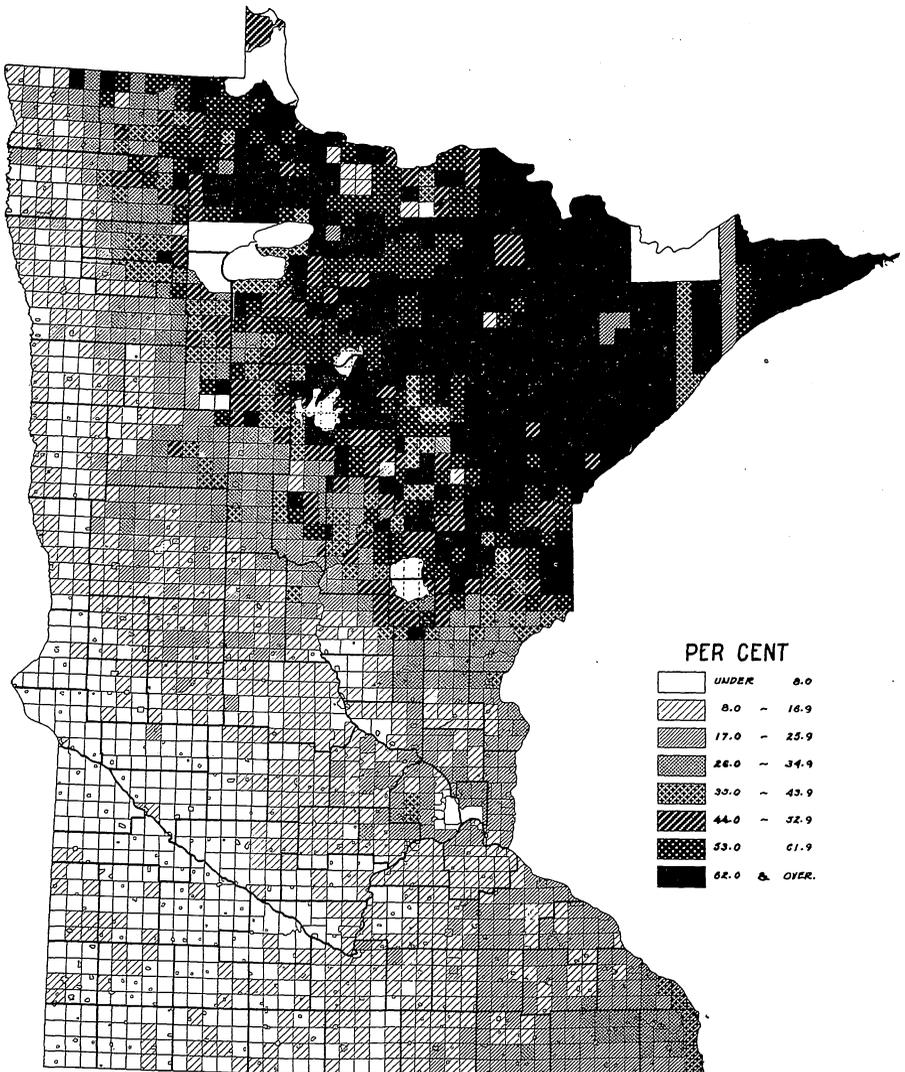


FIG. 38. PROPORTION OF TILLABLE LAND USED FOR TAME HAY, 1929

High yields relative to other crops and a need for hay for livestock has resulted in the use of a large proportion of tillable land for tame hay production in the northeastern counties. Control of erosion and the maintenance of soil fertility makes tame hay crops desirable in the southeastern counties. Corn and small grains have been more profitable than hay crops in the other counties.

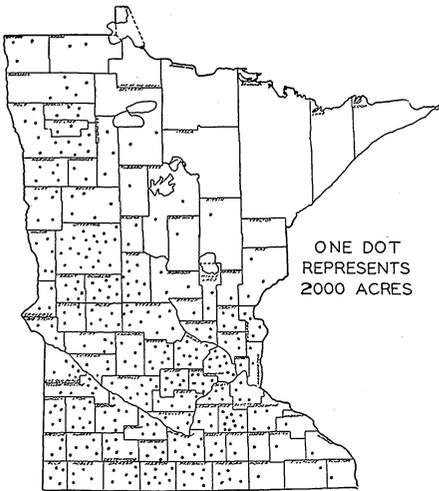


FIG. 39. ACREAGE OF ALFALFA, 1929  
Alfalfa does not thrive on low-lime soils.

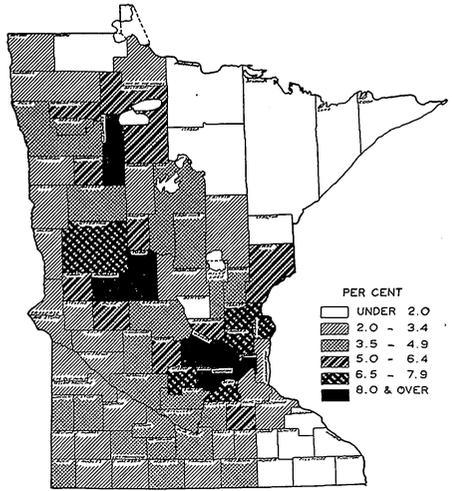


FIG. 40. PROPORTION OF TILLABLE LAND USED FOR ALFALFA, 1929

They tend to supplement the other crops grown in the state in the utilization of the labor and power supply in so far as the harvest period occurs when work on the other crops is slack.

In general, the cost of producing these crops is low because they are usually seeded along with the preceding crop, and the labor, power, and other costs of harvesting are low. The costs of the pasture crops are very low since all of the harvesting is done by the livestock.

In most sections of the state, a larger quantity of feed nutrients is produced per acre from hay than from any other crop except corn silage.

The acreage of tame hay is slightly more than twice that of tillable pasture. The distribution of the acreage and the proportion of the tillable land used for tame hay are presented in figures 37 and 38. The proportion of tillable land in tame hay is very large

in the northeastern counties. By producing as much hay as possible and supplementing it with shipped-in feeds, it has been possible to increase the size of business and thereby the earnings of the small farms that prevail in that region.

Alfalfa is a relatively new crop in Minnesota. Less than 1,000 acres were grown in 1899 and only slightly more than 2,000 acres in 1909. The acreage increased to approximately 45,000 acres in 1919 and 700,000 acres in 1929, in which year it occupied almost 4 per cent of the tillable land or approximately one fourth of the acreage of all tame hay. It is now grown in all parts of the state although the proportion of the land in alfalfa varies greatly (figs. 39 and 40).

The acreage of timothy and mixtures of timothy and clover is almost twice as large as that of alfalfa. The largest portion of this acreage is in the areas

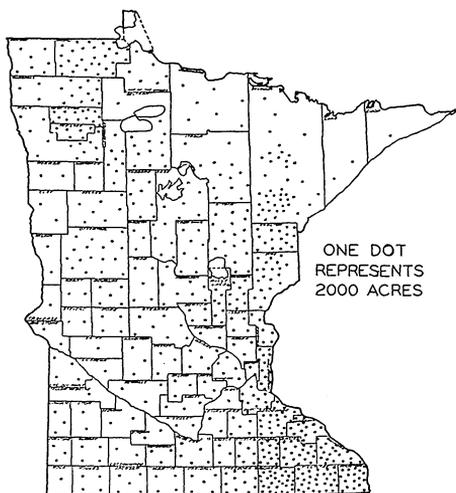


FIG. 41. ACREAGE OF TIMOTHY AND MIXED TIMOTHY AND CLOVER, 1929

The acreage of timothy and mixed timothy and clover is largest on the rolling, low-lime soils of the southeastern counties. The alfalfa acreage is small in these counties.

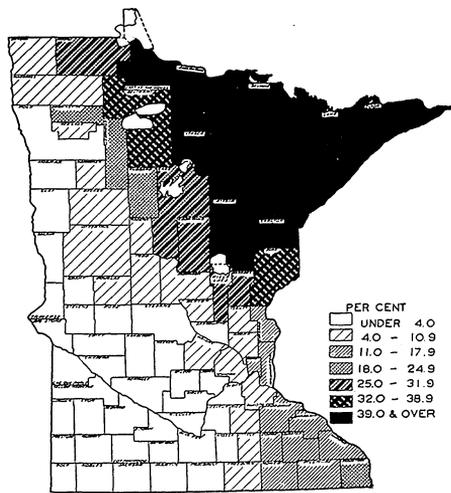


FIG. 42. PROPORTION OF TILLABLE LAND USED FOR TIMOTHY AND MIXED TIMOTHY AND CLOVER, 1929

Timothy and mixed timothy and clover are the most important crops of the northeastern counties.

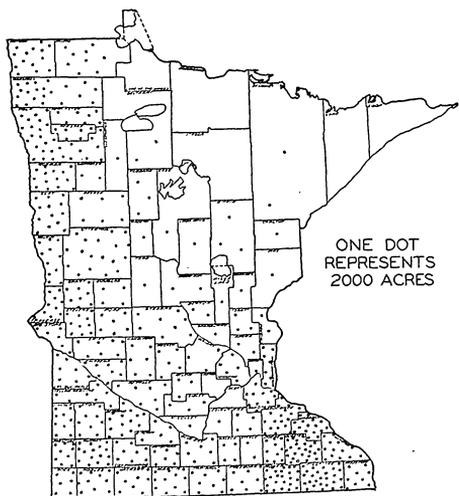


FIG. 43. ACREAGE OF TILLABLE PASTURE, 1929

The acreage is small in the cutover counties of the northeast and in the central counties where many poorly drained areas occur.

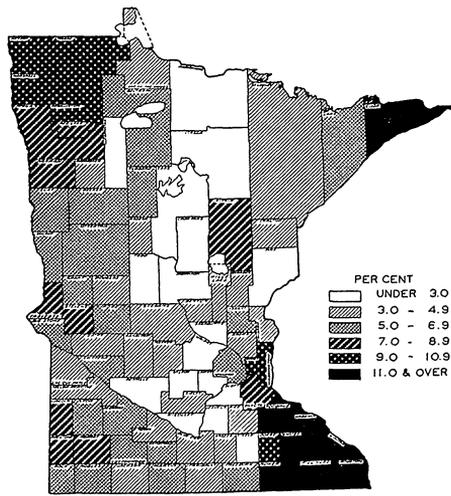


FIG. 44. PROPORTION OF TILLABLE LAND USED FOR PASTURE, 1929

The largest proportion of tillable land used for pasture is in the southeastern counties.

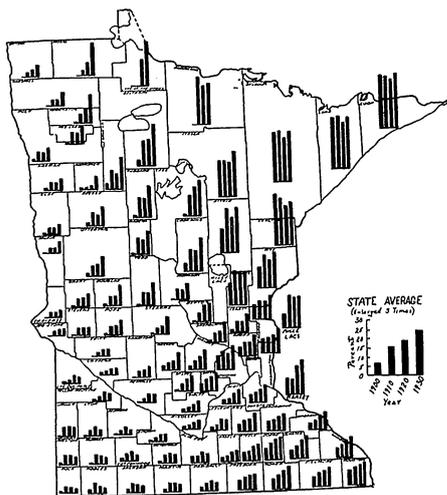


FIG. 45. PROPORTION OF TILLABLE LAND USED FOR FORAGE CROPS, 1899-1929

The trend of the proportion of tillable land used for forage crops has been steadily upward except in the southwestern and north-eastern counties.

where the acreage of alfalfa is low (figs. 41 and 42). Red and alsike clover, grown alone, occupy less than one per cent of the tillable acreage of the state, mostly in the eastern half. Considerable seed is harvested in the northern counties. Sweet clover is an important hay crop in the northwestern counties. Some annual crops, such as small grains, millet, and sudan grass are used for hay, but the acreages are quite small.

Some tillable land is used for pasture in all parts of the state, but the proportion so used differs widely among the counties (figs. 43 and 44).

The proportion of the tillable land used for forage crops of tame hay, corn fodder, and corn silage has steadily increased from 5 per cent in 1899 to more than 20 per cent in 1929. The trend is shown in figure 45.

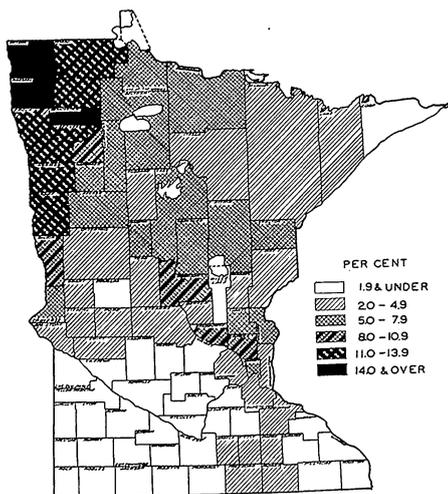


FIG. 46. PROPORTION OF TILLABLE LAND THAT WAS IDLE OR FALLOW, 1929

The proportion of idle and fallow land is fairly large in the Red River valley.

### OTHER USES OF TILLABLE LAND

A considerable acreage of tillable land in Hennepin and Ramsey counties is used for the production of truck and fruit crops for the markets of Minneapolis and St. Paul. Slightly more than one per cent of the tillable land, most of it in the northwestern counties, yielded no income in 1929 because of crop failures. A fairly large proportion of the land, 4 per cent in 1929, normally lies idle or fallow. The distribution of this land is presented in figure 46.

### CROP PRODUCTION

Most of the crops produced in Minnesota are utilized as feeds. These feed crops can be divided into two groups—concentrates (husked corn and small grains) and roughages (hay, corn fodder, and corn silage).

Different kinds of livestock differ widely in the relative proportion of concentrates to roughages that they can use to advantage. Horses, cattle, and sheep can utilize both kinds but in widely differing proportions. Breeding ewes and beef cows, for example, need very little concentrates, while fattening sheep or cattle require a very large proportion of concentrates. Hogs and poultry can utilize very little roughage.

The kinds of livestock produced in a given area will, therefore, be determined to a large extent by the proportions of the two types of feeds that are produced in that region. The ratio of concentrates to roughages in each county in Minnesota is presented in figure 47. For this comparison corn silage has been converted to a hay equivalent by dividing its weight by three.

