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# A STUDY OF REPORTED CROP YIELDS IN SOUTHEASTERN MINNESOTA

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# A Study of Reported Crop Yields in Southeastern Minnesota

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## Introduction and Purpose of Study

Numerous unsupported statements have been made to the effect that average crop yields in the rougher areas of southeastern Minnesota have declined relative to the changes in average crop yields in the smoother portions of the same general area. These statements suggested a study of available data to determine whether average crop yields on the rough land of southeastern Minnesota have kept pace with average crop yields in the more nearly level areas.

## Source of Data

For this purpose, the average crop yields for 9 counties in southeastern Minnesota, as reported in the Minnesota State Farm Census reports for 1917-1937, were used. The results of the computations are shown in Table 1, "Crop Yield Index," and in graphic form in Figure 3, "Crop Index - 5-Year Moving Average."

## Physical Characteristics of the Area

The topography of the counties bordering on the Mississippi River is extremely rugged, but this gradually flattens out into almost level land in portions of Mower, Dodge, and Rice Counties as one moves west away from the river (Figure 1.). The

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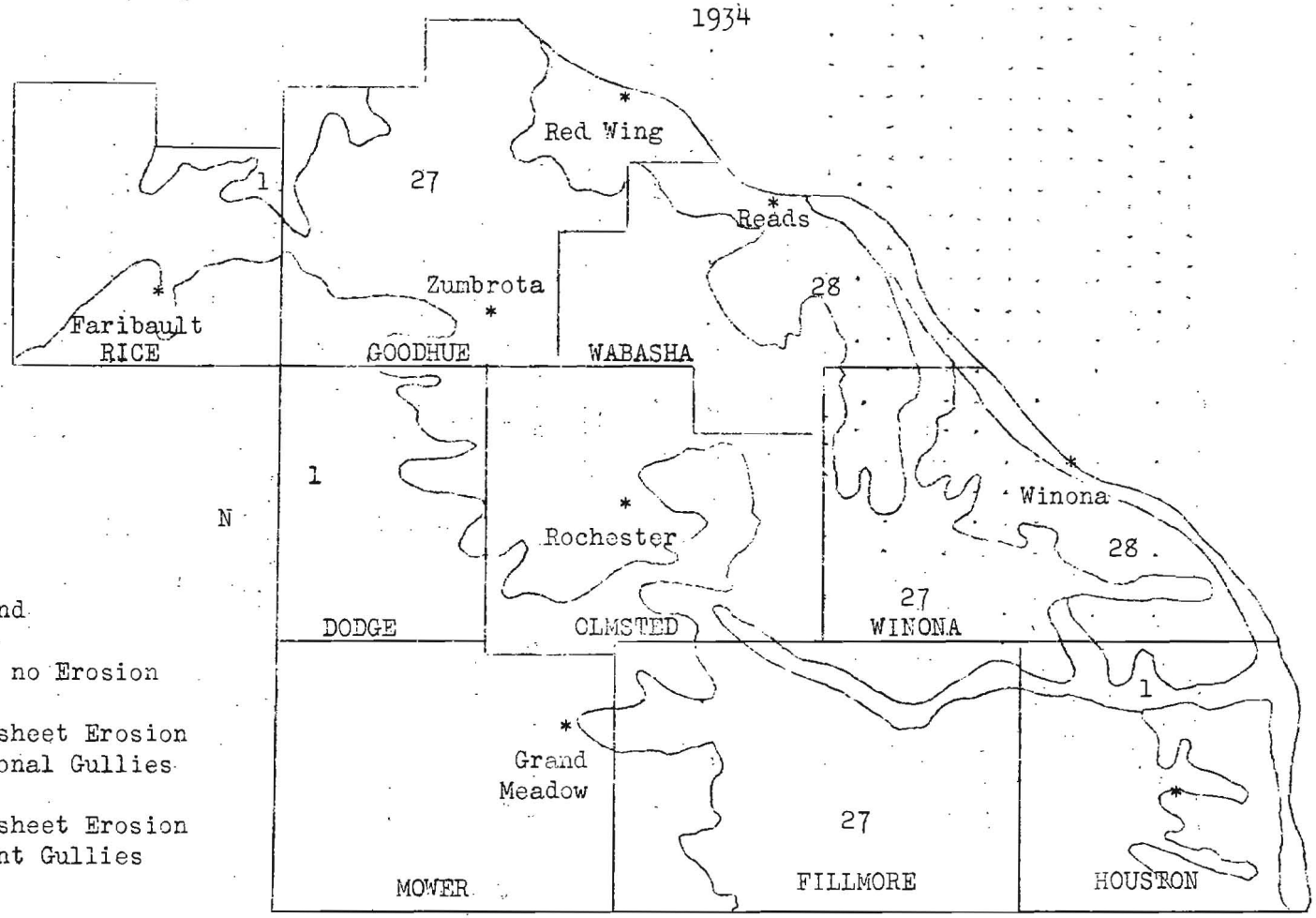
Figure 1.

