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The corn enterprise in Iowa

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The Corn Enterprise in Iowa

By Edgar B. Hurd

AGRICULTURAL EXPERIMENT STATION
IOWA STATE COLLEGE OF AGRICULTURE AND MECHANIC ARTS

C. F. Curtiss, Director

AGRICULTURAL ECONOMICS SECTION

Ames, Iowa
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The Corn Enterprise in Iowa

By Edgar B. Hurd

This is the second type of farming bulletin prepared by the Agricultural Economics Section of the Iowa Agricultural Experiment Station. The first one, "Types of Farming in Iowa," Iowa Experiment Station Bulletin 256, analyzes the geographical distribution of the important farm enterprises found in Iowa. It also goes a step further and shows why the farmers in each section of the state have combined their farm enterprises in just the proportions that they have.

This bulletin is devoted entirely to the corn enterprise. Other bulletins contemplated for this series will treat small grain and forage crops, including pasture, hogs, the dairy industry and beef cattle. Another series is planned, which will be based upon regional studies of the particular farm organization and management problems found to exist in various parts of the state. Finally, it is hoped that we can prepare and publish a research bulletin for the benefit of other workers in this field, which will give a complete report of the research work done and the analysis made as a foundation for the popular bulletins above enumerated.

THE CORN FIELDS OF THE STATE

The illusion that Iowa is one big corn field of equal stand is rather common. If you have believed that corn is equally important in all parts of the state, a look at fig. 1 will be a surprise to you. As a matter of fact, the average corn average per farm varies from 8 percent in Center Township, Allamakee County, to 59 percent in Prairie Township, Fremont County. Of course these two townships are extreme cases. From a study of fig. 1, it becomes obvious that the average farmer uses about one-third of his land for corn production. Some farmers using one-fourth and others using two-fifths of their land for corn are found quite frequently. Farmers having less than one-fifth or more than one-half of their land in corn are commonly found only in small sections of the state. This difference in the importance of corn in various parts of the state has not been emphasized in most of the published reports dealing with corn. This is due to the fact that corn is the vital farm enterprise in all parts of the state. Around and upon this enterprise is fitted Iowa farm production.

1Acknowledgment is made to Dr. C. L. Holmes of the Agricultural Economics Section of the Iowa Agricultural Experiment Station for having outlined the series of bulletins of which this one is a part. In the preparation of this manuscript and throughout the entire study, Dr. Holmes has made many valuable and constructive criticisms and suggestions.
The purpose of this bulletin is to present the picture of Iowa corn fields from the standpoint of (1) how much land is used for corn in each township, (2) the average yield of corn per acre by counties, (3) relative corn production in each county, (4) difference in the proportion of corn that is fed or sold in each county and (5) some of the reasons for the differences in the corn enterprise in different parts of the state. We cannot determine here the most profitable amount of corn that each farmer or each locality should raise or how much corn it is profitable to sell or to feed. We sincerely hope you will compare your own corn enterprise with the average in your township or county and with other parts of the state in which you have an interest. If you find your corn enterprise differing in any respect from the average for your township or county and you have about average conditions, the final test of whether you are better or worse off than your neighbors is whether you are making more or less money than they. As the different phases of the corn enterprise are presented, if you will make this test, you will secure the most practical benefit from the reading of this bulletin.

How does your township rank in Iowa corn acreage? If you will examine fig. 1 you can find your township. The percentage of farm land in corn for your township, as shown in this figure, represents the adjustment made by the average corn grower to the environment. Do you on your farm make a more profitable
adjustment to your environment than the average? In a later section of this bulletin, we show the adjustment in corn acreage made by an individual farmer to his environment. This adjustment will illustrate on a specific farm the principles developed here with reference to township and county averages.

CORN ACREAGE CHANGES FROM YEAR TO YEAR

The place given corn by farmers in their farm organizations is not decided at one time once and for all but is continually changing. Fig. 2 shows the percentage of land in corn from 1890 to 1927 by census years prior to 1920 and after 1920 by years. This figure shows a gradual increase in the importance of corn in the farming of Iowa from a fourth of the land in farms in 1890 to a third in 1927. Fig. 2, however, shows two periods when corn acreage was decreasing in importance. The first of these was from 1905 to 1910 and the second from 1915 to 1920. The latter decline was due to the substitution of wheat during the war. After the war, wheat was again abandoned and corn increased 3 percent in 1921 over 1920. Since 1921, while the increase in corn has not been as marked, the trend has been distinctly upward.

As might be expected from fig. 1, the increase in the importance of corn in Iowa from 1890 to 1927 did not take place uniformly over the state. Fig. 3 shows the percentage of land in corn in five counties selected to represent the five types of farming areas of the state. This figure shows the five counties increasing their corn acreage after the war. During the war all five counties except Calhoun decreased their percentage of land in corn. From 1910 to 1915 Calhoun County made an 8 percent
increase in corn acreage, while the rest of the counties held about steady. Fig. 3 suggests that historical changes should be studied geographically. The press usually reveals corn acreage changes as state or national totals. While this information is important for some purposes, it does not reveal local conditions. Farmers in one part of the state may be increasing their acreage, while others in different parts of the state may be decreasing theirs.

**FORCES DETERMINING THE AMOUNT OF CORN**

The use that farmers make of their land depends upon five different sets of forces or conditions: (1) Personal qualities and conditions; (2) natural conditions or resources; (3) methods of farming; (4) plant pests and diseases; and (5) economic conditions.

The effect of most of these forces and conditions is obvious. Perhaps, however, a word regarding the economic conditions may be helpful. In the present post-war depression, almost every farmer is giving more attention than usual to the economic phase of his business. Farmers adjust their business to changes in prices. The changing prices of corn, oats, wheat, hogs, beef cattle, butterfat and poultry products as well as some of the ratios between the prices of these products are quite closely watched. The corn-hog ratio is of such vital interest in the state that the idea has become commonplace. Other ratios of importance are the corn-steer ratio, the steer-hog ratio and the feeds-butterfat ratio. Cost changes do not create as much interest
As price changes. As a rule, costs change at a slower rate than prices. Furthermore, over 60 percent of the expenses of running a farm are generally fixed when the farmer buys his farm. Variations in farm organization, as determined by economic conditions, for shorter periods of time come about largely thru price changes. Over longer periods cost changes have as much influence as price changes.