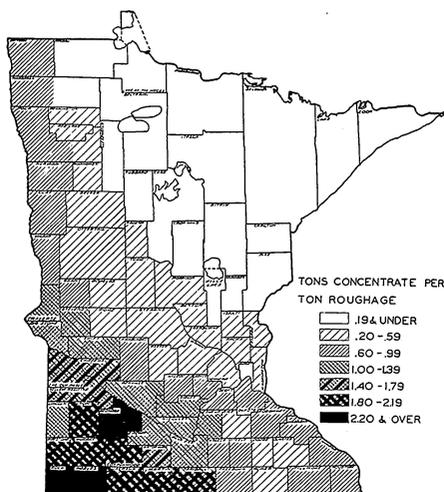


FIG. 47. RATIO OF CONCENTRATES TO ROUGHAGE PRODUCED, BASED ON 1929 ACREAGES, 1921-1930 YIELDS

Dairy cows and sheep have an advantage in the northeastern counties, while fattening cattle, fattening lambs, and hogs are better adapted in the southwestern counties.

## DISTRIBUTION OF LIVESTOCK

**R**AISING livestock and producing livestock products constitutes one of the most important agricultural enterprises of the state. Most of the roughages and a large proportion of the grains produced on farms are fed to livestock. Farm management studies indicate that nearly one half of the farm labor in Minnesota is used for the care of livestock. The income from the sale of livestock and livestock products accounts for almost 80 per cent of the total cash income of Minnesota farmers.<sup>10</sup>

<sup>10</sup> Waite, W. C., "Farm Income in Minnesota," Minnesota Farm Business Notes No. 180, Agricultural Extension Division, University of Minnesota.

The livestock enterprise helps to provide that full utilization of the farmer's resources which is desirable in order to obtain a satisfactory income. Livestock provides market outlets for many farm products which would otherwise be wasted. Some crops, as alfalfa and the clovers, must be raised in order to maintain the fertility of the soil; other crops, as wild hay and permanent pasture, are produced on land which could not be used for other purposes; others, as straw, corn stover, and sugar beet tops are by-products of other crops, and only a small portion of these could be marketed except through their conversion into livestock and livestock prod-

ucts. Livestock also provides profitable employment during the winter, distributing the farm work more uniformly throughout the year. Livestock thus helps to produce a more balanced agriculture.

The principal classes of livestock kept on farms in Minnesota are dairy cattle, beef cattle, sheep, hogs, poultry, and horses.

Minnesota is one of the leading dairy states of the union. It ranks second to Wisconsin in the number of dairy cows and in the production of milk, and ranks first among the states in the production of butter.

Dairying is the principal source of farm income within the state. The income from the sale of dairy products represented 28 per cent of the cash income of farmers in 1930 and 29 per cent in 1936. In addition, the income from

the sale of cattle, a large part of which was dairy stock, represented another 12 per cent in 1930 and 14 per cent in 1936.

Dairying is important in all parts of the state, but it is most important in the eastern half (figs. 48 and 49). In this area there is much land that is suitable only for use as a permanent pasture. Rolling topography and lack of nitrogen in the soil makes an extensive use of hay crops, particularly the legumes, desirable. Hay yields are quite high relative to the yields of other crops. These conditions have contributed strongly to the development of dairying in this area. This movement has been progressing steadily over several decades (fig. 50).

In the principal dairy areas, most of the cows are of specialized dairy breeding, while in the other areas, a large number of the cows milked are of beef or milk-and-beef breeding<sup>11</sup> (figs. 51 and 52). Some of the calves from these beef and milk-and-beef cows are vealed, but a large proportion of them are sold as feeders or are fattened on the farm and sold for slaughter.

The beef enterprise in Minnesota is much smaller than the dairy enterprise. During the last decade, the income from the sale of cattle has represented approximately 14 per cent of the cash income of Minnesota farmers. A considerable part of this has been income from the sale of dairy stock. Cows kept mainly for beef represent a very small proportion of the total number of cows, only 4 per cent on April 1, 1930. The distribution of these cows is presented in figure 53. Much of the

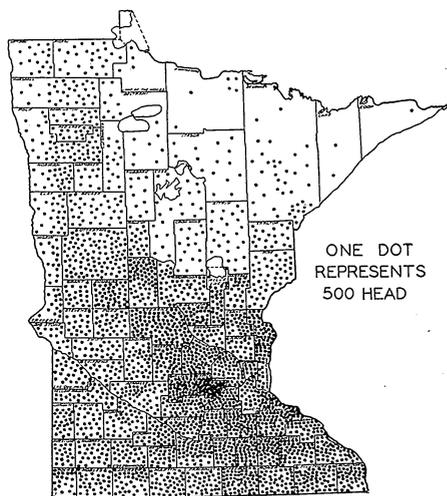


FIG. 48. NUMBER OF COWS KEPT MAINLY FOR MILK, APRIL 1, 1930

The greatest concentration of milk cows is in the southeastern quarter of the state, especially in Carver and McLeod counties.

<sup>11</sup> The term "milk-and-beef" is used in this publication in place of the term "dual-purpose" used in the 1930 United States Census.

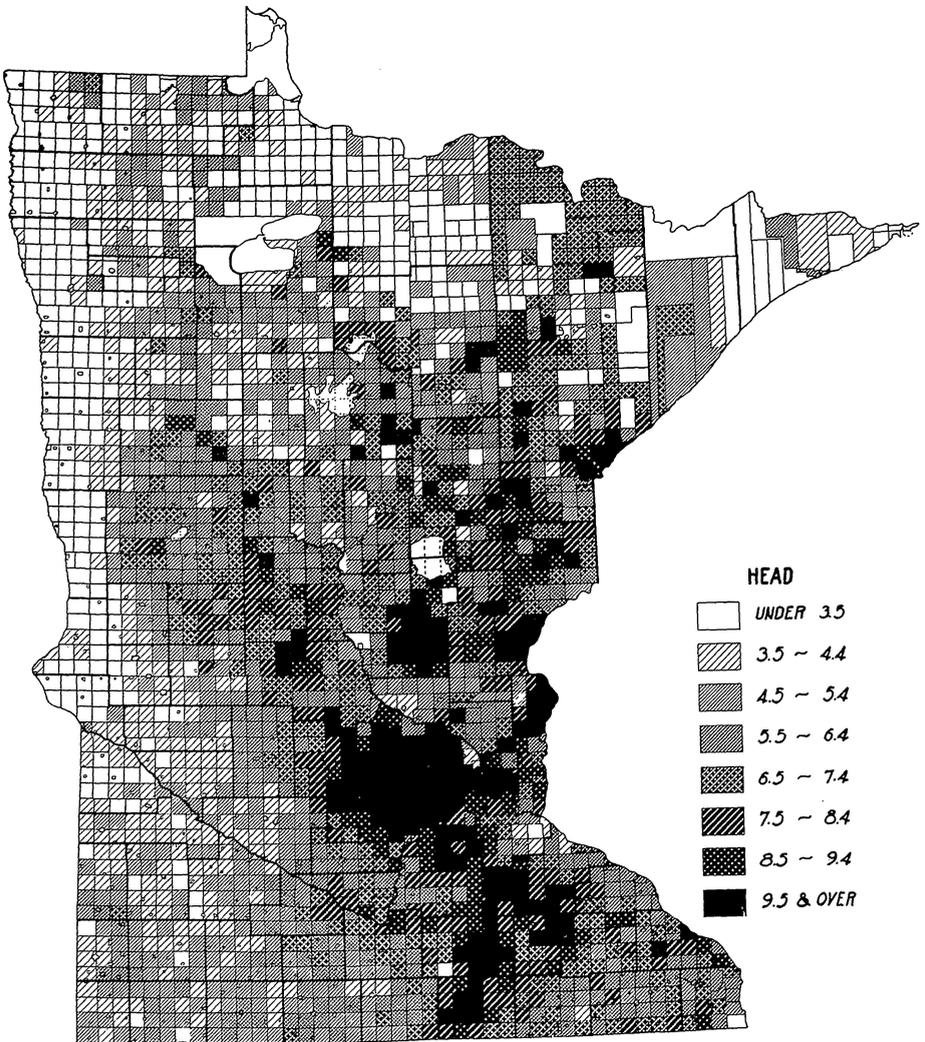


FIG. 49. NUMBER OF COWS KEPT MAINLY FOR MILK, PER 100 ACRES IN FARMS, MAY 1, 1930

Dairying is concentrated in the areas with much nontillable land and where tame hay is advantageously grown. The most intensive dairy region in the state is in the counties immediately west of the Twin Cities and extending southward to the border of the state.

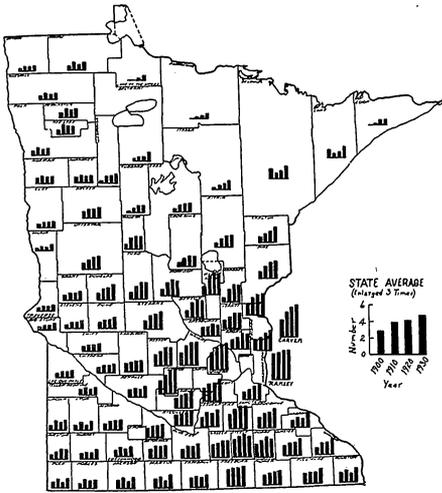


FIG. 50. NUMBER OF COWS KEPT MAINLY FOR MILK, PER 100 ACRES IN FARMS, 1900-1930

The trend of number of cows has been steadily upward in the major dairy areas and irregularly upward in the other areas.

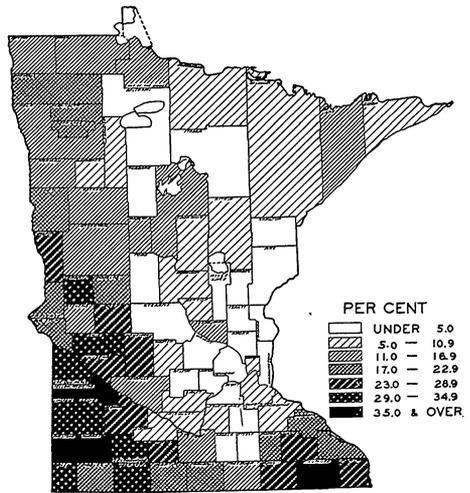


FIG. 51. PROPORTION OF COWS MILKED THAT WERE OF BEEF OR MILK-AND-BEEF BREEDING, 1929

Most cows in the principal dairy regions are of specialized dairy breeding.

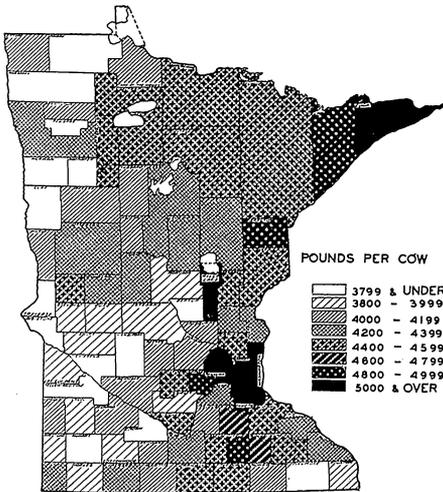


FIG. 52. MILK PER COW, AVERAGE OF PRODUCTION IN 1924, 1929, AND 1934

High production tends to prevail in the areas of numerous dairy cows.

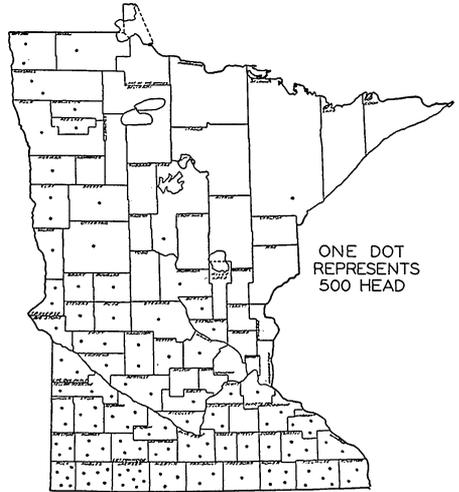


FIG. 53. NUMBER OF COWS KEPT MAINLY FOR BEEF, APRIL 1, 1930

Some beef cows are kept in practically all parts of the state.

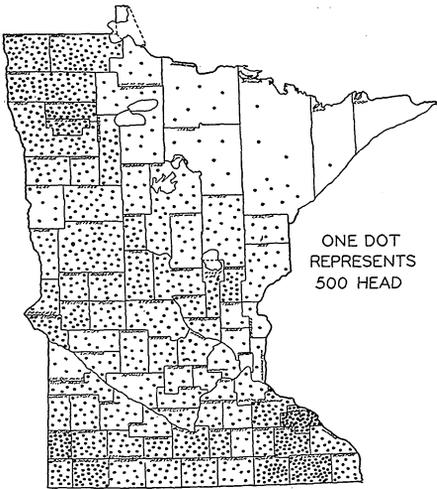


FIG. 54. NUMBER OF EWES (YEARLING OR OLDER) ON FARMS, APRIL 1, 1930

There are three areas of concentration of sheep.

beef production of the state represents the raising and fattening of the calves from beef or milk-and-beef cows that are milked. Shipped-in western cattle are fattened on many farms in the southwestern counties and to a limited extent in other areas of the state.

The sheep enterprise is one of the smallest livestock enterprises of the state, the income from that source representing approximately 2½ per cent of the cash farm income in 1936. The number of ewes and the trends in number of ewes, by counties, is presented in figures 54 and 55.