General Erosion Areas
from
Reconnaissance Erosion Survey Map
Soil Conservation Service
1934



Reconnaissance Erosion Survey map prepared by the Soil Conservation Service in 1934 indicates that erosion losses vary more or less directly with the slope of the land. Figure 1 shows that sheet erosion and gullying are most severe in Houston, Winona, and Wabasha Counties, less severe in Goodhue, Olmsted, Fillmore and Rice, and slight in Mower and Dodge, that is, the severity decreases as one moves from the rougher to the more nearly level land.

## Rainfall Data

Figure 2 shows the precipitation for March to July, inclusive, for the stations in southeastern Minnesota and LaCrosse, Wisconsin, from which complete reports have been secured for this period of time (U.S.Weather Bureau reports). Figure 2 also shows the departure from normal precipitation for the stations in southeastern Minnesota. These data show a marked decrease in precipitation in the spring and early summer months during the early 1930's.

## Comparing Yields of Rough and Level Counties

That severe soil losses which commonly occur on steep slopes should affect yields of crops, adversely, seems a logical premise. The statement is frequently made that no marked increase in yields is evident, in spite of improved varieties and improved cultural methods, because of the damage resulting from the loss of top soil through erosion. If this were the case, average yields should have suffered less, relatively, in counties that have suffered less from erosion damage assuming the level counties have also used these improved cultural methods and improved varieties. From the figures and charts which follow, no marked difference exists between the yields in the rough counties and those reported for the counties which are less rough. Some evidence is at hand pointing to an increase in yield for all counties in the period 1917 to 1930, followed by a marked decrease during the early 1930's. Precipitation data show that rainfall during the spring and summer in six of the seven years of this period was below normal, which may explain this situation.

## Corn Yields

Average yields of corn in Fillmore County have decreased slightly since 1917 but no evidence of similar trends appear in Houston and Mower counties. It is interesting to find that the average county yield of corn is highest in Houston - the roughest of the three counties. Average yields of this crop decreased in the other six counties since 1920, but no consistent differences between them in the rate of decrease are evident.