The five forces and conditions we have named are balanced by the farmers in an attempt to gain for themselves maximum profit. In this bulletin, we shall attempt to analyze some of the effects these forces have upon the corn enterprise from the standpoint, first, of the average farmer in different parts of the state, and, second, from the standpoint of an individual farm. The influence of the natural forces may be most easily seen by comparing different parts of the state. The influence of the other forces except the personal element may be most easily noticed by studying the changes in these forces over a period of time and comparing the effect, if any, on the corn enterprise in different parts of the state. The joint effect of all of these forces may be seen most clearly by studying intensively individual farms.

FARMERS PLAN THEIR CORN ACREAGES TO MEET NATURAL CONDITIONS

The Lay of the Land

The most obvious and the most influential natural condition determining variations in corn acreage is the difference in topography or lay of the land. A topographical map of the state has never been made. Since in Iowa the difference in tillable land is due to difference in topography, the percentage of tillable land may be taken as an index of topography. In fact, the percentage of tillable land is the best measure we have of topography. Fig. 4 shows the percentage of tillable land by counties. By comparing fig. 4 with fig. 1 we can readily see the high correlation between the amount of tillable land and the percentage of land in corn. From a study of the two figures, it becomes clear that areas having a higher percentage of tillable land have more of this tillable land in corn than do the areas having a smaller percentage of tillable land. This is surprising at first. One might think there would be more of an incentive to crop the tillable land more heavily where there is a smaller percentage of it. But this is not the case. The areas of the state having a high percentage of tillable land have a very level type of surface. This land may be plowed year after year without fear of serious loss of plant food thru erosion. On the other hand, areas having a small percentage of tillable land have a rolling to rough topography so that even the tillable land in
this area can not be cropped very heavily, particularly with intertilled crops, without danger of erosion. Consequently, farmers in this section leave a larger percentage of their tillable land in grass for hay or pasture. The explanation lies in the difference in the effect on profits of more or less plowing in different parts of the state. Fig. 4 shows merely the land that can be plowed. It shows nothing of how often the land may be plowed with profit.

Pasture in Iowa is on two kinds of land, (1) non-tillable land and (2) tillable land which for various reasons needs a rest from cropping. Non-tillable land must of necessity be pasture land, if it is to be farmed at all. Associated with this non-tillable pasture is the tillable pasture which, as we have seen, is left in grass largely to prevent erosion. Furthermore, areas with a large amount of pasture must have relatively a large amount of hay to feed the cattle in winter. Thus we see that rough, rolling topography as measured by tillable land has more than proportional influence in setting the maximum limit to which the corn acreage can expand.

Pasture and hay crops in Iowa today tend to be located on the less productive land, while the corn crop tends to be on the more productive land. For this reason areas having a high percentage of productive land have very little grass and a large amount of corn, and areas having a low percentage of productive land have a great deal of grass land and a small amount of corn.
Soil Areas

Soil fertility is likewise of great importance in determining the productiveness of farmland and consequently the amount of it used for corn. Considerably over 200 individual soil types have been identified in 53 counties of the state by the Soils Section of the Iowa Agricultural Experiment Station in cooperation with the United States Department of Agriculture. Each of these soils has characteristics of its own from the standpoint of topography, texture and fertility that make it economically different from all others. While each soil type has qualities that distinguish it from all others, some of these qualities are the same in many different types of soil. This fact makes grouping or classification possible. Most of the soils of Iowa owe their origin either to wind (loessal soil) or ice (glacial soil). This fact has enabled the Soils Section to group the soils of the state into five areas on the basis of origin. From a productive standpoint there are individual soil types within each soil area that are inferior while there are others that are superior. However there is less variation in the productiveness between soils within a given soil area than there is between the soils for the entire state. For this reason a part of the variation in corn acreage as shown in fig. 1 may be ascribed to differences between soil areas.

The relationship between soil areas and percentage of farmland in corn is shown in fig. 5. The townships in the Wisconsin drift area are more uniform in their corn acreage than are the townships in the other soil areas. This suggests that soils in this area are more uniform in fertility or topography than are those of other soil areas. Over three-fourths of the townships in this section have from 34 to 44 percent of their land in corn.

The Missouri Loess comes nearer to being like the Wisconsin Drift in its relation to corn than any other soil area. In both these areas more townships have from 39 to 44 percent of their farmland in corn than other similar percentage intervals. The Missouri Loess differs from the Wisconsin Drift in that only 37.2 percent of its townships fall in this class compared with 46.2 percent of the townships of the Wisconsin Drift. While townships in the Missouri Loess are more widely spread on both sides of their average than are the townships of the Wisconsin Drift, the Missouri Loess has, to a much greater degree, townships which have a higher percentage of their land in corn. Fourteen and five-tenths percent of the townships in the Missouri Loess have corn acreages varying from 49 to 59 percent of the farm area. In the Wisconsin Drift not a single township has a percentage of farm land in corn this high.

While the Mississippi Loess, Iowa Drift and Southern Iowa

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2See Soil Survey Reports Nos. 1-53, Iowa Agricultural Experiment Station.
Loess soil areas average about 13 percent less farm land in corn than the Missouri Loess and Wisconsin Drift areas, a large number of townships in these areas compare favorably in corn acreage with the Missouri Loess and Wisconsin Drift areas. This can be seen from fig. 5. The Mississippi Loess soil area is the third intensive corn area of the state. The average percentage of farm land in corn is 29 percent. However, more townships may be found in this section having corn acreage varying from 34 to 39 percent of the farm area than any similar range, and over three-fifths of the townships have corn acreage in excess of 29 percent.

The Iowa Drift area is next to the Wisconsin Drift area in having uniform corn acreage as revealed by township figures. More of the townships in this area have from 29 to 34 percent of their farm land in corn than any other range of similar width, as shown in fig. 5. This is 10 percent lower than the most popular choice in the Missouri Loess and Wisconsin Drift and 5 percent less than the popular choice in the Mississippi Loess area.

The Southern Iowa Loess has the lowest percentage of land in corn of any soil area. Over one-half of this area has corn acreage varying from 19 to 29 percent of the farm acreage. However, over 30 percent of the townships in this area have corn acreage varying from 29 to 49 percent. It is these rather high corn acreage townships which bring up the average corn acreage for the area to 26 percent. There is some excellent corn land in southern Iowa.
Soil Types

A part of the difference in corn acreage within each soil area is due to differences in the individual soil types. It is difficult from township figures to tell the percentage of farm land used for corn on each soil type as townships for the most part contain several soil types. However, a few townships of the state have only one predominant soil type. Sixteen of these townships have been selected which represent nine of the most important soil types found in the state. The corn acreage and yield per acre are tabulated for each of these townships in table I.

