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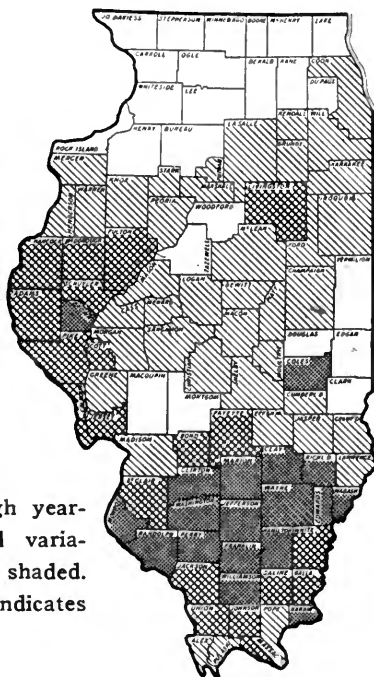
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VARIABILITY OF YIELDS AND INCOME FROM MAJOR ILLINOIS CROPS 1927-1953

By *Earl R. Swanson*



Counties with high year-to-year crop-yield variability are heavily shaded. Lighter shading indicates less variability.

BULLETIN 610

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Access to the facilities of the Illinois Electronic Digital Computer (Illiac) substantially reduced the computational burden involved in this study.

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FIG X

VARIABILITY OF YIELDS AND INCOME FROM MAJOR ILLINOIS CROPS 1927-1953

By EARL R. SWANSON, Associate Professor of Agricultural Economics

FARM BUSINESS decisions are based on expectations for the future which in turn are largely founded on past experience. An unusual experience may obscure the more common events which may be equally relevant to wise planning. Therefore to gain a consistent, long-range view, the following study of crop yield and income experience in Illinois reviews the 27-year period 1927-1953.

Such a review may be used as a guide in making decisions on land valuation, crop insurance, choice of crops, and related farm business matters.

Part I of the report contains average per-acre yields for five crops and an estimate of their variation in each county and for the state as a whole during the period of the study (1927-1953). By comparing county figures with each other and with those for the entire state, the reader may have a rough guide useful in land appraisal and crop insurance programs. Such a guide constructed from county averages cannot, of course, be considered to reflect accurately expected yields on any given farm. The more homogeneous the county, however, the more closely such averages may approach likely experience on individual farms in the county. A customary procedure in land valuation is to use average yields in determining the annual income which is used as a basis for estimating the value of the farm. In addition to consideration of the *average level* of yields, attention should be given to the variability of such yields. For example, an adjustment should be made in the values of farms in different counties that have the same average yields but are expected to differ in the stability of these yields.

Lending agencies may also use yield variability in adjusting the amount that will be loaned to allow for differences in such variability among farms in different areas. Appraisal of land for tax purposes might take differences in yield dependability into account along with average productivity.

The data in Tables 1-5 are significant to all-risk crop insurance programs featuring premium rates based on normal county yields. Premiums for such programs are determined in the following manner: Let us say that the long-time county average corn yield is 50 bushels per acre. If the farmer wishes to insure for 80 percent of the county average, his premium would be based on 40 bushels. If the actual aver-

age yield for the county for that year is 35 bushels, the claim is 5 bushels per acre irrespective of the insured farmer's yield.

Farmers considering such insurance will want to know if the premiums are set on current figures which take into account upward trends in yield averages. It is to the advantage of commercial insurance agencies to keep premiums in line to encourage farmers to buy their insurance. If the premiums are set on yield averages which are unrealistically low, premiums over a period of years would so greatly exceed claims as to discourage farmers from purchasing this insurance.

The data in Tables 1-5 may also be helpful in differentiating between high- and low-risk counties in establishing premium rates.