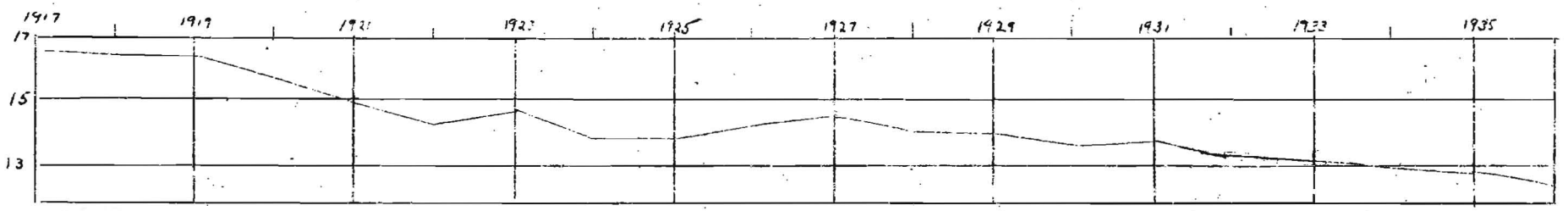
## Oat Yields

In general, the yields of oats decreased slightly from 1917 to 1921; increased slightly until 1925; were maintained at this level until about 1930; decreased sharply up to 1935-36, and increased in 1937. Rice County suffered a smaller decrease in average yields than did the other counties.

## Winter Wheat Yields

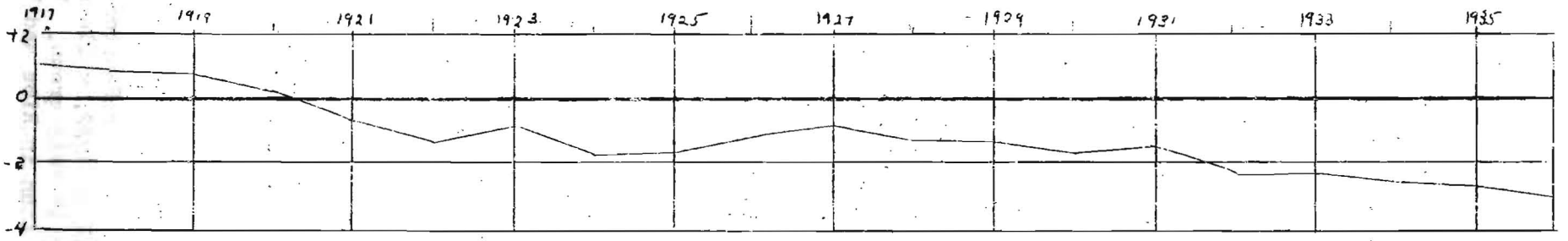
Average yields of winter wheat were rather uniform from 1917 to 1931, decreased from 1931 to 1935, and increased again in 1936. Fillmore suffered a larger decrease than Houston and Mower; Olmsted was favored with an increase in yield from 1917 to 1922, while no other consistent differences occurred in the three counties in this group. Yields of winter wheat decreased more, relatively, in Goodhue than in Rice and Wabasha.

Figure 2
Total Precipitation--Five-Year Moving Average
March to July, Incl.




Average of: Faribault, Grand Meadow, Red Wing, Reads, Zumbrota, Minnesota and LaCrosse, Wisconsin

Departure from Normal Precipitation--Five-Year Moving Average
March to July, Incl.




Average of: Faribault, Grand Meadow, Red Wing, Reads and Zumbrota, Minnesota

## Tame Hay Yields

Average yields of tame hay increased steadily from 1917 to 1928 in Houston and Rice Counties, and from 1917 to 1927 in the remaining counties; and decreased in all counties from 1928 to 1932. Since 1932 the trend has been upward. During the first period the increase in Fillmore was smaller than that of Houston and Mower. No consistent differences in yield trends between Winona, Olmsted, and Dodge are seen. Rice County suffered considerably less decrease than Goodhue and Wabasha. It should be noted that a much greater increase in hay acreages occurred in Rice County than in the other counties.

## Trends in Yields on the Basis of Crop Index

Crop yield indexes, made up of the ten principal crops grown in the area and based upon average yields of 1922, Minnesota State Farm census, and acreages as reported in the 1930 U.S. Census, are shown in Table 1 and Figure 3. These data show that Houston has fared better in maintaining yields than its neighbors on the west, while Fillmore suffered greater declines than did Mower. Average yields in Rice County decreased less than those of Goodhue and Wabasha. No consistent differences in trends are to be noted between Olmsted and Dodge counties, while Winona County seemed to fail to recoup its losses in average yields to the extent reported for the other counties.