Swine constitute a major farm enterprise in the state, ranking second to dairying as a source of income. During the last decade, the income from the sale of hogs represented from 20 to 25 per cent of the cash farm income. Some hogs are raised in all parts of the state, but most of them are raised in the

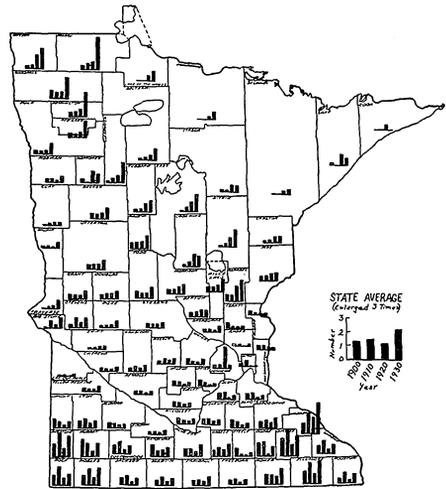


FIG. 55. NUMBER OF EWES, PER 100 ACRES IN FARMS, 1900-1930

There has been a sharp increase in the number of sheep in the northwestern and north-central counties.

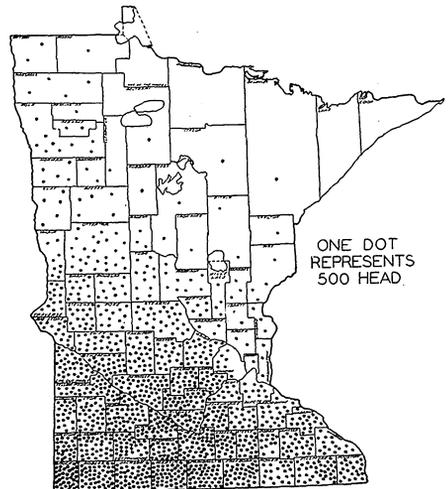


FIG. 56. NUMBER OF SOWS AND GILTS FOR SPRING FARROWING, APRIL 1, 1930

The greatest concentration of hogs is in areas where a large corn acreage makes available an abundant supply of fattening feeds.

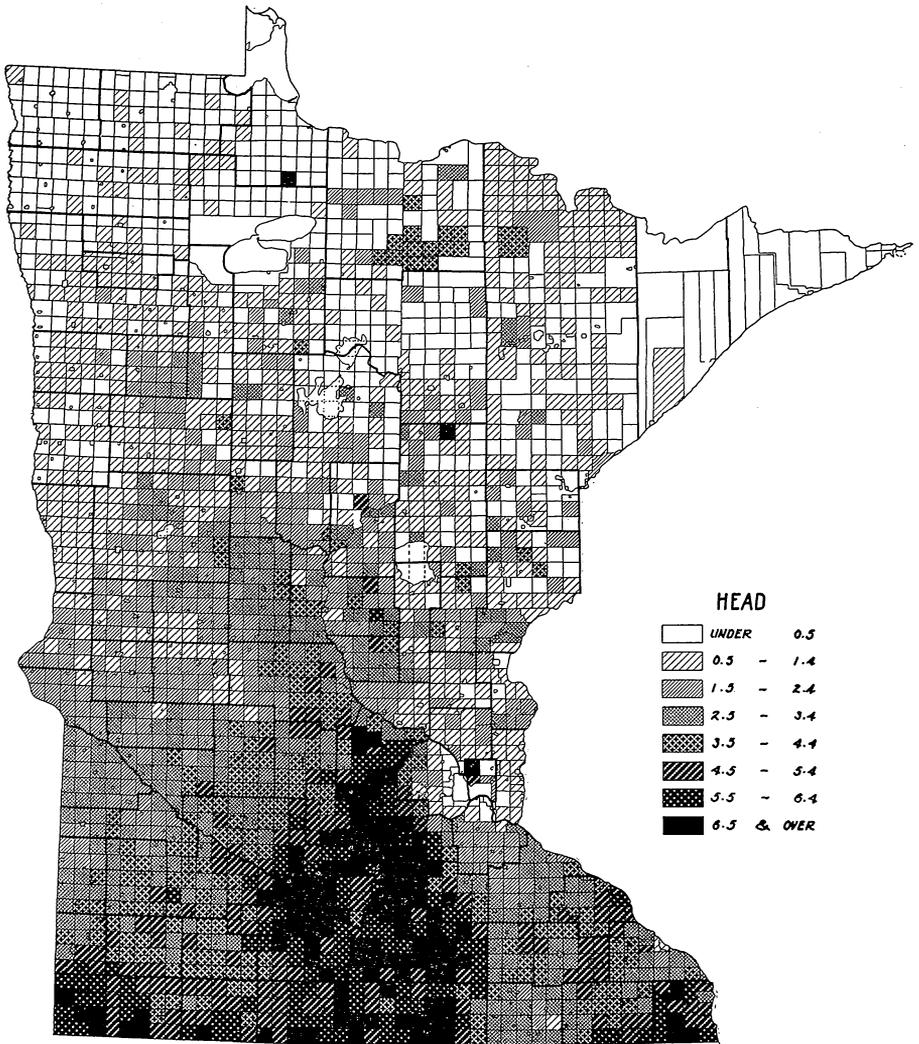


FIG. 57. NUMBER OF SOWS AND GILTS PER 100 ACRES TILLABLE LAND, MAY 1, 1930

High yields of corn and large quantities of skim milk contribute to heavy hog production in the south-central counties. Although corn production is very heavy in the southwestern counties, almost a quarter of the production is sold and a considerable proportion is used for beef production, resulting in less intensive hog production than in the south-central counties.

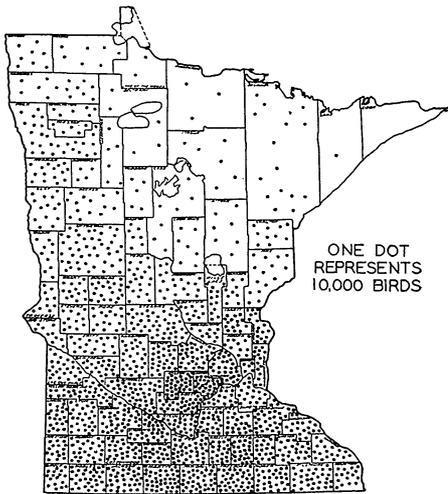


FIG. 58. NUMBER OF CHICKENS OVER THREE MONTHS OLD ON FARMS, APRIL 1, 1930

Chickens are raised in all parts of the state. More than three quarters of the total number are in the southern half.

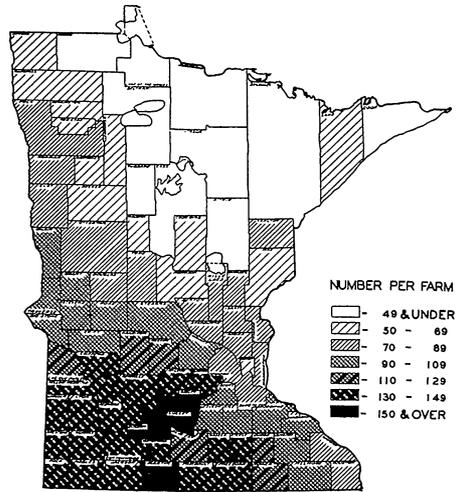


FIG. 59. NUMBER OF CHICKENS OVER THREE MONTHS OLD, PER FARM REPORTING, APRIL 1, 1930

The largest poultry flocks are in the area of heavy grain and corn production.

southern third in the areas of large corn production (figs. 56 and 57). The proportion of land in corn is very high in this entire area, while in the south-central counties the corn yields are high and a large quantity of the skim milk is available as a supplemental hog feed. Hogs are raised in the northern half of the state largely for consumption on the farm and for sale to the local markets.

The poultry enterprise of the state is relatively important, contributing from 6 to 7 per cent of the cash farm income. Poultry are kept on approximately 90 per cent of the farms of the state. The distribution of poultry is presented in figures 58 and 59. In the past, poultry flocks have been kept to a large extent to utilize waste feeds on the farm. During recent years, however, increased

attention has been given to the poultry enterprise, with an increase in the size of the flocks and in the egg production per hen.

Horses on farms in Minnesota are maintained largely as a source of power, providing cash income on only a few farms. The distribution of the horses is presented in figures 60 and 61.

The number of horses in the state increased from 606,000 in 1900 to 834,000 in 1920 and then decreased to 790,000 in 1930 and 695,000 in 1935. The decrease in the number of horses in the state resulted largely from the expansion in the use of tractors and trucks. In 1930, tractors were used on 25 per cent and trucks on 19 per cent of the farms of the state distributed among the counties as shown in figures 62 and 63.

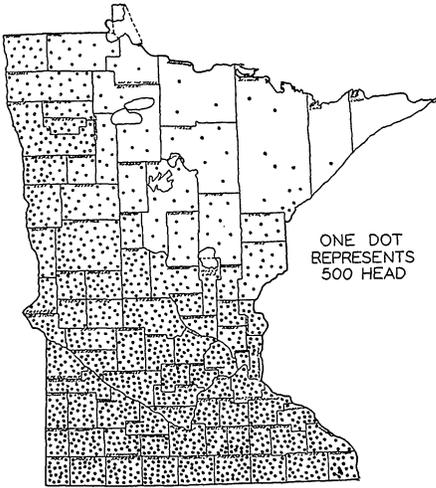


FIG. 60. NUMBER OF HORSES AND MULES OVER TWO YEARS OLD ON FARMS, APRIL 1, 1930

The number of horses is quite large in all counties except in the northeast corner of the state, where farms are relatively few and are small.

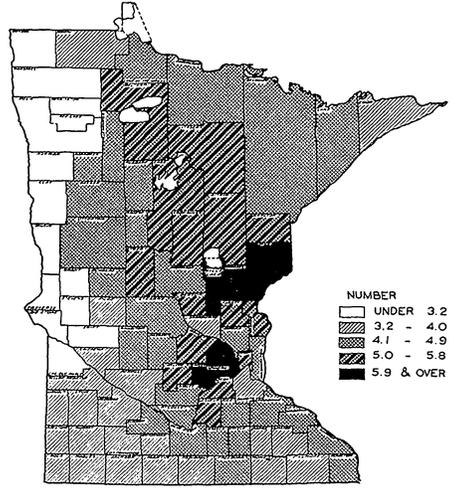


FIG. 61. NUMBER OF HORSES AND MULES, PER 100 TILLABLE ACRES, APRIL 1, 1930

The number of horses per 100 acres of tillable land is high in the east-central counties where the farms are small and the proportion of tillable land is low.

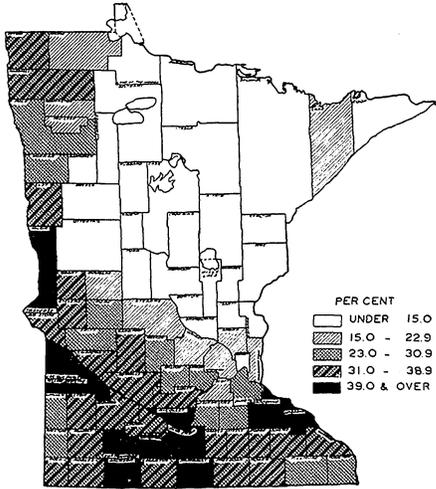


FIG. 62. PROPORTION OF FARMS REPORTING TRACTORS, 1930

The proportion of farms reporting tractors is highest in the areas of large farms with a high proportion of tillable land.

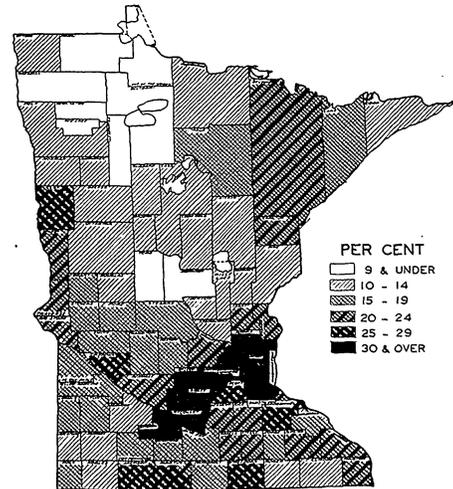


FIG. 63. PROPORTION OF FARMS REPORTING TRUCKS, 1930

The proportion of the farms reporting trucks is highest in the area marketing much of its produce in the Twin Cities.

## ORGANIZATION OF THE FARMING UNIT

**T**HE AGRICULTURAL industry of Minnesota is divided into approximately 200,000 individual farms, each of which is more or less independent of the others. The farmer makes and executes plans for his own farm taking into account those factors that apply to his farm.

Changes in the agriculture of the state, whether they are due to changing forces affecting the agricultural industry or due to attempts by farmers to improve their efficiency, must be effected through the medium of these individual farming units. Knowledge of the organization of the individual unit, as well as knowledge of the general distribution of enterprises is necessary for a thorough understanding of

the agricultural industry of the state, and for a wise planning of programs relating to that industry.

The average size of farms in Minnesota was 167 acres in 1930 and 161 acres in 1936. The average size by counties is presented in figure 64. The smallest farms are in Hennepin and Ramsey counties where there are many small truck, fruit, poultry, and part-time farms. The variations in size of farms within counties is presented in table 9 of the statistical supplement to this bulletin.

Modern agriculture requires a large capital investment. Land and buildings constitute the largest share of this value, \$11,471 per farm in Minnesota in 1930. The valuation, however, is sub-

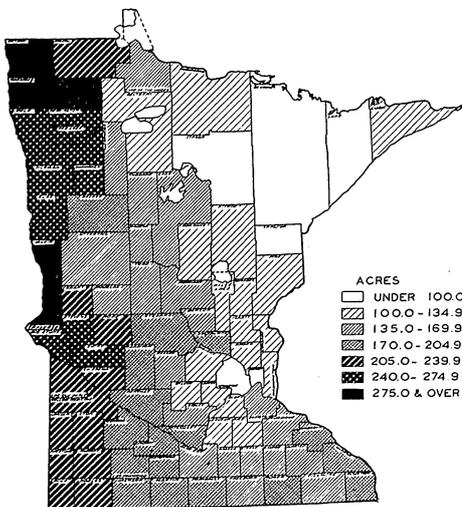


FIG. 64. ACRES PER FARM, 1930

The farms are largest in the western counties, where level land makes the use of large machinery practical.