In comparing two types of soil in their effect on the corn enterprise, it is well to have in mind the soil areas from which they come. The facts regarding soil areas usually hold true for the soil types found within the area. Then too, some soil types are found in more than one soil area. The Carrington Silt Loam, for example, is found in both the Wisconsin Drift and the Iowa Drift areas. In section I of table I, a comparison is made between the Carrington Silt Loam in the two soil areas. The Wisconsin Drift soil averaged 8 percent more of the land in corn and 7 bushels more per acre than the same type of soil in the Iowa Drift. This results in the Wisconsin Drift Soil producing about 600 bushels more corn per 100 acres of farm land than the Iowa Drift Soil. The Iowa Drift Soil is an older deposit than the Wisconsin and more of its plant food has been leached away.

Section II of table I compares the corn production on the Clarion Silt Loam and the Webster Loam. Both of these soils are in the Wisconsin Drift area. As shown in table I, 36 percent of the Clarion Silt Loam was in corn with an average yield of 31 bushels per acre; while the Webster Loam had 42 percent of its land in corn with a yield of 42 bushels per acre. The Webster soil, therefore, produces about 650 bushels more corn per 100 acres than the Clarion Silt Loam.

There are even greater extremes in corn production between different types of soil in the Mississippi Loess Area than in the Wisconsin Drift Area. Section III shows corn production on the three principal soil types of the Mississippi Loess; the Clinton Silt Loam, the Museatine Silt Loam and the Tama Silt Loam. Of the Clinton Silt Loam 19 percent was used for corn with an average yield of 33 bushels; of the Museatine Silt Loam 33 percent was used for corn with an average yield of 38 bushels; and of the Tama Silt Loam 38 percent was used for corn with an average yield of 46 bushels.

The chief upland soil in the Missouri Loess Area is the Marshall Silt Loam and for this reason there is no other soil in this area of sufficient extent to compare with it on a township basis.
<table>
<thead>
<tr>
<th>Section</th>
<th>County</th>
<th>Township</th>
<th>Soil Area</th>
<th>Soil Type</th>
<th>% Per cent farm land in corn</th>
<th>Average yield per acre (bushels)</th>
<th>Corn per 100 acres farm land (bushels)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Buena Vista</td>
<td>Maple Valley</td>
<td>Wisconsin Drift</td>
<td>89 Per cent Carrington Silt Loam</td>
<td>38</td>
<td>40</td>
<td>1,520</td>
</tr>
<tr>
<td>I</td>
<td>Buena Vista</td>
<td>Nokomis</td>
<td>Wisconsin Drift</td>
<td>89 Per cent Carrington Silt Loam</td>
<td>39</td>
<td>44</td>
<td>1,716</td>
</tr>
<tr>
<td></td>
<td>Grundy</td>
<td>Beaver</td>
<td>Iowan Drift</td>
<td>75 Per cent Carrington Silt Loam</td>
<td>31</td>
<td>35</td>
<td>1,085</td>
</tr>
<tr>
<td></td>
<td>Emmet</td>
<td>Armstrong Grove</td>
<td>Wisconsin Drift</td>
<td>89 Per cent Clarion Silt Loam</td>
<td>35</td>
<td>30</td>
<td>1,116</td>
</tr>
<tr>
<td></td>
<td>Webster</td>
<td>Clay</td>
<td>Wisconsin Drift</td>
<td>89 Per cent Lamoure Silty Clay Loam</td>
<td>45</td>
<td>46</td>
<td>1,764</td>
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<td></td>
<td>Johnson</td>
<td>New Port</td>
<td>Mississippi Loess</td>
<td>92 Per cent Clinton Silt Loam</td>
<td>19</td>
<td>33</td>
<td>627</td>
</tr>
<tr>
<td>III</td>
<td>Grundy</td>
<td>Melrose</td>
<td>Mississippi Loess</td>
<td>84 Per cent Tama Silt Loam</td>
<td>31</td>
<td>46</td>
<td>1,748</td>
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<tr>
<td></td>
<td>Muscatine</td>
<td>Wilton</td>
<td>Mississippi Loess</td>
<td>2 Per cent Lamoure Silty Clay Loam</td>
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<td>28</td>
<td>1,254</td>
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<td></td>
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<td>4 Per cent Webster, Clay Loam and Loam</td>
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<td>42</td>
<td>1,764</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>8 Per cent Webster, Clay Loam and Loam</td>
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<td>42</td>
<td>1,764</td>
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<tr>
<td></td>
<td>Sloux</td>
<td>Holland</td>
<td>Missouri Loess</td>
<td>90 Per cent Marshall Silt Loam (Smooth Phase)</td>
<td>40</td>
<td>33</td>
<td>1,320</td>
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<td></td>
<td>Sloux</td>
<td>Plato</td>
<td>Missouri Loess</td>
<td>93 Per cent Marshall Silt Loam</td>
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<td>36</td>
<td>1,512</td>
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<td></td>
<td>Page</td>
<td>Fremont</td>
<td>Missouri Loess</td>
<td>75 Per cent Marshall Silt Loam</td>
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<td>42</td>
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<tr>
<td></td>
<td>Mills</td>
<td>Rawles</td>
<td>Missouri Loess</td>
<td>17 Per cent Marshall Silt Loam</td>
<td>52</td>
<td>38</td>
<td>1,976</td>
</tr>
<tr>
<td>V</td>
<td>Henry</td>
<td>Wayne</td>
<td>Southern Iowa</td>
<td>96 Per cent Grundy Silt Loam</td>
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<td>47</td>
<td>1,927</td>
</tr>
<tr>
<td></td>
<td>Henry</td>
<td>Canaan</td>
<td>Southern Iowa</td>
<td>97 Per cent Grundy Silt Loam</td>
<td>41</td>
<td>42</td>
<td>1,764</td>
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<tr>
<td></td>
<td>Wayne</td>
<td>Jefferson</td>
<td>Southern Iowa</td>
<td>42 Per cent Shelby Silt Loam</td>
<td>44</td>
<td>35</td>
<td>560</td>
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<tr>
<td></td>
<td>Wayne</td>
<td>Warren</td>
<td>Southern Iowa</td>
<td>58 Per cent Shelby Silt Loam</td>
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<td>25</td>
<td>560</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>97 Per cent Shelby Silt Loam</td>
<td>20</td>
<td>25</td>
<td>560</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>67 Per cent Shelby Silt Loam</td>
<td>20</td>
<td>25</td>
<td>560</td>
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<td></td>
<td></td>
<td></td>
<td>20 Per cent Shelby Silt Loam</td>
<td>20</td>
<td>25</td>
<td>560</td>
</tr>
</tbody>
</table>

*Note: Column (1) times column (2).*

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The Missouri Loess Area covers the entire western side of the state as is shown in fig. 5. For this reason areas of Marshall Silt Loam will have different amounts of corn acreage and different yields of corn per acre owing to differences in climatic and topographic conditions. The yield per acre for example in Sioux County was reduced materially during the period studied, owing to dry seasons. The difference between the yield per acre in Page and in Mills counties is probably due to the fact that the Mills County farmers are using over one-half of their land for corn, while the Page County farmers are using only a little over one-third of theirs for corn. Extremely heavy cropping is bound to lower yields per acre.