## Acreages of Crops

The United States Census reports show a gradual decrease in the acreage of small grains and an increase in corn and hay crops from the latter part of the nineteenth century up to about 1930. Table 2 shows that since the period, 1921 to 1928, the acreage of small grain has increased in all counties, of row crops in all counties except Houston and Fillmore, and that of hay has decreased in all counties except Goodhue and Rice. The decrease in hay and the increase in small grain acreages during the past few years may be due, in part, to the difficulty of securing stands of new seedings during the drought period. Increases in total acreages of all crops occurred in all counties during this period.

Since a substantial decrease in the acreage of small grains has occurred in this section from that of thirty years ago, many granaries are not being filled to the extent that they used to be. In many cases the total production is smaller due to a reduced acreage rather than to reduced yield.

Because of this, some farmers when asked the question as to whether the average yields of crops have increased or decreased, they say that yields have decreased because they sometimes think in terms of the "binful." Statements made by a number of farmers located within the area indicate that this is the case.

## Farms Vary in Yield Trends

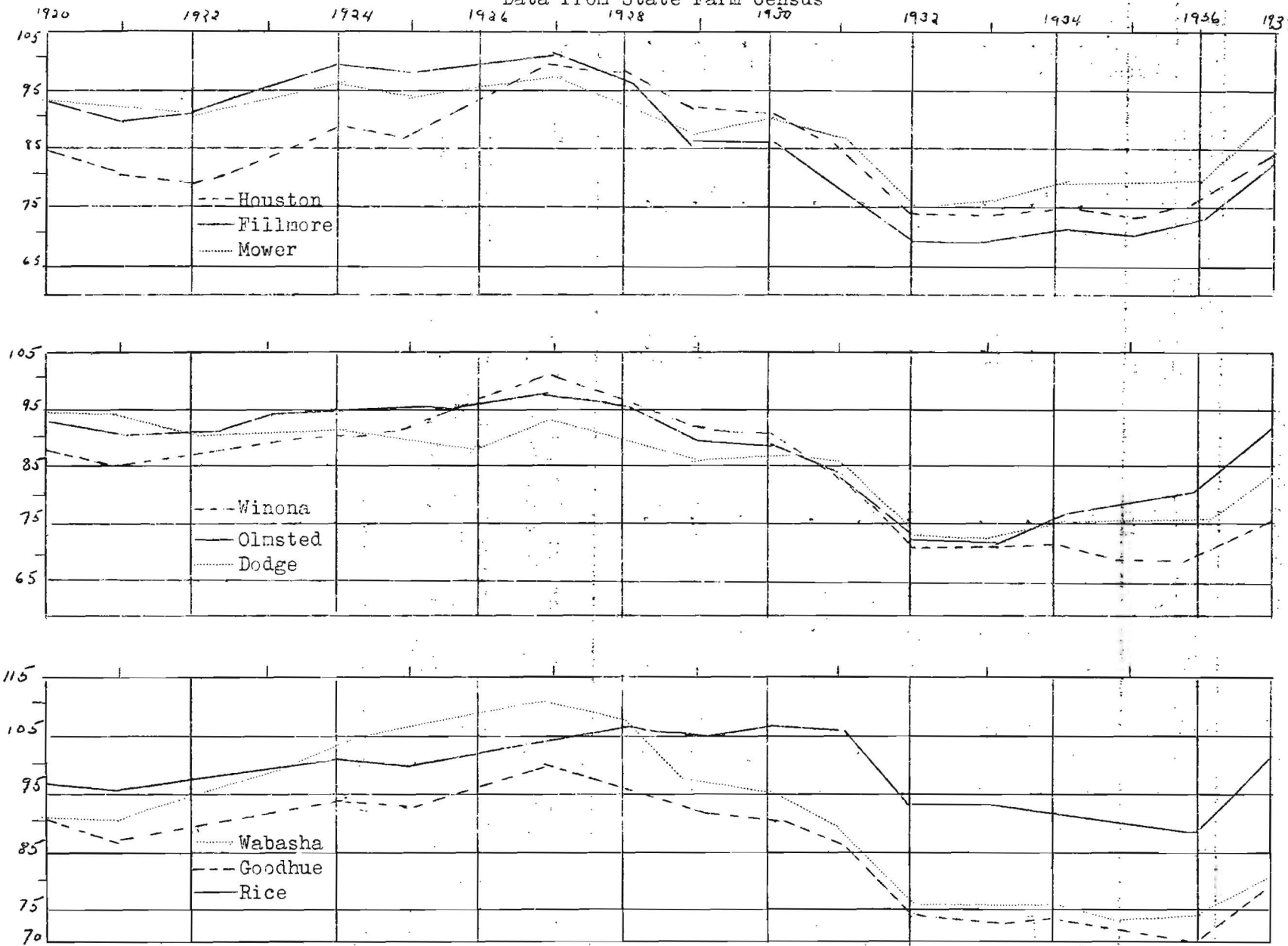
Evidences of reductions in yield where erosion losses are comparatively great are not difficult to find. Decreases approximating 100 per cent can be found where gullying is severe and where but little surface and subsoil cover the underlying rock. However, exact data relative to trends in yield under farm conditions have not been gathered for any extended period on either eroded or non-eroded land. On the other hand, evidences of a decreasing income and various economic difficulties on farms that were once prosperous can be found. The reasons for such decadence are no doubt varied; it cannot be ascribed to any one cause. A decrease in yield is undoubtedly an important factor on some of these farms.