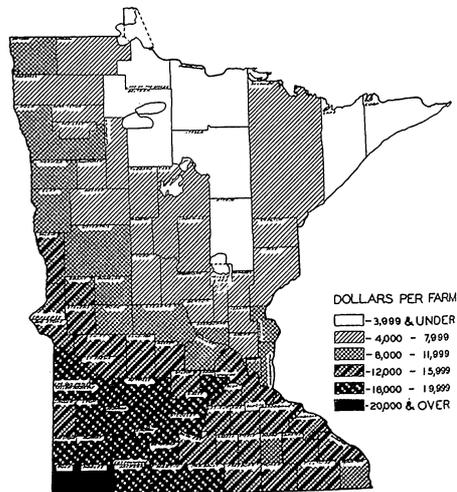


FIG. 65. VALUE OF LAND AND BUILDINGS PER FARM, 1930

The farms are large and the price per acre is moderately high in the southwestern counties.

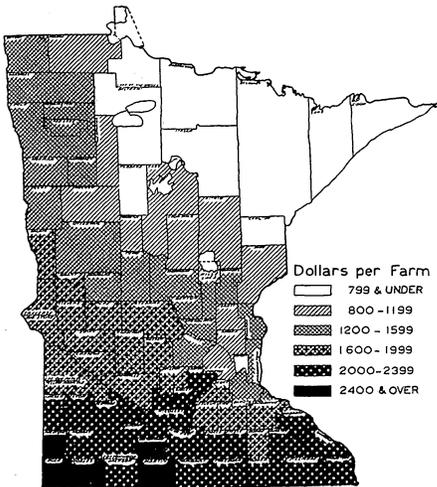


FIG. 66. VALUE OF LIVESTOCK PER FARM, APRIL 1, 1930

Large farms in the southern counties carry a heavy investment in livestock.

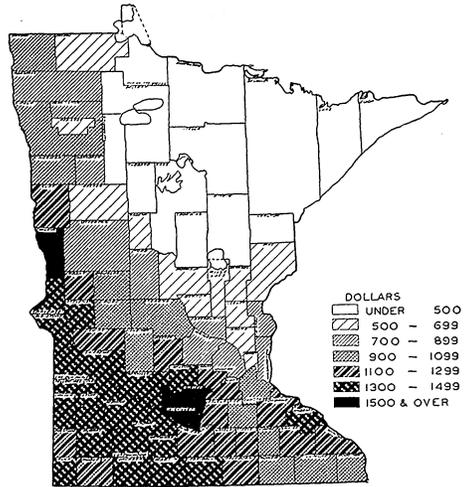


FIG. 67. VALUE OF IMPLEMENTS AND MACHINERY PER FARM, 1930

The large farms in the western counties require much machinery.

ject to large fluctuations with changing economic conditions, for by 1935 the average value per farm of land and buildings had dropped to \$6,803. The value per farm by counties is presented in figure 65.

The value of livestock is also quite high averaging \$1,626 per farm in 1930. The investment by counties is presented in figure 66.

The value of implements and machinery is somewhat less than that in livestock averaging \$981 per farm. The greatest value per farm, as shown in figure 67, occurs in the southwestern and the west-central counties, where the farms are large and have a great diversity of enterprises.

Only one half of the farmers in Minnesota own all of the land which they operate. In 1930, 53 per cent were full-owners, 16 per cent were part-owners, and 31 per cent were tenants. In that

year, 45 per cent of the land in farms was operated by tenants and 55 per cent by owners. The proportion by counties is presented in figure 68.

A little more than one half of the farms operated by full-owners are mortgaged. The highest proportion, as shown in figure 69, occurs in the southwestern corner in the areas of large investments per farm.

The borrowing of funds on mortgage notes enables farm owners to obtain larger farms than is otherwise possible. In 1930 the mortgaged farms in the state averaged 143 acres in size, and the unencumbered farms averaged 124 acres. The mortgaged farms were larger than the unencumbered farms in all except nine of the counties of the state.

Variations in the size of farms, in the types and proportions of enterprises, in rates of production, in prices,

and in other factors in the various sections of the state cause large variations in the income per farm. Variations in income affect the standards of living on the farms and affect the opportunities open to the farmers for making changes in the farming systems, particularly those changes which may involve further investment of capital.

The average value per farm of products sold, traded, or used in the home in Minnesota in 1929 was \$2,320. This was in a year of relatively high prices and average yields; income during succeeding years was considerably lower. Although data for one year cannot be considered an accurate measure of differences of income among the various sections of the state, it does give a general indication of the differences. The value of products sold, traded, and used

in the home, presented in figure 70, averaged more than \$3,000 per farm in 14 southwestern counties and decreased towards the northeast, falling to less than \$1,000 in six counties.

There are large variations among the farms in any community in the principal sources of their income, but certain sources tend to predominate in most sections. As an aid in analysis of these differences, the Bureau of Census classified the farms recorded in the 1930 census according to the principal source of income in 1929. The classifications of farms which are of importance in Minnesota are: (1) dairy, 40 per cent or more of the value of all products obtained from the sale of dairy products and dairy cattle; (2) animal-specialty, 40 per cent or more of the value of all products obtained from the

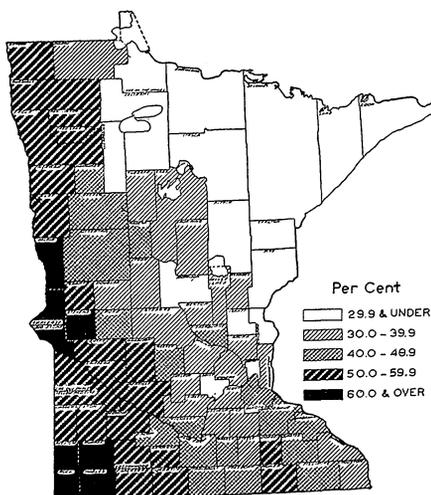


FIG. 68. PROPORTION OF FARM LAND OPERATED BY TENANTS, 1930

The proportion of tenancy is highest in the cash-grain areas in the western counties and lowest in the newly settled counties in the northeast.

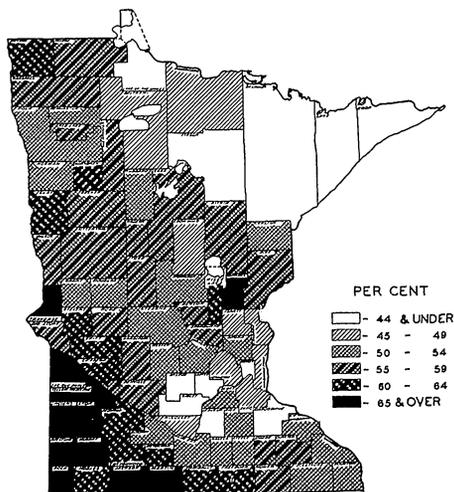


FIG. 69. PROPORTION OF OWNER-OPERATED FARMS THAT WERE MORTGAGED, 1930

The proportion of mortgaged farms is high in most counties, but is highest in the southwestern counties, where farms are large and land values are high.

sale of beef cattle, hogs, sheep, and wool; (3) cash-grain, 40 per cent or more of the value of all products obtained from the sale of corn and small grains; (4) crop-specialty, 40 per cent or more of the value of all products obtained from the sale of potatoes, sugar beets, hay, tobacco, and other minor crops; (5) general, less than 40 per cent of the value of all products from any single source or at least 40 per cent from each of two sources; (6) part-time, 150 days or more spent on work away from the farm or occupation reported to be other than that of farmer and with total value of all products \$750 or less; and (7) self-sufficing, 50 per cent or more of the value of all products represented by value of products used in the home.

For the state as a whole in 1929, 35 per cent of the farms were classified as dairy, 29 per cent as general, 12 per cent as animal-specialty, 9 per cent as cash-grain, 3 per cent each as crop-specialty, part-time, and self-sufficing, and 6 per cent as other.

General and cash-grain farms tend to predominate in the Red River valley with crop-specialty (potato) farms important in Clay County. General animal-specialty, and cash-grain farms tend to predominate in the west-central and southwestern counties. General

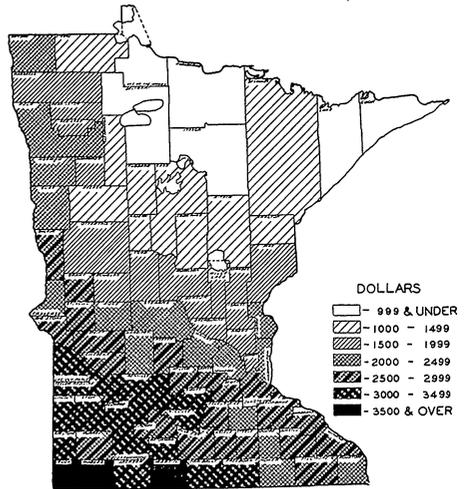


FIG. 70. VALUE PER FARM OF PRODUCTS SOLD, TRADED, AND USED IN THE HOME, 1929

The income per farm was largest in the southwestern counties.

farms predominate in the south-central counties; and dairy, general, and animal-specialty farms predominate in Fillmore, Mower, and Houston counties. Dairy, general, part-time, and self-sufficing farms are about equally important in the northeastern counties. Dairy farms constitute by far the largest proportion of farms in the remaining counties of the state. A distribution of farms by type for each county is presented in table 8 of the statistical supplement to this bulletin.

### TYPE-OF-FARMING AREAS

THE UTILIZATION of land, the combination of enterprises, the organization of the farm, and the farm practices as well vary widely among different parts of the state.

Even within a limited area, although

the natural environment may be fairly homogeneous, there may be several distinct types of farms; that is, farms differing materially in the selection and combination of enterprises and in general organization and methods of pro-

duction. The presence of farms of separate and distinct types within such an area may be the result of variations within the area in natural and economic conditions or of variations in the judgment, preferences, skills, and resources of individual producers.

As indicated in the introductory statement there are, however, certain general production patterns that characterize certain areas of the state. Natural and economic conditions are sufficiently homogeneous to result in the concentration of some particular type of farming in the area. It is possible to divide the state into geographi-

cal areas in each of which there is sufficient uniformity in type of farming to distinguish it from other sections where natural and economic conditions differ.

The division of a state into type-of-farming areas may be useful for a variety of purposes. It may serve as a basis for orienting research work in the region in which the problem studied is most pressing. The results of research work may be more readily applied if the regions concerned are clearly defined. The gathering, reporting, and tabulating of data relating to agriculture, such as acres of crops, num-

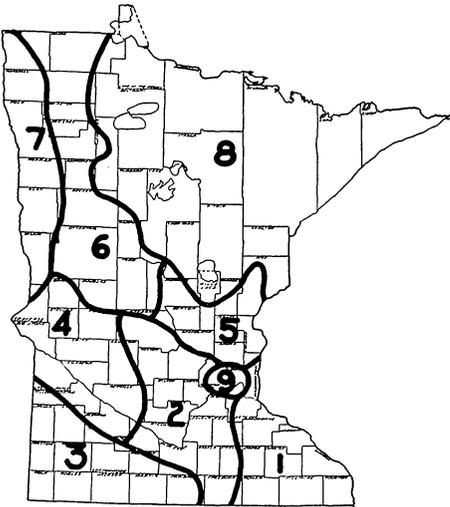


FIG. 71A. TYPE-OF-FARMING AREAS IN MINNESOTA, OUTLINED BY NATURAL BOUNDARIES

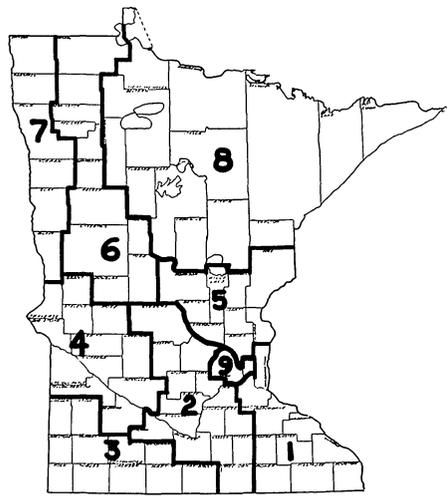


FIG. 71B. TYPE-OF-FARMING AREAS IN MINNESOTA, OUTLINED BY COUNTY BOUNDARIES

- Area 1—Southeast dairy and livestock
- Area 2—South-central dairy and livestock
- Area 3—Southwest livestock and cash grain
- Area 4—West-central livestock and cash grain
- Area 5—East-central dairy and potatoes
- Area 6—Northwestern dairy and livestock
- Area 7—Red River valley small grain, potatoes, and livestock
- Area 8—Northern cutover dairy, potatoes, and clover seed
- Area 9—Twin City suburban truck, dairy, and fruit

bers of livestock, and yields of crops by type-of-farming areas may facilitate the work and permit combinations of data that are highly significant. Since agricultural problems vary within the state, these areas should serve as a basis for applying agricultural plans and programs of both governmental and private agencies where they are most needed and in accord with the local conditions.

In this study the state of Minnesota has been divided into nine major type-of-farming areas, each with characteristics fairly distinct from the others. The location and boundaries of these areas are shown in figure 71a. These boundaries have been based principally on data presented in this bulletin although in many cases the data, presented here largely on a county basis, were studied on a township basis in order more clearly to define the area boundaries.

It must be remembered that the areas are not always clearly defined but are divided by transition zones with the boundaries fixed at approximately the centers of these zones. There are a few cases such as the north- and south-boundary line between areas 1 and 2 where a fairly sharply defined line of difference in natural conditions results in sharp differences in land utilization. Such marked lines of cleavage are rare and usually one area blends into another.

Although natural and economic factors and the distribution of types of farming tend to follow boundaries independent of governmental units, much of the data used in this study is available only on a county basis. In order to permit the summarizing of such data, the type-of-farming map has been

adjusted to county boundaries. This is shown in figure 71b. Marshall and Polk counties were divided between two areas because they are large counties with the agriculture of the western part greatly different from that in the eastern part. Wherever possible the data for each county were divided between Areas 6 and 7, but where this was impossible the data were included in area 7 in which the largest part of the county is located. All statistical data presented in this bulletin have been grouped according to the county-boundary basis shown in figure 71b.