Very extreme differences in the corn enterprise exist in Southern Iowa Loess owing to differences in soil types in this area. The Grundy Silt Loam when farmed correctly is one of the most productive soils of Iowa. As shown in Section V of table I, over 40 percent of this soil is in corn, and yields average from 42 to 47 bushels. Contrasted to the Grundy Silt Loam is the Shelby Silt Loam. This soil type has about 20 percent of its area in corn, and the yields per acre average only 28 bushels.

Other interesting comparisons can be made between soils as shown in table I; for example, the comparison between the Carrington Silt Loam and the Tama Silt Loam in Grundy County.

The most profitable use you can make of your farm will depend first upon the type of soil you have. It will pay to secure a soil map of your county* in order that you may know the type of soil on your farm and be in position to benefit from the soil experimental work. In this manner you will be able more profitably to adjust your corn acreage to your natural resources.

**Corn Competes with Other Grain As Well As Pasture and Hay**

As we have seen, corn tends to occupy a higher percentage of the more productive land than hay and pasture, while hay and pasture tend to occupy a higher percentage of the less productive land than corn. While it is true that hay and pasture reduce the amount of land available for corn, in no part of the state does corn occupy all of the grain land, or the difference between all of the land and the grass land. Furthermore, corn occupies varying amounts of the grain land in different parts of the state. Fig. 6, showing the percentage of grain land in corn, proves the truth of both of these statements.

The counties bordering the Missouri River come the closest to having all of their grain land in corn. This is especially true in Fremont County where corn occupies 85 percent of the grain land. Contrasted to the southwestern part of the state is the

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*Soil Survey Reports have been published for 53 counties. These may be secured from the Bulletin Section, Iowa Agricultural Experiment Station.
Fig. 6. The percentage of grain land in corn.

northeastern corner where the percentage of grain land in corn varies from 49 percent to 53 percent. In general as shown by fig. 6, the entire southern portion of the state has a much higher percentage of its grain land in corn than does the northern. In the southern sections corn yields per acre are very much higher, compared to oat yields, than in the northern, and the corn is usually of better quality. The southern portion of the state, with the exception of the southwest corner, has a smaller percentage of land available for grain. Furthermore, the grain land tends to be scattered thru the rough, non-tillable pasture land. This tends to make the farms in this section small. Consequently, the southern part of the state, having the usual family labor supply, does not encounter the excessive labor requirements during corn planting and cultivating periods that are experienced in the northern section with its larger corn acreage per farm. These factors, operating in varying degrees, tend to make corn acreage amount to over two-thirds of the grain land in the southern part of the state, as contrasted to a little over one-half of the grain land in the northern part of the state.

Farmers Choose Higher Yielding Crops

Fig. 7 shows the comparative corn and oats yields per acre. This map is based on figures secured by taking the average yield of corn from 1916 to 1925 by counties and dividing by the average yield of oats for the same period. For example, in Audubon County the average yield of corn per acre from 1916 to 1925 was 39 bushels. The average yield of oats for this same period was 32 bushels per acre. Dividing 39 by 32 gives us
1.22, the ratio of corn to oats as shown in fig. 6 for Audubon County. Where the ratio of corn yields to oat yields is high, the percentage of grain land in corn is also high. This can be seen by comparing fig. 6 with fig. 7.

Climatic conditions probably account for most of the difference in ratio of corn yields to oats yields as shown in fig. 7. The warmer days and longer growing season in the southern part of the state favor corn at the expense of oats. This is especially true of southwest Iowa where the heat is reinforced by hot winds. Both corn and oats suffer from this excessive temperature. The practice of listing the corn has benefited the corn crop, but no new methods have been generally introduced which help the oats to withstand the heat in this section. Fig. 7 shows a strip of territory in the north and northeastern part of the state where corn yields are lower per acre than oat yields. The line dividing the territory where corn yields more than oats from the territory where oats yields more than corn enters the state at about Sibley, Osceola County, goes south to the second tier of counties, east to about Charles City, Floyd County, then southeasterly to Cedar Rapids and north following a course paralleling the Mississippi river to the state line. This line follows closely the 150 day growing season line.

**Prospects of Soft Corn Incline Farmers to Grow Less Corn**

Fig. 8 shows the average percentage of merchantable corn by counties for the years 1923 to 1927 inclusive. This map is based on estimates of government crop correspondents. The highest
Fig. 8. Percentage of corn merchantable, average 1923 to 1927. Figures secured from the United States Department of Agriculture, unpublished data.

percentage of corn crop of merchantable quality is found in the southern part of the state, especially in the southwestern part, where the percentage of grain land in corn is the highest. The lowest percentage of merchantable corn is found in the northeastern part of the state, where the percentage of grain land in corn is the lowest. The relationship between percentage of grain land in corn and the percentage of the crop merchantable can be seen by comparing fig. 8 with fig. 6.

Counties having the highest comparative corn-to-oat yields do not necessarily have the highest percentage of their grain land in corn, nor do all counties having the highest percentage of merchantable corn invariably lead in the percentage of grain land in corn. This is true because counties having high corn-to-oats yields may have a low percentage of merchantable corn. Counties that lead in percentage of grain land in corn excel in both high comparative corn-to-oats yields and in percentage of merchantable corn. The joint influence of merchantable corn and the ratio of corn-to-oats yields on the percentage of grain land in corn is shown in table II. Note the rather uniform increase in the percentage of grain land in corn as the percentage of merchantable corn is increased, within each of the ratio-of-corn-to-oats-yields groups and also as the ratio of corn to oats yields is increased within each percentage-of-corn-merchantable group.