Table 1. Crop yield index[1] 1920 to 1937 for nine counties in southeastern Minnesota. 1922 = 100.

| COUNTY | 1920 | 1921 | 1922 | 1923 | 1924 | 1925 | 1926 | 1927 | 1928 | 1929 | 1930 | 1931 | 1932 | 1933 | 1934 | 1935 | 1936 | 1937 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Houston | 86.3 | 68.1 | 100.0 | 69.9 | 72.1 | 102.9 | 98.0 | 93.3 | 97.3 | 109.0 | 92.1 | 66.9 | 92.6 | 68.5 | 50.6 | 90.5 | 71.9 | 90.4 |
| Winona | 91.7 | 73.9 | 100.0 | 77.8 | 94.0 | 98.6 | 88.4 | 99.3 | 103.6 | 110.4 | 82.7 | 62.3 | 93.3 | 67.6 | 53.9 | 83.9 | 62.9 | 81.4 |
| Wabasha | 94.9 | 82.0 | 100.0 | 90.4 | 105.9 | 112.4 | 112.5 | 114.3 | 101.3 | 114.0 | 96.7 | 65.1 | 102.9 | 70.4 | 51.7 | 89.5 | 67.6 | 87.7 |
| Fillmore | 94.7 | 85.5 | 100.0 | 79.3 | 94.8 | 113.8 | 103.0 | 93.4 | 91.1 | 106.8 | 89.3 | 52.5 | 94.3 | 62.4 | 46.3 | 88.6 | 68.9 | 87.8 |
| Olmsted | 98.2 | 82.6 | 100.0 | 83.9 | 91.0 | 109.0 | 89.5 | 94.2 | 91.4 | 105.7 | 99.1 | 56.4 | 90.6 | 69.8 | 50.4 | 91.3 | 84.0 | 96.9 |
| Goodhue | 92.2 | 79.9 | 100.0 | 76.9 | 97.8 | 102.2 | 93.0 | 99.1 | 94.3 | 109.3 | 91.4 | 65.7 | 94.6 | 72.1 | 44.9 | 86.2 | 68.8 | 83.9 |
| Mower | 103.3 | 78.2 | 100.0 | 86.0 | 91.0 | 116.0 | 91.7 | 86.3 | 94.8 | 100.3 | 92.5 | 63.7 | 100.0 | 73.1 | 45.9 | 96.8 | 77.6 | 100.0 |
| Dodge | 101.6 | 85.7 | 100.0 | 91.2 | 83.2 | 99.1 | 88.4 | 82.5 | 86.5 | 106.8 | 87.8 | 65.5 | 93.5 | 74.4 | 46.4 | 84.5 | 79.5 | 92.0 |
| Rice | 98.9 | 92.2 | 100.0 | 92.0 | 104.9 | 104.3 | 99.2 | 99.1 | 104.3 | 122.3 | 106.0 | 90.0 | 114.3 | 97.8 | 57.0 | 107.6 | 85.1 | 104.6 |