A brief summary of the principal characteristics of each of the type-of-farming areas in Minnesota is presented in the following discussion. Included in this discussion are brief comparisons of the principal types of farming found in each area. As was mentioned previously in this bulletin, the farms recorded in the 1930 United States Census have been classified into types according to the principal source or sources of income in 1929. The following discussion of types of farming is based upon summaries prepared from that census.

It should be remembered that there is always to be expected a material variation from a normal distribution of income by source in any particular year. The average distribution of income over a period of years would be more desirable and would probably reflect less variation in type-of-farming within the same area, but such an average is not available.

Attention should also be called to the large number of general farms in most of the areas. It is probable that many of these closely approximate the major specialized type of that particular area.

At best, the census data on income are rough approximations of income, and more accurate information would result in a more accurate classification of these farms with further reduction in variations of type.

## AREA 1—SOUTHEAST DAIRY AND LIVESTOCK

Type-of-farming Area 1 is predominantly an area of livestock farming. Dairying is the principal enterprise, but the production of hogs, beef cattle, poultry, and sheep are also important particularly in the southern counties. Some crops, principally small grains, are sold, but most of the crops are fed to livestock.

### Forces Influencing Development

The proportion of the land that is rough is higher than in any other area in the state. Most of the nontillable land is wooded, steep, or both, and is, therefore, best suited for permanent pasture. Very little of it is used for wild hay. Since the growth of forage is limited on the wooded land and the grass on the open land makes little growth during the late summer and fall, the grazing capacity of this permanent pasture is limited necessitating the use of tillable land for pasture. Good drainage and lack of stones makes possible the cultivation of most of the land that is not too steep.

Erosion is a fairly serious problem in all counties except Dakota, Dodge, and Mower and has influenced the cropping systems to some extent. With the aid of the Soil Conservation Service, attempts are being made in several

communities to change the cropping systems and cropping practices in such a way as to control erosion more effectively.

Throughout much of this area, liming of the soil is necessary for the satisfactory production of alfalfa and sweet clover. The low nitrogen content of the soil makes it advisable to include alfalfa or the clovers as an important part of the cropping system. In some sections, the addition of phosphorous will materially increase the production of crops. These soil differences have tended to produce a cropping system that differs sharply from that in Area 2.

The annual precipitation in this area is higher than in any other area in the state, and the growing season is longer. Crop yields are somewhat higher than for the state as a whole.

### Cropping System

Small grain, hay, and pasture occupy a large part of the tillable land. In 1929 the small-grain acreage represented 43.3 per cent, the intertilled crop acreage 20.4 per cent, and the hay and pasture acreage 33.2 per cent of the tillable land.

Oats occupies the largest acreage of the small grains closely followed by barley which has been increasing in importance. These two crops are frequently grown in mixtures. Wheat, rye, and flax are grown, but the acreages are small.

The small proportion of the tillable land used for corn, sharply differentiated from the areas to the west, is one of the outstanding characteristics of this area.

Timothy and clover are the most important hay crops although the acreage of alfalfa has been increasing rapidly. Considerable clover and timothy seed is harvested in some years. The largest proportion of the tillable land used for pasture in the state, about one eighth of the tillable land, is another outstanding characteristic of this area.

### Livestock

Cattle are the most important livestock of the area. There is an average of more than six cows for every 100 acres in farms, a number exceeded in only two other type-of-farming areas in the state. In the northern counties of this area, the major emphasis in the cattle enterprise is upon the production of dairy products. In the southern counties, although most of the cows are milked, a material proportion of them are of beef or milk-and-beef breeding. Less emphasis is placed upon milk production resulting in a lower production per cow, and more emphasis is placed upon the production of beef.

Hog production is an important supplementary enterprise, particularly in the southern counties. The number of hogs per 100 acres of tillable land is lower in this area than in the other southern areas because a smaller proportion of the tillable land is used for the production of corn. Sheep are raised on about 20 per cent of the farms in flocks averaging about 24 ewes. Poultry, with flocks averaging about 100 hens, are raised on practically all of the farms.

### Types of Farming

Most of the farms in this area can be classified into types according to the relative importance of the two princi-

pal sources of income, the sale of dairy cattle and dairy products and of beef cattle and hogs. Dairy farms predominate in most counties, but the proportion is highest in the northern counties. On the average, these dairy farms are slightly smaller than the other types both in total land and in tillable land (Table 2). Large, well-constructed buildings are needed, resulting in a large investment in real estate per farm in spite of the smaller acreage.

No data are available concerning the cropping systems on these farms, but data are available from the 1930 census indicating amounts and kinds of livestock and sources of income. The average number of milk cows per farm is 12. These are largely of specialized dairy breeding and are managed for high production. Most of the calves not needed for replacements in the herd are sold for veal. Several litters of pigs are raised per farm utilizing the skim milk as well as some of the corn and barley that is produced. The sale of dairy cattle and dairy products contributes more than half of the cash income on many of these farms. The sale of other livestock, principally hogs, contributes most of the remainder. Some crops are sold on practically all farms, but a large part of the proceeds from this sale of crops is used for the purchase of additional feed.

Animal-specialty or meat-producing farms are scattered throughout this area, but they are most numerous in the southern counties. These are considerably larger than the dairy farms both in terms of acres of land and in terms of investment in real estate. On these farms, too, the average number of cows per farm is 12. Most of these are of beef or milk-and-beef breeding,

Table 2. Data Relating to Principal Types of Farms in Area 1

Item	Type of Farm			
	Dairy	General	Animal-specialty	Cash-grain
Per cent type is of all farms, 1930.....	42	26	17	4
Total acres per farm, 1930.....	157	161	210	203
Acres harvested per farm, 1929.....	90	98	119	139
Value land and buildings per farm, 1930.....	\$12,656	\$12,213	\$16,297	\$14,215
Tenants as per cent of all operators, 1930.....	36	36	33	50
Number horses and mules per farm, 1930.....	4	4	5	4
Number milk cows per farm.....	12	8	10	6
Number beef cows per farm.....	*	*	2	*
Number other cattle per farm.....	13	11	21	8
Number sows and gilts per farm.....	4	4	8	3
Value all products per farm, 1929.....	\$2,708	\$2,281	\$3,364	\$2,164
Value crops sold or traded.....	264	483	233	1,214
Value livestock sold or traded.....	795	656	1,922	304
Value livestock products sold or traded.....	1,418	763	841	397
Value forest products sold.....	11	18	18	6
Value products used in the home.....	310	361	350	243

\* Less than .5.

some are kept mainly for beef, but most of them are milked. The milk production per cow, however, is considerably smaller than on the dairy farms. Although the sale of beef cattle is an important source of income, only a small proportion of the cattle sold are finished on grain; most of them are sold directly from pasture as yearling or two-year-old feeder or slaughter stock. The number of hogs produced on these farms is twice as large as on the dairy farms. The income from the sale of hogs is as large as, or larger than, the income from the sale of beef cattle. The income from the sale of crops is very small with most of the proceeds being used for the purchase of feeds. Although the sale of hogs and cattle constitutes the principal source of income, the sale of livestock products is also important.

A large number of farms in this area

can best be classified as general, or diversified farms. The cattle enterprise is the principal enterprise, but the number of head per farm is considerably less than on the other types. In the northern counties these are principally dairy cattle, while in the southern counties, beef and milk-and-beef cattle, managed as on the animal-specialty farms, are important. The number of hogs is about equal to that on the dairy farms. The sale of crops, livestock, and livestock products are all important sources of income on these farms.

On a small percentage of these farms, the sale of corn and of small grains contributes a very large proportion of the income. The acreage of tillable land on these cash-grain farms is considerably larger than on any of the other principal types of farms, and the number of livestock per farm is smaller.

The value per farm of the produce used in the home is quite small. One half of these farms are operated by tenants, a considerably larger proportion than for any other type.

Other types of farms occur in the area, but the number is small.

## AREA 2—SOUTH-CENTRAL DAIRY AND LIVESTOCK

Type-of-farming Area 2 is an area of intensive livestock production. The income per acre from the sale of livestock and livestock products is exceeded only in Area 9. Dairying, the principal livestock enterprise, is supplemented by the production of other livestock, particularly hogs and poultry. As in Area 1, some crops are sold, but most of the crops are utilized as livestock feeds.

### Forces Influencing Development

Most of the land in this area is level to rolling, with numerous small areas of rough land. Small, poorly drained depressions, not suitable for cultivation, are numerous. Some of the large proportion of nontillable land in the area is utilized for wild hay, but most of it is used for permanent pasture. This large proportion of permanent pasture, of fairly good productivity, has been an important factor causing the development of the intensive livestock production of the area. The soils are fertile, with an adequate supply of lime for alfalfa and sweet clover, and climatic conditions are favorable, with an average annual precipitation of 24 to 30 inches, and an average growing season of 140 to 150 days. Crop yields are higher than in any other area in the state.

### Cropping System

The small grains and corn are the most important crops. The small-grain acreage in 1929 represented 47.2 per cent of the tillable acreage, the intertilled crops 32.5 per cent, and the hay and pasture crops 17.2 per cent. The proportion of intertilled crops is considerably higher and of hay and pasture crops lower than in Area 1.

Oats, grown alone or in mixtures, occupies approximately one half of the small-grain acreage, while barley and wheat occupy approximately a quarter each. The wheat acreage is located largely in LeSueur, Scott, and the neighboring counties.

Corn is the only intertilled crop of importance in this area, except in the Hollandale district in Freeborn county, and in parts of Wright and Stearns counties, where potatoes are important.

The proportion of tillable land used for tame hay is somewhat smaller than in Area 1, but it has been increasing since 1920. More than one third of this tame hay is alfalfa. The proportion of tillable land used for pasture is very low.

### Livestock

As in Area 1, milk cows represent the most numerous class of livestock. In 1929, seven milk cows were kept for every 100 acres in farms, a ratio exceeded only in Area 9. A very large proportion of these cows are of specialized dairy breeding, particularly Holstein. The number of cows kept mainly for beef is very low.

Hog production is the principal supplementary livestock enterprise, with the number of cows and gilts per 100 acres of tillable land almost as high as in Area 3, and considerably higher than

in any other area in the state. The number of chickens is large, but the number of sheep is small.

### Variations within the Area

Although dairying is the principal enterprise in all counties, Area 2 could be divided into two subareas on the basis of the intensity of the dairy enterprise and the nature of the supplementary enterprises. Dairying is considerably less intensive in the six southwestern counties of Blue Earth, Brown, Le Sueur, Nicollet, Sibley, and Waseca. The number of milk cows per 100 acres in farms is considerably lower in these counties, and the proportion of these cows that are of beef or milk-and-beef breeding is larger. The number of beef cattle and of hogs is higher than in the other counties. Corn occupies a larger proportion of the tillable land, and tame hay a

smaller proportion. Crops contribute a larger proportion of the income, and the income from the sale of livestock exceeds that from the sale of livestock products. On the whole, however, the agriculture of these counties resembles that of the other counties of Area 2 more closely than that of Area 3.

### Types of Farming

Most of the farms in Area 2, as in Area 1, can be divided into types on the basis of the proportion of the income that is derived from the sale of dairy cattle and dairy products and of beef cattle and hogs. The proportion of dairy farms is about the same in the two areas, but the proportion of general farms is larger and of animal-specialty farms is smaller in Area 2 (Table 3).

In general, the farms in Area 2 are slightly smaller than the farms of

Table 3. Data Relating to Principal Types of Farms in Area 2

Item	Type of Farm			
	Dairy	General	Animal-specialty	Cash-grain
Per cent type is of all farms, 1930 .....	45	32	10	4
Total acres per farm, 1930 .....	141	146	183	174
Acres harvested per farm, 1929 .....	87	94	122	123
Value land and buildings per farm, 1930.....	\$14,099	\$13,696	\$17,595	\$15,881
Tenants as per cent of all operators, 1930 .....	27	29	29	43
Number horses and mules per farm, 1930 .....	4	4	5	4
Number milk cows per farm .....	12	9	9	5
Number beef cows per farm .....	*	*	1	1
Number other cattle per farm .....	10	8	13	6
Number sows and gilts per farm .....	5	5	9	4
Value all products per farm, 1929 .....	\$2,735	\$2,424	\$3,562	\$2,282
Value crops sold or traded .....	213	468	335	1,260
Value livestock sold or traded .....	748	710	2,011	371
Value livestock products sold or traded .....	1,393	821	838	378
Value forest products sold .....	10	14	8	6
Value products used in the home .....	381	411	370	267

\* Less than .5.

similar type in Area 1, the value per acre of land and buildings is higher, and the proportion of tenancy is lower. The number of cows per farm is about equal in the two areas, but the proportion of the cows that are of beef or milk-and-beef breeding is lower in Area 2. The number of hogs per farm is slightly larger in Area 2. In other respects, the characteristics of the various types and the differences between the types are quite similar to those in Area 1.

### AREA 3—SOUTHWEST LIVE-STOCK AND CASH GRAIN

Type-of-farming Area 3 is an area of wide diversity of enterprises. All classes of livestock are important although livestock kept for meat production tends to predominate. The sale of crops constitutes an important source of income. This area lies between the corn belt to the south, the dairy region to the east and northeast, and the small-grain region to the west and northwest, and it has been influenced by the forces affecting each of these three regions.

#### Forces Influencing Development

Most of the land in this area is level to rolling. Natural drainage is inadequate in many localities, but artificial drainage has made much of this land tillable. About 78 per cent of the land in farms is now tillable, while 4 per cent is used for wild hay, and 13 per cent is used for permanent pasture. Crop yields are somewhat higher than the average for the state in the eastern counties, and are fairly stable from year to year, but they are considerably

lower and fluctuate widely from year to year in the northwestern counties.

The yields of corn have tended to be high compared with the yields of hay and pasture. This relationship, together with the level topography, has encouraged the utilization of a large proportion of the land for the production of corn, and a small proportion for hay and pasture, resulting in a high ratio of concentrates to roughages. There has, therefore, been a tendency for the meat-producing livestock, particularly hogs and beef cattle, to concentrate in this area, for this livestock can best utilize these concentrate feeds.