It is very important for a farmer to produce merchantable corn (the higher the grade the better) if he is going to have
much over one-half of his land in corn. Farmers of this type will usually have some corn to sell, largely because this amount cannot all be fed profitably without more hay and pasture than are generally found on farms of this kind. Obviously, if the corn is to be sold, it must be of merchantable quality. Farmers having one-fourth or less of their land in corn have no trouble in feeding all of their corn. Of course, it is to the advantage of the farmers who feed all of their corn to have good quality of corn too, but soft corn which is not merchantable is not such a disadvantage to these farmers. As the percentage of land in grass increases, it becomes more and more important to have some corn, even though the quality is poor; and as the percentage of land in corn increases it becomes more and more necessary to have good quality corn. In the first case it is necessary to have some corn in order to provide a balanced ration for livestock. In the second case, a balanced ration may usually be secured without feeding all of the corn and it is very necessary that the surplus be salable. Then, too, the farmer who has corn to sell must usually obtain a higher price per bushel to offset the larger costs per bushel resulting from lower yields through using a large amount of his land for corn. Thus it becomes doubly necessary for the specialized corn farmer to have good quality corn.

**Corn Yields Are a Balance Between Acreage and Conditions**

Fig. 9 shows the average yield of corn per acre, 1916 to 1925, by counties. The map shows a section of the state, stretching from Sioux County in a southeasterly direction to the Mississippi
river, where the average yield of corn is from 40 to 46 bushels per acre. Counties to the north and to the south of this belt, as shown by the map, have an average yield of corn varying from 32 bushels to 40 bushels per acre. Counties that have the highest yield of corn per acre do not necessarily have the highest ratio of corn-to-oats yields. This can be seen by comparing fig. 9 with fig. 7. The highest ratio of corn-to-oats yields is found to the south of the part of the state having the highest corn yields. We have already seen that the southern part of the state has the highest percentage of its grain land in corn. From this, we conclude that farmers vary their corn acreages in the light of their alternative opportunities and not absolutely on the basis of the yield of corn. This is illustrated by comparing farmers in the southwestern part of the state with those in the central. In both cases, as shown in fig. 4, there is the same amount of tillable land, so the influence of this factor in the two cases is the same. The average yield of corn per acre is about 38 bushels in southwestern Iowa compared to 42 bushels per acre in central Iowa. Central Iowa averages 4 bushels more per acre than southwestern Iowa, yet southwestern Iowa has about 10 percent more of its acreage in corn than central Iowa. This is because the growing of as much oats in southwestern Iowa as are grown in central Iowa would be throwing time and money away. In central Iowa, however, oats can compete more successfully. Fig. 7, showing the relative corn and oats yields, tells why.

Of course, we might say the higher the corn yields, other
things being equal, the more corn a region will raise. But other things are never equal, such as alternative opportunities, the quality of the corn, the type of soil and the percentage of land tillable. These things have already been discussed. Quite as important is what will be the effect on yield of corn per acre, if the percentage of land in corn is increased. Some of the areas that are getting higher yields per acre than others and still have a smaller percentage of land in corn may be following a wise policy. If an expansion in corn acreage in the area having high yields per acre results in these yields decreasing, then this expansion may not be justified. Some soils respond more quickly in yields to heavier or lighter cropping than do others. The individual farmers have worked this response out for themselves, and the potential yields of corn per acre for various percentages of land in corn determine just as much the percentage of land in corn as the actual yields per acre under the present acreage conditions do. Viewed in this light, the corn acreage determines just as much the corn yields per acre as yield of corn per acre determines the corn acreage. To some extent they are both mutually determined by favorable or unfavorable soil, climatic and surface conditions and to some extent they work toward opposite results; that is, in any locality the higher the percentage of land in corn the lower the yield per acre. Thus the yield of corn per acre is a compromise or a balance between natural conditions and the percentage of land in corn. Fig. 9, the average corn yields per acre for each county of Iowa, shows the result of this compromise or balance.

Fig. 10. Corn production per 100 acres of land in farms. The production as here indicated is reached by multiplying the percentage of land in corn by average corn yields per acre, 1916-1923.
Corn Production Is a Product of Acreage Times Yield

No matter what the relationship is between corn acreage and corn yield, they both work together to obtain corn production. Corn production per 100 acres of land in farms is shown in fig. 10. The production as shown in this map is the result of the percentage of land in corn, as shown in fig. 1, multiplied by the average yield per acre, as shown in fig. 9.

How does the production on your farm compare with that for the county in which you live, or with the production in other counties of the state? Are you doing better than your neighbors? If you are interested in these questions, multiply the county production as shown in fig. 10 by the number of hundred acres you have in your farm. That is, if you have a 160-acre farm, multiply the county production as shown in fig. 10 by 1.6. The result of this multiplication will put the county production on the same area basis as your farm. If you find that your production exceeds that of the county average on this basis, then look at fig. 9 to see if your average yield exceeds that of the county. On the other hand, if your production is less than the county average on a comparable area basis, then turn back to fig. 1 and see if you have a lower percentage of land in corn than the county or township as a whole. If you find any discrepancy between your farm and the county average in either corn production, percentage of land in corn, or average corn yields, are you better or worse off than your neighbors?

METHODS OF FARMING DETERMINE CORN ACREAGE

It is not possible here to mention all the methods that determine or affect the corn enterprise. Neither is it feasible to explain how these methods have been evolved. However, it seems practical to discuss a few of the newer methods or practices in relation to their effect on corn acreage. These will serve as illustrations.

Drainage and the Acreage of Corn

Increased drainage has been one of the most important developments increasing the amount of corn. This is not an individual matter because the individual farmer could not drain his farm in most cases without the help of drainage districts. Drainage has increased the percentage of land in corn very materially in northwest Iowa. In most counties of this section over one-half of the tillable land is drained land. Herbert Quick in his autobiography tells of his father driving across the state from Grundy County to Fort Dodge in the sixties looking for a farm. His father returned to Grundy County with this explanation. "The country is an uninhabitable swamp." This swamp was uninhabitable because of lack of drainage. Old
settlers around Gowrie, Webster County, tell of the time when considerable of the now fertile land was under water. The crooked roads found in the level plain of this region today are due to the difficulties of surveying land under water. The drainage of this area has resulted in a high percentage of tillable land of good quality. We have seen that an increase in tillable land means an increase in corn acreage.

**New Methods of Farming Coming In**

Future changes in methods of farming also will probably have their effect on the cropping system. One of the most important changes in process now is the introduction of sweet clover. Sweet clover tends to decrease the concentration of alkali in the surface soil and to transfer mineral plant food from the lower substrata to the surface soil. Both results tend to increase corn yields per acre relative to oats yields and thus make profitable a higher percentage of land in corn. The introduction of sweet clover is taking place most rapidly in northwest Iowa. This area as shown in fig. 1 has already the second largest corn acreage of any section of the state. For this reason, while we can expect some increase of corn acreage in this section because of sweet clover, the increase will probably be slight.