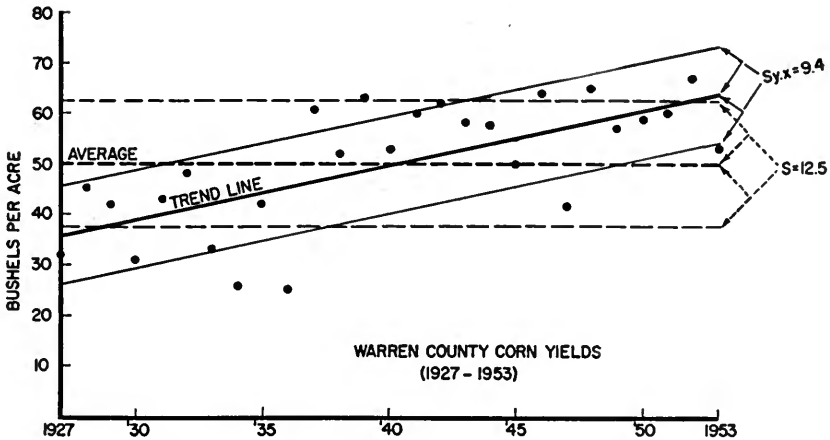
In Part II, the effect on income and income variability of various degrees of specialization in certain crops is examined. Such figures can be useful to the farmer who does not want to move to another county with less variability than the location he is presently farming. He may wish to consider reducing uncertainty by diversification of crops. (The undesirable consequences of yield variability may, of course, also be met by crop insurance and by the maintenance of cash reserves large enough to tide him over unfavorable years.)

In areas such as Illinois where there are rather stable yields for all crops, it is believed that the proportion of total land in each of the three classes of crops, (1) cultivated, (2) small grain, and (3) meadow, will be determined chiefly by considerations other than reduction of income variability. Thus the expected effect of meadow on succeeding corn crops, maintenance of physical properties of the soil, distribution of labor throughout the season, and considerations of livestock feed are likely to be more important than income variability in choosing the proportion of the three classes of crops. However, choices within each of these three classes might be made with a view toward reducing income variability.

Specifically, Part II seeks to find which combinations of corn and soybeans and of wheat and oats minimize income variability from land devoted to these crops.

Part I — YIELD VARIABILITY

One of the components of year-to-year income variability is the year-to-year fluctuation in crop yields. Average yield data for counties are published by the Illinois Cooperative Crop Reporting Service and are the sole source of yield data used in this study. Use of county average yields tends to underestimate the variation for any particular farm or field within the county. Ideally, crop yields for a particular



Yield variability measured from average and trend. (Fig. 1)

farm over a long period of time would provide a basis for a more precise investigation of yield fluctuations. However, such data are not available for all areas of the state for the length of time comparable to that of the county average data of the Illinois Cooperative Crop Reporting Service. Yield data for townships would also be more specific and therefore more suitable than county averages but are likewise not available.

During the 1927-1953 period there has been, almost without exception, an upward trend in county yields for the five crops studied—corn, soybeans, oats, wheat, and hay. New crop varieties, improved machinery, increased fertilizer use, and other technological advances are responsible for this upward yield trend. Our focus in measuring yield variation is, however, to estimate the influence of such natural causes as varying weather conditions. Therefore it is desirable to measure yield fluctuation as independently as possible of the long-time trend in yields over the years.

The procedure is illustrated in Figure 1. The Warren county average corn yields are plotted for the 27-year period 1927-1953. The average yield for the entire period is 50.0 bushels per acre. The standard deviation¹ S , is 12.5 bushels. The range from the average minus one standard deviation to the average plus one standard deviation will include approximately two-thirds of the annual yields. In this case, 18 yields fall in the range 37.5 bushels to 62.5 bushels.

Yield variability is also shown measured about a trend line.² The yield range between the two lines drawn parallel to the trend line—

¹ For method of computation see any standard statistical text, e.g., Snedecor, G. W., *Statistical Methods*, Ames, Iowa State College Press, 1946.

² Fitted by the method of least squares. See Snedecor, Chapter 6.

one 9.4 bushels above and the other 9.4 bushels below — also includes approximately two-thirds of the yields. The standard deviation about the trend line (9.4 bushels) is called the standard error of estimate, $S_{y \cdot x}$. Use of a straight line instead of a curve to approximate a trend line from which to measure yield variability may tend to cause over-estimation of the yield variability. Corn, for example, shows evidence that increases in yield have not been at a uniform rate.

* A measure of variability should also be related to the average level of yield. It might be expected that the actual variations in bushels would be greater in a county that averages 60 bushels of corn per acre than in a county which averages only 40 bushels. A measure of variability that is expressed as a percent of average yield would therefore be more useful in comparing areas than one expressed in absolute terms.