[1]This index is based upon average yields of the principal crops of the area, namely, corn, oats, barley, winter, spring and durum wheat, rye flax, potatoes, and tame hay, as reported in the Minnesota Annual Crops and Livestock Statistics Bulletins and upon acreages as reported in the 1930 U. S. Census.

Figure 3
Crop Index: Five-Year Moving Average
Southeastern Minnesota 1917-36
Data from State Farm Census




Note: 1920 and 1937 — 3-Year averages; 1921 and 1936 — 4-Year averages.

Table 2. Average annual acreage in ten principal crops[1] and percentage increase or decrease in various types of crops and in total crops by eight-year periods, 1921-28 and 1929-36 (Excluding 1934)[2]. Minnesota State Farm Census.

| | Total Ten Crops Average Acres | | | Pct. Increase or Decrease in Acreage, 1921-28 to 1929-36[2] | | |
|---|---|---|---|---|---|---|
| | 1921-28 | 1929-36[2] | Pct. Increase | Small grain Pct. | Row crops Pct.[3] | Tame hay Pct.[3] |
| Houston | 131,190 | 131,730 | .4 | 4.2 | -3.5 | -0.5 |
| Winona | 172,550 | 174,080 | .9 | 5.2 | .1 | -6.3 |
| Wabasha | 160,940 | 162,320 | .9 | 1.7 | .02 | -0.5 |
| Fillmore | 288,950 | 298,250 | 3.2 | 14.7 | -3.3 | -7.5 |
| Olmsted | 230,180 | 231,770 | .7 | 7.0 | 1.0 | -12.8 |
| Goodhue | 263,180 | 268,650 | 2.1 | .2 | 8.2 | 1.5 |
| Mower | 282,500 | 286,750 | 1.5 | 1.4 | 3.0 | -0.1 |
| Dodge | 158,600 | 163,140 | 2.9 | 3.7 | 6.6 | -3.7 |
| Rice | 157,010 | 166,370 | 6.0 | 1.1 | 6.9 | 19.7 |

[1] This includes the following crops: Corn, potatoes, oats, durum, other spring and winter wheat, barley, rye, flax and tame hay.

[2] Unusually large acreages of emergency hay, pasture, and other crops were planted in 1934 and the total acreage in crops, excluding rotation pasture was considerably smaller than normal in most counties. For that reason the 1934 acreages were omitted from this tabulation.

[3] Minus sign indicates decrease in acreage.

It may be well to mention briefly a few cases of decreasing crop yields and decreased farm earnings. Farm A, practically level and having no erosion problem, has been tilled for a period of about eighty years. The present owner is not securing as large crop yields as did his father, nor are his farm earnings as large. As no evidence of erosion appears on the farm, other factors must contribute largely to the decreased yield.

Farm B has been operated for about the past thirty years by the present owner. Yields on this farm formerly were up to the average of the community, but for the past ten or twelve years crop production has been insufficient to provide feed for the number of livestock usually kept on the farm. This land is rolling and suffers to some extent from erosion damage, but it is likely that other factors are largely responsible for the decline in yields.