#### Cropping System

The corn acreage is almost as large as the small-grain acreage in this area. Small grains occupied 45.3 per cent of the tillable land in 1929, intertilled crops 39.8 per cent, and hay and pasture crops 13.4 per cent.

More than half of the small-grain acreage is oats, but this proportion has been steadily declining since 1920. Barley has been displacing oats until it now occupies about one quarter of the small-grain acreage. Some flax is raised in the area, its acreage representing 3.3 per cent of the tillable land, or about one fifth of the total flax acreage of the state in 1929.

The proportion of the land used for intertilled crops, principally corn, is considerably higher than for any other area in the state. In this area, about 90 per cent of the corn is husked; the other 10 per cent is harvested as fodder or as silage.

The proportion of the tillable land used for tame hay is small, almost as large a proportion is used for pasture.

Legumes, particularly alfalfa, are prominent.

Approximately 25 per cent of the corn, 40 per cent of the barley and oats, and most of the flax are sold.

### Livestock

The dairy enterprise is important in Area 3 although it is considerably less intensive than in the other areas of southern Minnesota. The number of milk cows kept per 100 acres in farms in 1930 was 3.9 in Area 3, compared with 7.0 in Area 2 and 6.0 in Area 1. A very large proportion of the milk cows are of beef or milk-and-beef breeding. Although approximately one fourth of the cows kept mainly for beef in the state are located in this area, there are about 10 milk cows for every cow kept mainly for beef. In 1930 only 8 per cent of the farmers in the area reported cows kept mainly for beef. The production of beef is important in this area, however, through the raising and fattening of the calves from the beef and milk-and-beef cows that are milked and through the fattening of cattle that are shipped into the area.

Hog production is one of the most important enterprises in this area with approximately 30 per cent of the hogs in the state being raised here. Hogs are raised on most farms with 10 or more litters per year being raised on a large proportion of the farms. About 20 per cent of the farms in the area keep sheep with an average of 24 ewes per flock. Fattening of shipped-in lambs has become quite important during recent years. Poultry are kept on practically every farm in the area with flocks averaging almost 150 hens, or larger than in any other area in the state.

### Types of Farming

Approximately one third of the farms can be classified as animal-specialty farms, or farms on which the sale of livestock constitutes the principal source of income. These are larger than the animal-specialty farms in Area 1 and Area 2, averaging 217 acres (Table 4). Beef production is an important enterprise on most of these farms. Although four fifths of the cows are milked, a fairly large proportion of them are of beef or milk-and-beef breeding, producing calves suitable for fattening. The fattening of purchased cattle is an important enterprise on many of these farms. Hog production is very large on most of them. The number of sows per farm is larger than in any other area in the state. The sale of crops is a more important source of income than on the animal-specialty farms in Area 2.

Another third of the farms can be classified as general or diversified farms with several sources of income of nearly equal importance. These farms are somewhat smaller than the animal-specialty farms, but the proportion operated by tenants is slightly larger. Cattle constitute the principal class of livestock with about 8 cows per farm. Although some of these cows are of beef or milk-and-beef breeding, practically all of them are milked. On some farms the calves are raised and fattened for market. On very few of them are cattle purchased for feeding. Hogs are raised on most of these farms on a fairly large scale. Crop sales, sales of livestock, and sales of livestock products contribute approximately equal amounts to the income of the farm.

About one fifth of the farms in this area can be classified as cash-grain

Table 4. Data Relating to Principal Types of Farms in Area 3

Item	Type of Farm			
	Dairy	General	Animal-specialty	Cash-grain
Per cent type is of all farms, 1930 .....	7	34	32	22
Total acres per farm, 1930 .....	169	186	217	231
Acres harvested per farm, 1929 .....	121	140	163	184
Value land and buildings per farm, 1930 .....	\$16,655	\$17,101	\$20,686	\$20,233
Tenants as per cent of all operators, 1930 .....	37	50	43	64
Number horses and mules per farm, 1930 .....	5	6	6	6
Number milk cows per farm .....	12	8	8	6
Number beef cows per farm .....	*	*	2	*
Number other cattle per farm .....	13	10	17	9
Number sows and gilts per farm .....	8	8	13	7
Value all products per farm, 1929 .....	\$3,119	\$2,914	\$4,109	\$3,174
Value crops sold or traded .....	300	781	552	1,775
Value livestock sold or traded .....	981	947	2,477	631
Value livestock products sold or traded .....	1,510	819	738	468
Value forest products sold .....	2	2	2	1
Value products used in the home .....	326	365	340	299

\* Less than .5.

farms. As in other areas, these are larger than the livestock farms, and the proportion of tenancy is higher. Milk cows are kept on almost 90 per cent of these farms, but the number per farm is smaller than on the other types. Here, also, a large proportion of the calves are fattened and sold for beef. Although the sale of crops is the principal source of income, the sale of livestock and livestock products is also of considerable importance.

Less than one tenth of the farms can be classified as dairy farms. Here, also, the dairy farms are smaller than the other types, and the percentage of tenancy is lower. An average of 12 cows are kept per farm, a number larger than on the other types. Most of these cows are of dairy breeding, with the production per cow about equal to that on the dairy farms in Area 1 and Area 2. The number of hogs produced per farm is equal to that on the general

farms, but is smaller than that on the animal-specialty farms. The income from the sale of crops is smaller than on any of the other three types.

The number of farms of other types is very small.

#### AREA 4—WEST-CENTRAL LIVESTOCK AND CASH GRAIN

Type-of-farming Area 4 is also an area of wide diversity of enterprises with the sale of livestock, livestock products, and crops each contributing substantial proportions of the total income. In many respects this area is very similar to Area 3.

#### Forces Influencing Development

The topography, the soils, and the proportion of the land that is tillable is very similar to that in Area 3. The

average annual precipitation is somewhat less, ranging from less than 22 inches to 26 inches with less than 24 inches in most of the area. The growing season is slightly shorter giving corn a lesser advantage over other crops. This area marks the extreme northern limit of the corn belt of the United States.

During the 20 years from 1917 to 1936, the yields of crops in this area were about 7 per cent below the average for the state and fluctuated very widely from year to year. This great variability in crop yields has tended to hinder the development of the livestock industry in the area because it has been difficult to maintain adequate and uniform quantities of feeds. Sharp reductions in the rate of feeding and extensive sales of livestock have been necessary at times, particularly during the drouth of 1934.

As in Area 3, the relative yields of the various crops and the possibility of utilizing large scale machinery has favored the production of concentrate crops rather than roughage crops. This in turn has favored the sale of crops or the maintenance of those kinds of livestock that can best utilize large proportions of concentrates, such as hogs and beef cattle.

### Cropping System

Small grains occupy a larger place in the cropping system in this area than in the southern areas of the state. In 1929, small grains occupied 54.8 per cent, intertilled crops 30.1 per cent, and hay and pasture crops 11.2 per cent of the tillable land.

The proportion of tillable land in small grains in this area is approxi-

mately equal to that in Area 7 and higher than in any other area in the state. Oats is the principal small grain although the acreage has been decreasing slightly since 1920. Barley ranks second to oats in acreage. Barley became important in this area at an earlier date than in the southern counties, but the increase in acreage during recent years has not been so marked. Wheat is an important crop in this area, occupying approximately 10 per cent of the tillable land. As in most of the other areas of the state, wheat was originally the principal crop of the region, but it decreased to a low point in 1931 and has since increased slightly. Some flax is grown.

Here, also, corn is the principal intertilled crop.

The acreage of tame hay, principally alfalfa, is small, representing 6.0 per cent of the tillable land in 1929. A slightly smaller acreage is used for tillable pasture. The use of sweet clover for pasture has developed more extensively in this area than in the counties farther south.

The sale of crops contributes approximately the same proportion of the income as in Area 3. The sale of corn is considerably smaller in Area 4, and the sale of oats is slightly smaller, but this difference is offset by the larger marketings of wheat.

### Livestock

The livestock industry of Area 4 is developed less intensively than that in Area 3. The kinds of livestock are quite similar, but the number of sheep is slightly less, and the number of feeder cattle shipped in and the number of hogs is considerably less. The number

of ewes per 100 acres in farms is 1.3, compared with 2.3 in Area 3, and the number of sows per 100 acres of tillable land is 4.0 compared with 6.0.

**Types of Farming**

The types of farms in Area 4 resemble quite closely those in Area 3. The proportion of dairy farms is slightly larger and the proportion of animal-specialty farms is slightly smaller, otherwise the proportions of the various types are similar (Table 5). The number of acres per farm is larger in Area 4, but the value of land and buildings per acre is considerably smaller giving a smaller real-estate value per farm. The proportion of tenancy is slightly lower in Area 4. The number of cattle per farm is slightly smaller and of hogs is considerably smaller. The proportion of the income obtained from the various sources is very similar in the two areas.

**AREA 5—EAST-CENTRAL DAIRY AND POTATOES**

Dairying is the predominant enterprise of type-of-farming Area 5. Although livestock of the other classes are raised, the income from that source is small compared with the income from the dairy enterprise. The sale of potatoes constitutes an important supplementary source of income.

**Forces Influencing Development**

The topography of most of this area is level to rolling with some hilly land. The soil in a large part of the southwestern section is sand or loamy sand with a gravel subsoil. Liming of much of this soil is necessary for the satisfactory production of alfalfa and sweet clover. This soil ranges from sands to loams, much of it containing considerable stone. All of these mineral soils are deficient in nitrogen. There are nu-

**Table 5. Data Relating to Principal Types of Farms in Area 4**

Item	Type of Farm			
	Dairy	General	Animal-specialty	Cash-grain
Per cent type is of all farms, 1930 .....	11	35	24	24
Total acres per farm, 1930 .....	199	209	240	251
Acres harvested per farm, 1929 .....	135	155	180	200
Value land and buildings per farm, 1930 .....	\$12,984	\$14,260	\$17,319	\$17,101
Tenants as per cent of all operators, 1930 .....	35	43	37	60
Number horses and mules per farm, 1930 .....	5	6	6	6
Number milk cows per farm .....	11	8	8	5
Number beef cows per farm .....	*	*	1	*
Number other cattle per farm .....	12	9	14	7
Number sows and gilts per farm .....	5	6	10	6
Value all products per farm, 1929 .....	\$2,658	\$2,450	\$3,595	\$2,709
Value crops sold or traded .....	244	598	488	1,531
Value livestock sold or traded .....	821	784	2,113	520
Value livestock products sold or traded .....	1,256	692	650	377
Value forest products sold .....	4	5	4	2
Value products used in the home .....	333	371	340	279

\* Less than .5.

merous and extensive areas of peat, all of which are naturally poorly drained. Most of this area was originally covered with hardwood forests, with some coniferous forests along the northern edge.

The annual precipitation ranges from 24 to 28 inches. In most of the area, the growing season is less than 140 days. Crop yields tend to be somewhat lower than the average for the state and fluctuate widely from year to year. Drouth damage is frequently quite severe on the sandy soils.

### Cropping System

Small grains occupy a smaller proportion of the tillable land in this area than in most of the areas in the state. In 1929, small grains occupied only 41.8 per cent of the tillable land, while intertilled crops occupied 23.7 per cent, and hay and pasture crops 26.7 per cent.

Oats occupies about one half of the small-grain acreage, and rye occupies almost one fourth. The proportion of the tillable land used for rye in this area is far larger than in any other area in the state. Barley is less important here than in most areas, occupying only 5.9 per cent of the tillable land. The barley acreage has not increased as rapidly in this area as in most areas.

Corn occupies only about one sixth of the tillable land although there has been a slight tendency for the acreage to increase during recent years partially as the result of the development of better adapted varieties. The acreages of corn husked in the field, cut for fodder, and harvested as silage are about equal. Potatoes occupied 7.0 per cent

of the tillable land in 1929, a proportion considerably larger than in any other area except Area 9. However, this proportion has been decreasing for several years.

Tame hay, principally timothy and clover, occupies almost one quarter of the tillable land. Since the acreage of permanent pasture is very large, the proportion of the tillable land used for pasture is small.

### Livestock

Milk cows are kept on most farms in the area. In 1930, there were 6.0 cows for every 100 acres in farms, a number almost as great as that in Areas 1 and 2. Since the proportion of tillable land is small, the number of cows per 100 acres of tillable land is very high. The number of cows of beef or milk-and-beef breeding, whether milked or kept mainly for beef, is very small.

Sheep are quite numerous, particularly in Kanabec County. Hogs are kept on only one half of the farms. In 1930, there was an average of one sow for every farm in the area, a number considerably smaller than that in the southern areas. Chickens are also kept on most of the farms in the area, with an average of 72 birds per flock.

### Types of Farming

More than half of the farms in Area 5 can be classified as dairy farms. These are smaller than the dairy farms in the other areas, averaging only 131 acres per farm with only 57 acres of harvested crops (Table 6). The proportion of tenancy is very low. In spite of the small acreage, the number of cows, 10 per farm, is almost as large

as in the four southern areas. Practically all of these cows are of dairy breeding. Almost one half of these farms produce some hogs, but the number per farm is small. The income from the sale of crops and livestock constitutes a smaller proportion of the income from the sale of all products than it does in the southern areas.

Almost one quarter of the farms can be classified as general, or diversified farms. Most of these farms combine dairying with the production of crops for sale. These are slightly larger than the dairy farms. The number of cows per farm and the production per cow is smaller than on the dairy farms. The income from the sale of crops, mostly rye and potatoes, is larger than the income from the sale of livestock.

A small proportion of the farms can be classified as crop-specialty farms. Most of these are located in Isanti County. The number of livestock on these farms is less than on the general

farms. A large proportion of the income on these farms is derived from the sale of crops, principally potatoes. The value of the produce used in the home is somewhat less than on the dairy and general farms where a wider variety of livestock and livestock products is available.