In northeast Iowa we may expect a considerable increase in corn acreage due to drainage, liming and the growing of sweet clover. Many farmers will delay increasing their corn acreages until the effects of the corn borer are evident and until economic conditions improve. Northeast Iowa is the largest section of the state needing additional drainage. The soil in some parts of this section is low in natural fertility. The growing of sweet clover under a proper soil building program will increase the fertility, but lime will need to be applied first as most of the soil in this section is sour. In spite of the expense such a program will incur, we may expect gradual developments along these lines in this section, with accompanying increases in corn acreage.

The southeastern part of the state offers the greatest possibilities for increasing the yield of corn per acre by bringing in new methods of farming. The Soils Section of the Iowa Agricultural Experiment Station has proof that the use of lime and phosphate in this section will result in more profitable yields. The use of lime will permit the growth of sweet clover, which in turn will reduce the necessity of having a high percentage of land in grass. Phosphate will supply a very necessary soil element that is lacking on most of these soils. While the new methods of producing corn will result in a more profitable corn crop, we cannot expect much of an increase in acreage in southern Iowa because of the tendency of this soil to erode.

The extreme northern tier of counties will probably use more
land for corn because increasing yields will make corn more profitable in this section. Early maturing varieties that improve the quality of corn and the quantity per acre will increase the corn acreage in this part of the state. This is especially true in the northwestern corner where the soil and surface conditions are favorable to corn production. Northwest Iowa in the past has increased its corn acreage materially, largely because of this very thing. Lyon County, for instance, increased its land in corn 20 percent from 1900 to 1926. This increased corn acreage was accompanied by higher average yields; 31 bushels per acre as an average from 1890 to 1900, as contrasted with 43 bushels per acre from 1917 to 1926. What is to hinder this average yield of corn per acre from increasing still further and making profitable still further increases in the amount of land used for corn?

WHAT WILL THE CORN BORER DO?

All of the improved methods of farming we have mentioned may be offset by the corn borer. It appears definite that the corn borer will arrive in Iowa. Various authorities place the time when the corn borer will reach Iowa in commercial importance at different times, but it will probably be at least 10 years before the borer begins to do much damage. Until the borer arrives, Iowa may find it profitable to grow more corn. The borer may cut down the supply of corn in other sections. If this occurs the price of corn will increase and thus make profitable a higher percentage of corn in the regions not infested. When the borer arrives, the price of corn will probably be high enough to encourage more expensive methods of raising some corn, but the price probably will not be high enough to warrant raising it in as large quantities as formerly.

The question that next arises is which regions will be hit the hardest and which will find it profitable to make the greatest cut in corn acreage? If the corn borer works with equal intensity all over the state, then the regions enjoying the greatest advantage at the present time probably will not cut their acreages. The increase in the price of corn probably will be sufficient to warrant these farmers in using more expensive methods of corn growing and keeping up or even increasing their present acreages. On the other hand, farmers who are making the least out of their corn crop will not find it profitable to maintain their present acreage. All of this hinges on the corn borer working equally over the state. But suppose the borer works harder in some places than in others. Then the greatest cut in corn acreage will come where the borer finds the most favorable natural conditions. It is yet too early to tell how the corn borer will affect a locality, but it behooves any corn farmer to learn...
what he can about the borer so that when it does come he will be able to adjust his business to the best advantage.

**SHELL I SELL OR FEED MY CORN?**

The average Iowa farmer has answered this question by saying, "I'll be a feeder." On an average, during the four crop years 1923-1926, 85 percent of Iowa's corn was retained within the county where it was produced.\(^3\) This figure was obtained from railroad car loadings of corn from each shipping point in Iowa.

The percentage of the crop retained for feed in the state as a whole varies a little from year to year. In the 1926-1927 crop year, 82 percent was retained for feed. The biggest contrast we have with this year is 1924-1925 when 87 percent of the crop was used for feed. These variations in the percentage of the crop retained in the state, while important for some purposes, seem very small compared to the yearly variations of each county or the average differences between counties.

The average percentage of the crop sold within a county varies from next to nothing in many counties to as high as 59 percent in Calhoun County. Fig. 11 shows the average percentage of the crop sold in each county. One-half of the counties, located chiefly in the eastern and southern part of the state, sell less than 10 percent of their corn; less than one-tenth of the counties, located chiefly in the northwest corner of the state

\(^3\)R. C. Bentley, Movement of Iowa's Commercial Corn and Oats. Iowa Agricultural Experiment Station Bulletin 252.
TABLE III. THE EFFECT OF GRAIN LAND AND GRAIN LAND IN CORN UPON PERCENTAGE OF CORN SOLD

<table>
<thead>
<tr>
<th>Percent grain land</th>
<th>Percent grain land in corn</th>
<th>Percent corn sold</th>
<th>Number counties</th>
</tr>
</thead>
<tbody>
<tr>
<td>25—38</td>
<td>48—57</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>57—66</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>66—75</td>
<td>2</td>
<td>7</td>
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<tr>
<td></td>
<td>75—85</td>
<td>--</td>
<td>0</td>
</tr>
<tr>
<td>38—50</td>
<td>48—57</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>57—66</td>
<td>4.3</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>66—75</td>
<td>6.1</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>75—85</td>
<td>--</td>
<td>0</td>
</tr>
<tr>
<td>50—62</td>
<td>48—57</td>
<td>5.2</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>57—66</td>
<td>13.8</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>66—75</td>
<td>23.0</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>75—85</td>
<td>26.0</td>
<td>3</td>
</tr>
<tr>
<td>62—74</td>
<td>48—57</td>
<td>24.6</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>57—66</td>
<td>28.1</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>66—75</td>
<td>24.0</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>75—85</td>
<td>31.0</td>
<td>1</td>
</tr>
</tbody>
</table>

sell more than one-third of their corn, and only Webster and Calhoun counties sell more than one-half of it.

If you have been following the maps on the corn enterprise up to this point, fig. 11, showing the percentage of the crop sold will be no surprise to you. The explanation of why some counties sell a higher percentage of their corn than others is the same old story of the amount of grain land and percentage of it in corn. If a farmer has a high percentage of his farm in grain, he will not be able to handle a very extensive cattle or sheep business. Calhoun County is the most intensive grain county of the state. Here 74 percent of the total farm land is in grain. Add to this 5 percent for building lots and roads, and only 21 percent of the farm area is left for hay and pasture.