Farm C may be considered rough and has suffered from erosion damage since the present owner has been operating it. Yields of crops on this farm were as large as the average of the community when the previous owner was farming it. The present owner had to reduce the number of cattle and hogs from that previously supported by home-grown feeds. Erosion is, no doubt, a more important factor in reduced yields on the farm than is the case on A and B, but other factors have also contributed to the decline in crop production.

It may be well to cite cases of improvement in yields on farms in this part of the state. Farmer Y stated that, twenty years ago when he started tilling his farm, even with normal weather conditions his grain did not grow tall enough to be cut with a binder. Yields increased as he raised more legumes and more livestock, and his yields are now as large as the average for his community. Farmer Z began renting his farm immediately after the World War. At that time the yields of crops were very small, and the farm could not support many head of livestock. Through the use of commercial fertilizers and of other fertility-building practices for a few years, this farm now yields as much, if not more, per acre than do the neighboring farms. This operator believes that the soil could have been "built up" without the use of commercial fertilizers, but he thinks that it would have taken a longer period of time. (He has not been using commercial fertilizers for several years). These two farms were considered to have been "poorly managed" previous to the time they were taken over by the present operators. More legumes, more livestock, improved varieties, improved tillage practices, and better rotations of crops contributed to the increased productivity. The two farms were classified in the erosion survey as having lost considerable top soil, and it seems reasonable to suppose that the fertility of the soil on these farms can be increased still further through a decrease in the rate of erosion.

It is obvious that reported average yields do not tell the whole story of yields and yield trends within a county. Yields vary from farm to farm and the county averages can be maintained because increases on some farms offset decreases on others. On some farms, yields are increasing as the farmers improve their cultural practices; while on others they may be decreasing as the result of slipshod farming. Improved farming methods have resulted in increased yields, and it is reasonable to assume that specific soil conserving practices will have the same effect. Since yields respond rather quickly to cultural treatment, the difference in yield which will result from a soil-conserving program, in contrast to the yields secured from poorer methods, will depend upon the extent to which good farm practices are utilized by the farmer. Differences in yields because of strip cropping or terracing may come more slowly than from improvements in other cropping and farm management practices. The effect of these practices on yields should be studied carefully in connection with the Soil Conservation Service operations.

The better farmers in Minnesota raise larger crops, and it seems that erosion losses are smaller on their farms. More fertility is taken from the soil by the higher yielding crops than by those that yield less. Means must be taken to replenish the disappearing plant food, if yields are to be maintained where the available supply in the soil becomes the limiting factor in the production of crops. It is important that a differentiation be made between the loss of soil and the loss of soil fertility. While the two are interrelated in some sections of the state, cognizance should be taken of both in order that proper planning and practice will provide the best result possible. In other words, good yields are not conclusive proof of absence of erosion and poor yields are not an unfailing sign of excessive erosion. A farmer whose crop yields are high can well afford to take inventory of possible soil losses, and a farmer whose crop yields are low should undoubtedly attempt to improve his general farming practices, as well as specific soil conserving practices.

## Summary and Conclusions

Yields of crops increased in all counties in southeastern Minnesota up to about 1930, from which time they decreased rapidly. Average precipitation during the summer months was slightly below normal for a number of years before the drought period, but a serious deficiency of moisture did not occur in this section until 1931.

According to the data reviewed, average yields have been maintained about as well in the rougher counties of southeastern Minnesota as in the more nearly level counties of that section. To find out why this is so is not within the purpose of this study. The data indicate, in addition to the above, that the soil in this section of the state is highly productive, and as such, it is worth saving. Where productive soil like that found in this section is exposed to excessive erosion, a program of soil conservation is particularly desirable.

County yield averages obviously cannot be used in a study of the effects of specific systems of farming or specific tillage practices upon crop yields. Such studies must be based on data gathered on individual fields. The Soil Conservation Service has a real opportunity for gathering basic crop yield information on farms of its cooperators under varying conditions of soil, slope, and erosion control practices. Research in this very important aspect of our soil and water conservation should be inaugurated through the appropriate agencies.