Another small group of farms can be classified as self-sufficing farms. These are farms on which the value of the produce used in the home represents at least one half of the income from all products of the farm, and on which the operator obtains only a limited income from employment away from the farm. These farms are small, averaging only 70 acres in size, with 22 acres of harvested crops. From 1 to 3 milk cows are kept on most of these farms, providing dairy products for use in the home and a small quantity for sale. Sows for farrowing are kept on only about 20 per cent of the farms, but in some cases hogs are purchased from

Table 6. Data Relating to Principal Types of Farms in Area 5

Item	Type of Farm			
	Dairy	General	Crop-specialty	Self-sufficing
Per cent type is of all farms, 1930 .....	55	23	7	4
Total acres per farm, 1930 .....	131	140	129	70
Acres harvested per farm, 1929 .....	57	68	64	22
Value land and buildings per farm, 1930 .....	\$7,884	\$7,508	\$7,359	\$3,466
Tenants as per cent of all operators, 1930 .....	17	19	22	20
Number horses and mules per farm, 1930 .....	3	3	3	2
Number milk cows per farm .....	10	7	5	2
Number other cattle per farm .....	9	7	5	2
Number sows and gilts per farm .....	1	1	1	*
Value all products per farm, 1929 .....	\$1,949	\$1,686	\$1,946	\$487
Value crops sold or traded .....	237	446	1,149	53
Value livestock sold or traded .....	343	298	139	34
Value livestock products sold or traded .....	1,044	568	404	99
Value forest products sold .....	16	25	13	7
Value products used in the home .....	309	349	241	294

\* Less than .5.

neighbors to be fattened and slaughtered for home use. In spite of the fact that the value of the produce used in the home constitutes more than half of the value of all products, the value per farm of the produce so used is less than on the dairy or general farms. The income from all farm products is very small.

### AREA 6—NORTHWESTERN DAIRY AND LIVESTOCK

Type-of-farming Area 6 is also predominantly a region of dairy farming. The agriculture of this area, however, is less intensive than that of the dairy regions to the south. In general, a smaller proportion of the land is tillable, a larger proportion is used for hay and pasture, and the number of livestock is less. Cash crops are important in the northern counties, while livestock other than dairy cattle are of some importance throughout the area.

Since most of this area was originally covered by forests, in many respects the agriculture resembles that of the main forest region to the east. In some places, particularly in the north-central portion of the region, the prairies of the west project into the area. In Mahnomen and northern Becker counties, the presence of the White Earth Indian Reservation has affected the agricultural development. This area tends, therefore, to show a rather wide variety of types of farming.

#### Forces Influencing Development

The topography of the southern part of the area is level to hilly, with numerous lakes and poorly drained areas, but on the whole most of the land is well drained. The northern part is

level to rolling with large areas of poorly drained land. The soils are largely loams with heavy subsoils, some sand, and large amounts of peat. The original vegetation of this area represented all of the three types found in the state. The coniferous forest extended into the area along the entire eastern side; the hardwood forests extended northward for approximately one half the length of the area; the grass-land prairie projected into the area from the west, principally in the territory north of the hardwood forests.

The growing season ranges from about 110 days at the northern end to about 140 days at the southern end. The average annual precipitation ranges from 20 to 24 inches. Crop yields during the years from 1917 to 1936 averaged about 11 per cent below the yields for the state as a whole.

#### Cropping System

Intertilled crops occupy a relatively unimportant place in the cropping system of Area 6, while hay and pasture crops are fairly important. In 1929, 48.3 per cent of the tillable land was used for small grains, 12.8 per cent for intertilled crops, 30.2 per cent for hay and pasture crops, and 8.7 per cent for other uses, principally idle and fallow land.

Oats is the most important small-grain crop throughout the area, while barley is quite important in the southern counties, and a considerable acreage of wheat is grown in most counties. Flax is of some importance in the northern counties.

Corn is produced on about 10 per cent of the tillable land, with the percentage ranging from almost none in Roseau County to about 20 per cent in

Douglas County. Some potatoes are produced for sale in this area, but the importance of this crop compared with other crops is steadily declining.

Hay is produced on one fifth of the tillable land. In spite of the relatively large acreage of permanent pasture that is available in this area, more than 5 per cent of the tillable land is used for pasture.

In the northern counties, a large proportion of the tillable land is fallowed or left idle each year. In these counties where the acreage of intertilled crops is low, fallow has been used as an aid in weed control.

Minnesota and is considerably smaller than in the other dairy areas of the state. Although more than 10 per cent of the cows in this area are of beef or milk-and-beef breeding, the number of cows kept mainly for beef production is very small.

Sheep are raised on about 25 per cent of the farms. This industry is most important in the northern counties where sheep are raised on 40 per cent or more of the farms. Hogs are raised on about one half of the farms, but the number raised per farm is small. Chickens are raised on most of the farms, but the flocks are small.

**Livestock**

Milk cows, the principal class of livestock in the area, are kept on more than 90 per cent of the farms. The number of milk cows kept per 100 acres of land in farms, however, is about equal to that in southwestern

**Types of Farming**

More than half of the farms in Area 6 can be classified as dairy farms. These farms average 173 acres with 85 acres of harvested crops (Table 7). The value per farm of the real estate is quite low compared with the dairy farms in the

**Table 7. Data Relating to Principal Types of Farms in Area 6**

Item	Type of Farm		
	Dairy	General	Self-sufficing
Per cent type is of all farms, 1930 .....	51	30	4
Total acres per farm, 1930 .....	173	186	84
Acres harvested per farm, 1929 .....	85	99	27
Value land and buildings per farm, 1930 .....	\$7,859	\$7,627	\$3,019
Tenants as per cent of all operators, 1930 .....	23	28	26
Number horses and mules per farm, 1930 .....	4	4	2
Number milk cows per farm .....	10	7	2
Number other cattle per farm .....	10	8	2
Number sows and gilts per farm .....	2	2	*
Value all products per farm, 1929 .....	\$1,983	\$1,710	\$429
Value crops sold or traded .....	166	374	36
Value livestock sold or traded .....	450	389	31
Value livestock products sold or traded .....	1,025	577	89
Value forest products sold .....	18	25	9
Value products used in the home .....	324	345	264

\* Less than .5.

southern areas. About 10 cows are kept per farm, most of them of specialized dairy breeding. Sows for farrowing are reported on more than half of these farms with an average of 4 sows each or 2 sows for every dairy farm. Income from the sale of livestock products is about double that from the sale of livestock. Income from the sale of crops is relatively very small.

Slightly less than one third of the farms can be classified as general farms. Most of these are farms on which dairying is supplemented with the production of other livestock and the production of crops for sale. The average acreage of these is slightly larger than of the dairy farms, but the number of livestock per farm is less. The income from the sale of livestock and livestock products is less than on the dairy farms, but the income from the sale of crops is larger.

Here also a small proportion of the farms can be classified as self-sufficing farms. These are quite similar to the self-sufficing farms in Area 5.

Other types of farms occur throughout the area, but the proportion is quite small except in certain counties. There are some cash-grain farms in Red Lake and Pennington counties, with the sale of wheat and flax constituting important sources of income. There are some crop-specialty farms in the three northern counties where the sale of clover seed is an important source of income.

#### AREA 7—RED RIVER VALLEY SMALL GRAIN, POTATOES, AND LIVESTOCK

The production of grain for sale is an important characteristic of type-of-farming Area 7. This is the only type-

of-farming area in Minnesota in which the income from the sale of crops is approximately equal to the combined income from the sale of livestock and livestock products. Wheat has been the principal crop, but the acreage has fallen to about half that of three decades ago. The increase of crop diseases, insect pests, and weeds has made necessary the diversification of the cropping system with oats, barley, and the forage crops displacing some of the wheat. The production of some livestock has been found to be profitable, and the number of livestock has been increasing.

#### Forces Influencing Development

The greater part of the Red River valley is very level. Clay loams and silt loams predominate in the area nearest to the river. Along the eastern edge are found sandy loams and sands. These occur largely near and on the shore lines that were formed by the northward recession of the old glacial Lake Agassiz. The natural drainage is poor on the greater part of the heavier soils, but the construction of ditches has provided fairly satisfactory drainage in most sections. The level lands, with their possibilities for large fields and the use of large machines, has favored the development of the small-grain enterprises in the area.

The climate in this area is somewhat severe thus limiting the alternatives for crops. The growing season ranges from 110 days in the northern end to 130 days at the southern end, or a season too short for the production of corn. The annual precipitation averages 20 to 22 inches. The climatic conditions tend to favor the production of

small grains although the yields of forage crops are quite satisfactory. In general, crop yields in Area 7 are lower than in the other areas of the state.

The distance to market is greater from Area 7 than from any other area in the state. Crops of high value per pound hold an advantage over the more bulky commodities because shipping costs represent a smaller proportion of their value. Wheat has held an advantage because direct rail connections are available with the milling center in Minneapolis and with Duluth for shipment to the eastern states by way of the Great Lakes.

### Cropping System

The small grains are the most important crops in the area. In 1929, the small-grain acreage represented 54.4 per cent of the tillable land, intertilled crops 9.3 per cent, hay and pasture crops 18.1 per cent, and other uses, principally idle and fallow, 18.2 per cent.

Although small grains do not occupy a larger proportion of the tillable land than they do in Area 4, they represent a larger proportion of the acreage of harvested crops. Oats, barley, and wheat occupy approximately equal acreages. This is the only area in the state where oats is not the predominant small-grain crop. Both barley and wheat occupy a larger proportion of the tillable land than in any other area in the state. Approximately 4 per cent of the tillable land is used for the production of flax.

Corn is a minor crop, occupying less than 5 per cent of the tillable land. The potato acreage is almost equal to the corn acreage and represents about

30 per cent of the potato acreage of the state. There has been a tendency for the center of potato production in Minnesota to shift from Area 5 to Area 7 particularly to Clay county.

Hay, primarily alfalfa and sweet clover, is produced on less than 10 per cent of the tillable land. An acreage almost equal to that of tame hay is used for tillable pasture.

### Livestock

Although the development of the livestock industry has progressed rapidly, it still is less intensive than in the other areas of the state. Dairying is the most important livestock enterprise, for there are milk cows on about 90 per cent of the farms with average herds of more than 7 cows. Since the farms average about 230 acres in size, the ratio of cows to land is quite low, less than 3 cows per 100 acres. Almost 20 per cent of these milk cows are of beef or milk-and-beef breeding. The number of cows kept mainly for beef is small.

Although sheep are raised on only 20 per cent of the farms, there are about 3 ewes for every 100 acres of land in farms. This is the only area in the state in which the ewes outnumber the cows. Hogs are raised on only about 40 per cent of the farms. Chickens are raised on most farms, but the flocks are quite small.

### Types of Farming

Although this area is the principal small-grain area in the state, dairy farms are more numerous than either cash-grain or crop-specialty farms. These are considerably larger than the dairy farms in other areas, averaging

Table 8. Data Relating to Principal Types of Farms in Area 7

Item	Type of Farm				
	Dairy	General	Animal-specialty	Cash-grain	Crop-specialty
Per cent type is of all farms, 1930 .....	21	36	4	19	12
Total acres per farm, 1930 .....	239	268	342	368	267
Acres harvested per farm, 1929 .....	124	160	197	246	182
Value land and buildings per farm, 1930 .....	\$7,825	\$9,161	\$12,464	\$12,804	\$10,923
Tenants as per cent of all operators, 1930 .....	30	38	37	46	38
Number horses and mules per farm, 1930 .....	5	6	7	6	6
Number milk cows per farm .....	10	7	7	5	5
Number beef cows per farm .....	*	*	1	*	*
Number other cattle per farm .....	11	9	13	7	6
Number sows and gilts per farm .....	1	1	4	1	1
Value all products per farm, 1929 .....	\$1,964	\$2,026	\$3,128	\$2,518	\$3,147
Value crops sold or traded .....	302	708	466	1,575	2,301
Value livestock sold or traded .....	397	373	1,678	268	205
Value livestock products sold or traded .....	965	595	664	395	354
Value forest products sold .....	10	10	7	5	6
Value products used in the home .....	290	340	313	275	281

\* Less than .5.

239 acres with 124 acres of harvested crops. Less than one third of these farms are operated by tenants (Table 8). An average of 10 milk cows are kept per farm, or a number almost as large as on the dairy farms in the principal dairy regions of the state. The number of livestock other than dairy cows is quite small, with the income from the sale of livestock amounting to half or less than half the income from the sale of livestock products. The income from the sale of crops is almost equal to the income from the sale of livestock.

The number of cash-grain farms is slightly smaller than the number of dairy farms. These are considerably larger than the farms of other types, and the proportion of tenancy is larger. Some milk cows are kept on about 80 per cent of these farms. Hogs are raised on only one half of them. Wheat, oats, barley, and flax are the principal

cash crops. The income from the sale of livestock and livestock products constitutes a smaller proportion of the total income from all products here than they do on the cash-grain farms in other sections of the state.

Crop-specialty farms are slightly less numerous than are cash-grain farms. In Clay County, however, this type is most numerous, representing about one fourth of all farms. These are considerably smaller than the cash-grain farms, but the number of livestock per farm is almost the same. Potato production is one of the important enterprises on these farms. The income from the sale of livestock constitutes a smaller proportion of the income from all products than on the cash-grain farms.

There are some animal-specialty farms scattered throughout the area although the proportion is largest in the southern counties. These farms are

almost as large as the cash-grain farms. The number of livestock per farm is smaller than on the animal-specialty farms in the southern areas. Here, too, a large proportion of the cows are of beef or milk-and-beef breeding although most of them are milked. Most of the calves not needed for replacement are raised on the farm and are sold as feeders or for slaughter. Shipped-in cattle and lambs are fattened on some of the farms. The number of hogs per farm is much larger than on the other farms of this area. The sale of crops is an important source of income, contributing almost as much as the sale of livestock products.

About one third of the farms in this area can be classified as general, or diversified farms. These are slightly larger than the dairy farms and considerably smaller than the cash-grain and animal-specialty farms. The production for sale of small grains and potatoes, with clover seed and hay on a few farms, is important on most of them. Milk cows are kept on most of these farms, with average herds of 7 cows. Hogs and sheep are raised on some of them. The income from the sale of crops, however, exceeds that from either the sale of livestock or livestock products.