In order to utilize this 21 percent of hay and pasture land efficiently some corn will be needed. In the case of Calhoun County 41 percent of the crop is used to strike this balance. This leaves 59 percent to be sold for cash. Of course Calhoun County could feed all of its corn by expanding the hog enterprise. Hogs may be handled profitably on a minimum of pasture. However, farmers restrict the number of hogs to the number that can be handled at farrowing time. This is about 20 brood sows per farm having the usual family labor supply. Since the farms in a grain section like Calhoun County tend to be of large acreage, the number of hogs per 100 acres tends to be small. The percentage of the corn crop sold increases rather uniformly, then, as the percentage of the land in grain increases and as the proportion of the grain land in corn increases. This compound influence is presented in Table III. If you are

*J. A. Hopkins, Economic Study of Hog Enterprise in Humboldt County. Iowa Agricultural Experiment Station Bulletin 255.*
interested in comparing your farm with the data in table III, decide first what percentage of your farm is in grain, as corn, oats, barley, wheat, etc., (Column 1); second, what percentage of grain land you have in corn (Column 2); third, compare the percentage of the crop which you are selling with what is sold (Column 3). If you have an excessively large farm or your yields are larger than the average shown in fig. 9, then you will probably have a higher percentage to sell than is indicated in Column 3.

**Bushels of Corn Sold**

The average number of bushels of corn sold out of the county per 100 acres for the crop years 1923-1926 is shown in fig. 12. The number of bushels sold per 100 acres varies directly as the percentage of the crop sold. On the average, for each 100 bushels of sales per 100 acres of farm land, there is 7 percent of the crop sold. In general, the Iowa farmer sells about 15 percent of his crop or about 215 bushels per 100 acres for a normal season. Of course, the percentage sold will vary, depending upon farm conditions such as are shown in table III and for this reason the number of bushels sold will vary likewise.

**Variations in the Feeding of Corn**

The geography of bushels fed is shown in fig. 13. This map shows the feeding to be heaviest on the Missouri-Des Moines divide running from Cherokee to Mills County and including Pottawattamie County. Pottawattamie is the most intensive corn feeding county of the state. The second largest feeding areas
Fig. 13. Average bushels of corn fed per 100 acres of land in farms, by counties, 1923-1926.

are in the east central part of the state and in the western tier of counties. The lightest feeding areas are in the extreme eastern part of the state and in the extreme southern part as well as Webster and Calhoun counties. The very heavy production

Fig. 14. Relationship between average corn production and average bushels of corn fed, 1923-1926, by counties.
and light feeding in these latter counties make them the heaviest corn selling counties.

Counties which produce a small amount of corn feed all of it. As the production increases, more and more corn is sold. This results in counties having the largest production using less corn for feed than the medium corn producing counties, which feed the most corn. The relationship between corn production and bushels of corn fed is shown in fig. 14. This chart shows that as corn production increases the number of bushels fed increases almost an equal amount up to the point where corn production amounts to 1,000 bushels per 100 acres, and the bushels fed amount to about 900 bushels per 100 acres. As production increases from this point the number of bushels fed increases very slowly and in some counties actually decreases.

THE CORN ENTERPRISE ON AN INDIVIDUAL FARM

We have shown how the corn enterprise varies over the state in regard to acreage, yields, production and sales, and some of the reasons for these variations. The next logical step would be to see in what proportions the different species of livestock utilize the corn that is fed. This, however, is a task for later bulletins in this series on types of farming. Our remaining task is to trace in more detail just how the natural conditions determine the percentage of farm land in corn upon an actual farm. For this purpose, we have selected a farm, the owner of which has cooperated with us in the Iowa County Farm Cost Route.

The Natural Conditions on this Farm

Fig. 15 is a map of the farm showing the topography and soil type. The soil is principally the Tama Silt Loam, with the exception of a strip across the southern end of the farm. This strip was originally the Wabash Silt Loam, a bottomland soil, but it is for the most part covered over by surface soil washed down from the hills to the north. Fig. 15 shows a large gully which has worked its way from the southeast corner of the farm to about the center of the north side. While this gully was formed before the present farmer’s time, gully erosion is one of the serious problems with which he has to deal. The topography of the farm is characteristic of Tama Silt Loam areas which are gently to strongly rolling.

Adjusting the Crop Rotation to Natural Conditions

Fig. 16 shows the field divisions of the farm. A comparison between fig. 15 and fig. 16 shows the adjustment made by the farmer in the cropping system to the soil and topography. Field 1 has some Clinton Silt Loam and also the shallow phase of the Tama Silt Loam. The field has a rolling topography. The rotation followed on this field is corn, oats, clover and timothy.
Rotations of this type result in 25 percent of the land in corn. This is 3 percent less than the average of Honey Creek township, Iowa County, in which the farm is located.

Field 2 is made up entirely of the Tama Silt Loam. The surface soil has been partly eroded on the slopes of the hills but is very deep in the areas adjoining the drainage areas and on the southern part of the field where the slope blends into the bottom land found in field 3. The rotation followed on this field is corn, corn, oats, clover and timothy. A rotation of this type results in 40 percent of the farm land in corn.

Field 3, which is mostly Wabash Silt Loam, a very productive
black soil, has a corn-oats rotation with an occasional clover crop. These three fields illustrate the difference in the number of times a field may be plowed with profit and the corresponding effect on corn acreage. According to the farmer's judgment field 1 may be plowed with profit one year in four; field 2, two years in five; and field 3 one year in two.

Field 4 has somewhat the same soil and topography conditions as field 3 and is used for the same type of rotation as can be seen from figs. 15 and 16.

Field 5 is a small triangular area. It has about the same type of topography and soil as field 1. However, the size and shape of the field make cultivation impractical and the farmer decided in 1926 to seed this field down and add it to the general pasture (field 6).

Field 6 is permanent pasture. It is for the most part non-tillable. Near the drainage areas are small irregular shaped tracts of good rich soil. These tracts are too small to be handled.

Fig. 16. Field Division and crop rotation of an actual farm.
TABLE IV. RELATIONSHIP BETWEEN TYPE OF LAND AND PERCENT OF TIME IN CORN

<table>
<thead>
<tr>
<th>Field number</th>
<th>Type of soil</th>
<th>Topography</th>
<th>Percentage of time in corn</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Tama</td>
<td>Strongly rolling</td>
<td>25</td>
</tr>
<tr>
<td>2</td>
<td>Tama</td>
<td>Rolling</td>
<td>40</td>
</tr>
<tr>
<td>3</td>
<td>Tama and Wabash</td>
<td>Level</td>
<td>50</td>
</tr>
<tr>
<td>4</td>
<td>Tama</td>
<td>Slightly rolling</td>
<td>40</td>
</tr>
<tr>
<td>5</td>
<td>Tama</td>
<td>Rolling</td>
<td>Indefinite</td>
</tr>
<tr>
<td>6</td>
<td>Mixed</td>
<td>Strongly rolling</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>Tama</td>
<td>Rolling</td>
<td>40</td>
</tr>
<tr>
<td>8</td>
<td>Tama</td>
<td>Strongly rolling</td>
<td>Indefinite</td>
</tr>
<tr>
<td>Average</td>
<td></td>
<td></td>
<td>31</td>
</tr>
</tbody>
</table>

profitably in field crops. However, they do make excellent pasture.