#### AREA 8—NORTHERN CUTOVER DAIRY, POTATOES, AND CLOVER SEED

The characteristics of type-of-farming Area 8 differ sharply from those of the other areas of the state. This is a cut-over forest area, with only a limited agricultural development. Only 15 per cent of the land of the area is in farms,

and much of this is still in the process of development. Dairying is the principal agricultural enterprise. Hay is the principal crop; a large proportion of the necessary concentrate feeds are shipped in from other areas. Farms are small and incomes are low. The type of farming is fairly uniform throughout the area, but it is undergoing a constant change. There are many serious economic problems which must be solved before this can become a stable agricultural region.

#### Forces Influencing Development

This area was originally covered by forests, mostly coniferous. Although practically all of the original growth has been removed, and restocking has been slow, much of the land has been difficult to clear. The topography ranges from level to hilly, with much of it rolling. Numerous low knolls and ridges and poorly drained depressions have been left by the glaciers that have repeatedly covered this area. The soils are a mixture of well drained loams, peat bogs, sand plains, and wet depressions of clay loams. Poorly drained peat bogs are extensive in the north-western counties, and smaller areas are found over most of the other counties. In the eastern counties, stones are very numerous. In some places they make the use of tillage implements impossible; in other places the stones can be removed to the extent that tillage is possible, but the cost of removal is very high. Areas of good soils are intermingled with soils of such low productivity as to have little agricultural value.

The growing season is quite short ranging from 130 days to less than 100

days. The annual precipitation ranges from 22 to 28 inches. The yields of crops are approximately equal to the average for the state.

Although the forests have hindered the development of this region, they have served as a source of income to many farmers. Winter employment has been available in the forests. However, with the removal of the virgin timber and with the mechanization of the forest industry, these opportunities for employment have been greatly reduced. The presence of a large number of people employed full-time in the forest industry has provided a local market outlet for a considerable quantity of agricultural products in the past.

The presence of numerous lakes and large areas of forest lands has permitted the development of an extensive recreational industry. Many farmers have constructed a few lakeside cottages, renting them out during the summer as a supplementary source of income. The presence of this industry provides a local outlet for farm produce during the summer months.

Iron mining is an important industry in this area. The value of the iron ore removed in 1929 was about five times as large as the value of the agricultural products produced in this area. Since a large number of people are employed in this industry, a local market for farm produce is available.

Settlement of this area has proceeded very slowly. Some land was in farms by 1880, but by 1930 the proportion had grown to only 15 per cent of all land in the area. Development of this land also has proceeded slowly. In 1930, only 26.6 per cent of the farm land was tillable, 3.7 per cent was used for wild hay, 41.8 per cent was in permanent

pasture, mostly wooded, and 17.5 per cent was woodland not pastured.

### Cropping System

The outstanding characteristics of the cropping system of Area 8 is the large proportion of the tillable land that is used for the production of tame hay. In 1929, 23.0 per cent of the tillable land was used for small grains, 8.9 per cent for intertilled crops, and 58.9 per cent for hay and pasture.

About two thirds of the small grain in this area is oats, and most of the remainder is barley. There has been a tendency for the proportion of the tillable land used for oats to decrease.

The intertilled crops are divided approximately equally between corn and potatoes.

Since there is such a large quantity of permanent pasture available, little tillable land is used for pasture. In the northern counties, a considerable acreage of clover and alfalfa seed is harvested, but this acreage fluctuates widely from year to year. In 1929, the acreage from which clover seed was harvested represented 3 per cent of the tillable land. Tame hay is harvested from more than half of the tillable land of the area. Utilizing such a large proportion of the tillable land for tame hay makes it possible to maintain a large number of cattle, with the home-grown feed being supplemented by concentrates shipped into the area.

### Livestock

Dairying is the principal enterprise in the area. Dairy cattle are kept on about 80 per cent of the farms, with an average of more than 5 cows per farm. In spite of the small proportion

of improved land, there were 3.7 cows per 100 acres in farm in 1930. Very few of these milk cows are of beef or milk-and-beef breeding. There are some sheep. Hog production is very limited. In 1930 only 14 per cent of the farms reported that they had any sows or gilts to farrow that spring. Poultry are kept on about 70 per cent of the farms, but the flocks are small.

### Types of Farming

Dairy farms are the most numerous in this area. They represent 40 per cent of all farms. These farms are small, averaging only 134 acres with 41 acres of harvested crops (Table 9). Since the acreage is small, and the value of land per acre is small, the value per farm is also small. The proportion of farms operated by tenants is very low. The number of cows per farm is quite small—seven per farm.

Most of these are of specialized dairy breeding and are managed for fairly high production. The income from the sale of crops is quite small. Some forest products are sold on about half of these farms.

General farms are next in importance to dairy farms, with about half the number. The acreage of harvested crops is slightly less on the general farms than on the dairy farms, and the number of livestock is considerably less. The income from the sale of crops exceeds that from the sale of livestock, and the sale of forest products is of considerable importance on about one half of the farms.

Although potatoes and clover seed are important in this area, less than 10 per cent of the farms can be classified as crop-specialty farms. On these farms the acreage of land and of harvested crops is equal to that of the other two types, but the number of

Table 9. Data Relating to Principal Types of Farms in Area 8

Item	Type of Farm			
	Dairy	General	Crop-specialty	Self-sufficing
Per cent type is of all farms, 1930 .....	40	18	7	12
Total acres per farm, 1930 .....	134	134	132	84
Acres harvested per farm, 1929 .....	41	37	41	16
Value land and buildings per farm, 1930 .....	\$5,072	\$4,293	\$4,220	\$2,508
Tenants as per cent of all operators, 1930 .....	9	9	11	11
Number horses and mules per farm, 1930 .....	2	2	1	1
Number milk cows per farm .....	7	4	2	2
Number other cattle per farm .....	8	5	2	3
Number sows and gilts per farm .....	*	*	*	*
Value all products per farm, 1929 .....	\$1,454	\$1,054	\$862	\$434
Value crops sold or traded .....	97	182	543	30
Value livestock sold or traded .....	219	155	47	27
Value livestock products sold or traded .....	832	342	124	83
Value forest products sold .....	31	88	21	20
Value products used in the home .....	275	287	127	274

\* Less than .5.

livestock is very small. The income from the sale of crops, principally clover seed and potatoes, constitutes a very large proportion of the income from all products. Forest products are sold from only about one fourth of these farms. The value of farm products used in the home is very low.

More than 10 per cent of the farms in this area can be classified as self-sufficing farms. As in the other areas, these farms are small with a very small number of livestock. Many of these farms represent new developments where the settlers have not yet had time to clear land and obtain the livestock that is necessary for satisfactory incomes, but a large proportion of them represent farms that are permanently on a subsistence basis with a very low standard of living.

Thirteen per cent of the farms in this area are classified as part-time farms where the operator obtains a large proportion of his income from employment away from the farm. These farms are smaller than the self-sufficing farms, but other information concerning their organization is not available.

### AREA 9—TWIN CITY SUBURBAN TRUCK, DAIRY, AND FRUIT

Type-of-farming Area 9 is an area of intensive agriculture. Vegetable gardening is very important in the area immediately surrounding the two cities of Minneapolis and St. Paul. The production of small fruits and berries is important in many localities, particularly in the lake region west of Minneapolis. Dairying, producing fluid milk and cream for the city markets, is important throughout this area.

### Forces Influencing Development

The topography of this area ranges from level to hilly land, with most of it rolling. The soils range from productive loams to rather large acreages of sand and peat. The growing season in the area is long averaging about 160 days near the Twin Cities, and falling to somewhat less at a greater distance from the Mississippi River. The proportion of tillable land, wild hay, and permanent pasture is similar to that in Area 2.

The major factor causing the type of farming of this area to differ from the surrounding areas is the presence of the Twin Cities. These cities, with a combined population of about 750,000, provide a market for a large quantity of perishable commodities such as truck crops, berries, small fruits, fluid milk and cream, and fresh eggs. In general, the farming of this region is organized to supply this market.

### Cropping System

Small grains occupy a very small acreage in this area, representing only 26.9 per cent of the tillable land in 1929, while intertilled crops represented 31.2 per cent, hay and pasture crops 31.4 per cent, and other uses, including truck crops and berries, 10.5 per cent.

Oats and barley, grown alone or in mixtures, constitute the principal small-grain crops.

Corn is grown on about 20 per cent of the tillable land. Potatoes occupy a larger proportion of the tillable land in this area than in any other part of the state, almost 10 per cent.

Hay is produced on about 24 per cent of the tillable land, and tillable pasture occupies another 7 per cent.

Table 10. Data Relating to Principal Types of Farms in Area 9

Item	Type of Farm					
	Dairy	General	Crop-specialty	Truck	Fruit	Poultry
Per cent type is of all farms, 1930.....	40	10	8	10	6	4
Total acres per farm, 1930.....	92	59	76	24	23	14
Acres harvested per farm, 1929 .....	50	35	57	16	12	7
Value land and buildings per farm, 1930.....	\$15,055	\$10,209	\$17,165	\$9,771	\$8,199	\$8,965
Tenants as per cent of all operators, 1930.....	24	18	27	20	6	12
Number horses and mules per farm, 1930.....	3	2	3	2	1	1
Number milk cows per farm .....	11	4	3	1	2	1
Number other cattle per farm .....	8	5	2	1	1	1
Number sows and gilts per farm .....	1	1	*	*	*	*
Value all products per farm, 1929.....	\$2,761	\$1,828	\$4,224	\$2,146	\$1,811	\$1,634
Value crops sold or traded.....	286	659	3,326	1,860	1,319	181
Value livestock sold or traded .....	382	208	139	13	29	48
Value livestock products sold or traded.....	1,758	635	417	110	249	1,212
Value forest products sold .....	11	9	2	1	2	1
Value products used in the home .....	324	317	340	162	212	192

\* Less than .5.

About 6 per cent of the tillable land is used for the production of special crops, a proportion much larger than in any other area in the state. This area produces about one third of the small fruits and vegetables (excluding sweet corn and canning peas) produced in the state.

### Livestock

Dairying is the principal livestock enterprise, with a very large number of cows per 100 acres of land. Most of these cows are bred for milk production with a high production per cow. The number of beef cattle and sheep is very small.

Hogs are produced on a small proportion of the farms; some of these are fed on the garbage available from the cities. Poultry are kept on a large proportion of the farms, some of them

being maintained in large commercial units but most of them in relatively small flocks.

### Types of Farming

Many different types of farms are prominent in Area 9, but dairy farms are most numerous. Although these dairy farms are small compared with the dairy farms in other areas, averaging only 92 acres with 50 acres of harvested crops, they are large compared with the other types in the area (Table 10).

Since the value per acre of the land in the vicinity of the Twin Cities is very high, the value per farm is large. The number of cows per herd is about equal to the highest in the state, but the number of other cattle is low in proportion to the number of cows. On very few farms are young cattle kept

for any purpose other than to supply replacement stock, and on many farms the replacements for the herds are purchased. The income from the sale of crops and livestock is very small compared with the income from the sale of livestock products.

The general farms are considerably smaller than the dairy farms, with a much smaller number of livestock. Most of these are farms on which some dairying is combined with the production of some potatoes, truck crops, or fruit crops.

The crop-specialty farms are somewhat larger than the general farms, with more harvested crops than on the dairy farms. The number of livestock is small. The principal source of income is the sale of crops, particularly potatoes.

The truck farms are small, averaging only 24 acres, with 16 acres of har-

vested crops. The number of livestock is very small. These are very intensively operated farms with an income of \$116 per harvested acre in 1929. The value of the farm produce used in the home is very small on these farms.

The fruit farms are quite similar in size and in number of livestock to the truck farms. The principal crops are strawberries and raspberries. Here, too, the income per acre is very large.

There are also a small number of specialized poultry farms in this area, producing fresh eggs for the city market. These are very small farms with only 7 acres of harvested crops. A large proportion of the feeds are purchased. On the average, these farms keep about 250 hens and very few other livestock.

There are also some part-time, self-sufficing, and other types of farms in this area.

## STATISTICAL SUPPLEMENT

The data upon which many of the maps in this bulletin are based are available in a separate volume, "Statistical Supplement to Agricultural Production and Types of Farming in Minnesota." This supplement is available free of charge at the Bulletin Office, University Farm, St. Paul, Minnesota.

The data are given for the state, for each type-of-farming area, and for each county, and include the following information:

- Table 1—Yield per acre of corn, oats, barley, spring wheat, winter wheat, rye, flax, and potatoes, 1917-36; for tame hay and wild hay, 1920-36; and index of yields, combining the yields of all crops except wild hay.
- Table 2—Coefficients of variation of yields for the same crops and years as in table 1.
- Table 3—Total acres in farms, proportion of all land in farms, proportion of farm land in tillable land, wild hay, permanent pasture (woodland and other), woodland not pastured, and all other uses, 1929.
- Table 4—Total acres of tillable land, and proportion of tillable land devoted to each of the principal crops (25 classifications), 1929.
- Table 5—Number of cows for milk, cows for beef, and ewes per 100 acres in farms, April 1, 1930; number of sows and gilts, chickens, and horses and mules per 100 acres tillable land, April 1, 1930; and proportion of milk cows of beef or milk-and-beef breeding, 1929.
- Table 6—Number of cows for milk, cows for beef, ewes, sows and gilts, and chickens per farm reporting, and per cent of farms reporting cows for beef, April 1, 1930.
- Table 7—Value per farm of products sold, traded, and used in the home, and proportion obtained from crops, livestock, livestock products, forest products, and products used in the home, 1929.
- Table 8—Proportion of farms classified as dairy, general, animal-specialty, cash-grain, crop-specialty, part-time, self-sufficing, and all other types combined, 1930.
- Table 9—Number and size of farms, and proportion of farms 0 to 49 acres, 50 to 99 acres, 100 to 174 acres, 175 to 259 acres, and 260 acres or over, 1930.