Field 7 resembles field 2 in contour, soil and use.

Field 8 presents a new situation. It has that type of land which may be tilled occasionally if rotated with semi-permanent timothy or blue grass pasture. Permanent pasture is necessary to prevent erosion. This field had been in permanent pasture in 1925. In 1926 the sod was broken and the field was put in corn. As is usually customary with sod-land the field was reseeded to corn. In 1928 the field was in barley with clover seeding. Owing to a failure of the clover, the farmer intends to use this field for corn instead of hay. He might have seeded to small grain, but very seldom do Iowa farmers grow two crops of small grain in succession even on land of this type.

Table IV summarizes the soil and topography conditions on each field and the percentage of the time the field was in corn. Field 6 is non-tillable and of course is not used for corn. However, all the tillable fields outside of field 3 need a rest from cropping because of erosion and loss of fertility. This leads us to the conclusion stated earlier, that rough rolling topography as measured by the percentage of tillable land has more than proportional influence in setting the maximum limit to which the corn acreage can expand.\(^5\)

A word of caution needs to be given here, namely that the proportion of rolling land to the total farm land is apt to be a factor determining the use of the rolling land. If a farmer has a small percentage of rolling land, he can usually make the best use of it as permanent pasture. On the other hand, if a high percentage of the land is rolling, he can usually use it best by putting a part of it into crops. Since farms differ in the amount of rolling land, there will be somewhat the same difference in the use made of it.

\(^5\)For a discussion of this point from the standpoint of county statistics read the section on “The Lay of the Land,” page 231.
A Comparison of This Farm with Neighboring Farms

As previously mentioned, this farm is located in Iowa County. Iowa County is a part of the Mississippi Loess soil area. As shown in fig. 5, the percentage of farm land in corn by townships in the Mississippi Loess area varies from 8 percent to 44 percent, the average being 29 percent, and the most common amount of farm land in corn is from 34 to 39 percent. The farm we have been studying has one field that is never used for corn and another field that is in corn one-half of the time. The average amount of land in corn for the five-year period is 31 percent, and the most common amount of the time any field is placed in corn is 40 percent. The farm is rather typical of the area so far as corn is concerned. The average percentage of farm land in corn is 2 percent more for the farm than the area, and the most common amount of the time any field is in corn is 3 percent more for the farm than the area.

Of course, as was revealed earlier, there is a large variation in corn acreage within a soil area due to differences in soil type. The principal soil type on the farm we have been studying is the Tama Silt Loam. Table 1, Section III, shows Melrose Township, Grundy County, having 84 percent of its land in Tama Silt Loam. The township had 38 percent of its land in corn with an average yield of 46 bushels per acre or an average return of 1,748 bushels per 100 acres of farm land. The Iowa County farm had 31 percent of its land in corn, an average yield of 60 bushels per acre or a total return of 1,860 bushels per 100 acres of farm land. In other words this farm produced more corn on relatively less acres than the township which had the same soil conditions. We would therefore conclude that this farm operator was justified in reducing the amount of farm land in corn 7 percent below the average of farms operated under similar conditions, as he was able to obtain higher yields and greater total corn production.

Corn Yields in Relation to Rotation

The yielding power in terms of corn per acre of the different fields on this farm is largely obscured by the difference in rotations followed and also by the fact that fields 1, 2 and 3 are never all in corn the same year. Climatic conditions have a big influence on yields, and a difference in yield per acre between any two of these fields may be due to a favorable corn year followed by an unfavorable one. Then too, field 1 may show a higher average yield per acre over a long period of time than field 3 simply because field 1 has more fertility returned to it than field 3. Yet in spite of this it may very well pay the farmer to follow the rotations as he has them on these fields. More frequent corn crops on field 1 than are now grown would, no doubt, result in large reductions in the yield per acre on this field. On the other hand, a substitution of some of the corn crops on
field 3 for clover might not result in sufficient increases in the yield per acre of corn to make this substitution profitable.

We do not have sufficient records on this farm to warrant us in making definite conclusions on the effect of heavier or lighter cropping on yields per acre. However, the years we do have records on indicate the tendency of heavier cropping to reduce the yield per acre. The record on field 7 illustrates this point. In 1924 this field was in tame hay. This was followed in 1925 by corn with a yield of 80 bushels per acre. In 1926, the field was again in corn with a yield this time of only 55 bushels per acre. Of course, 1926 was not as good a corn year as 1925 and some of the reduction in yield was no doubt due to unfavorable climatic conditions. Fortunately, field 8 serves as a check plot for it is similar in soil and topography to field 7, except for being a little more rolling. For this reason it has been in pasture previous to 1926. In this year, when conditions were unfavorable to corn production, the farmer broke up field 8 and put it into corn. The yield per acre was 70 bushels. The 1926 corn crop on field 8 following pasture was 10 bushels per acre less than the 1925 corn crop following hay on field 7. This difference in yield was no doubt due to unfavorable climatic conditions. Therefore, the reduction of 25 bushels in 1926 on field 7 from the yield of 1925, was due to unfavorable weather conditions, to the extent of 10 bushels per acre; and by the fact that corn followed corn, to the extent of 15 bushels per acre.

The successful farmer in deciding how many times to raise corn on a field in succession does not only balance the immediate returns of a corn crop with the returns of alternate crops but considers rather what the total returns will be over a long period of time. Suppose two farmers both have the same kind of land. One farmer uses a rotation of corn, oats and clover. The second farmer uses a rotation of corn, corn, oats and clover. It may very well be that altho he gets a higher return per acre because of the second crop of corn, the second farmer is making a mistake in having one-half of his land in corn instead of one-third. By increasing the corn acreage from one-third to one-half, the yield per acre on most soils will be reduced. The amount of this reduction should be charged against the increased acreage of corn. For example, if the yield per acre on the one-third system is 60 bushels of corn and the yield per acre on the one-half system is 50 bushels; then the extra one-sixth made an average yield of 30 bushels per acre. It is this figure that should be used as a basis for determining whether the second crop of corn was more profitable than more oats and clover, and not the 50 bushels as might at first appear. Difference in costs of production under the two systems and comparative returns will need to be taken into consideration as well as the decrease in corn yields in determining the most profitable rotation to follow.