Further, if such a measure of relative variation is to be used to compare crops or counties for forming future expectations, it may be desirable to express the relative variability as a percent of recent average yields. Accordingly, the standard error of estimate was divided by the average yields for the five-year period 1949-1953. The resulting measure of yield variability, expressed as a percent, is in the third column of Tables 1 through 5. (A high value indicates high variability.) The first column in these tables gives the average yield for the 27-year period and the second column the standard error of estimate based on the trend line for the 27 years.

In addition to the likely underestimation of variability for a specific farm or field when county data are used (see page 4), two more limitations of the basic data should be noted.

First, the yield data reported by the Cooperative Crop Reporting Service are based on harvested acres rather than planted acres. This tends to overestimate yields of planted acres in years of crop abandonment. A reduction in year-to-year variation may be expected as a result of using yields based on harvested acreages. A second limitation of the basic data is the measurement of hay yields. Since few farmers actually weigh the hay produced, considerable errors may occur in reporting hay yields. Without additional information, the effect of such individual reporting errors cannot be estimated.

Certain regional differences within the state are apparent when each county is given a weighted rank according to its average yield variability. The following method was used to rank the counties:

First each crop was weighted according to the fraction it represented of the total county acreage devoted during 1949-1953 to the

(Text continued on page 12)

Table 1. — Average Corn Yields in Illinois Counties and Their Variation, 1927-1953

County	Average yield in bushels per acre 1927-53	Standard error of estimate about trend 1927-53	Standard error in column 2 expressed as a percent of 1949-53 average yield	County	Average yield in bushels per acre 1927-53	Standard error of estimate about trend 1927-53	Standard error in column 2 expressed as a percent of 1949-53 average yield
Adams.....	41.9	11.9	21.2	Lee.....	51.2	6.3	9.7
Alexander.....	29.2	5.8	18.6	Livingston....	44.1	8.6	16.2
Bond.....	31.6	8.3	19.5	Logan.....	48.3	10.6	16.7
Boone.....	48.6	8.0	12.2	McDonough..	47.1	11.7	20.2
Brown.....	39.9	11.9	22.9	McHenry.....	46.2	8.0	13.3
Bureau.....	52.7	7.7	12.1	McLean.....	48.0	8.0	13.9
Calhoun.....	44.0	10.2	20.0	Macon.....	46.6	10.5	17.7
Carroll.....	54.2	6.4	9.1	Macoupin....	38.3	9.9	18.8
Cass.....	45.2	9.8	17.5	Madison.....	37.2	9.6	20.9
Champaign....	48.2	9.0	15.3	Marion.....	24.4	7.9	23.7
Christian.....	44.3	10.8	17.9	Marshall....	46.8	9.2	15.7
Clark.....	37.1	5.6	12.6	Mason.....	36.9	8.5	17.8
Clay.....	25.8	8.1	23.5	Massac.....	31.4	5.8	16.7
Clinton.....	31.2	10.3	26.5	Menard.....	44.5	9.6	16.7
Coles.....	42.9	8.6	16.3	Mercer.....	49.3	8.6	14.7
Cook.....	41.3	8.0	16.3	Monroe.....	38.0	8.9	20.4
Crawford....	35.7	6.4	14.7	Montgomery..	37.3	9.4	17.4
Cumberland...	33.9	7.2	15.9	Morgan.....	46.3	10.9	18.3
DeKalb.....	53.7	7.8	11.8	Moultrie....	43.7	9.7	17.3
DeWitt.....	45.9	9.2	16.3	Ogle.....	51.9	6.2	9.3
Douglas.....	47.0	8.6	14.7	Peoria.....	46.5	9.2	15.8
DuPage.....	44.8	7.4	12.8	Perry.....	24.1	6.4	20.4
Edgar.....	46.9	7.9	14.6	Piatt.....	49.2	10.0	15.8
Edwards.....	33.4	8.1	20.0	Pike.....	41.9	11.3	20.9
Effingham....	30.3	6.4	15.0	Pope.....	27.3	6.2	19.0
Fayette.....	28.8	8.1	20.5	Pulaski.....	29.5	5.1	17.6
Ford.....	44.2	7.9	14.8	Putnam.....	51.2	8.6	14.2
Franklin.....	24.5	6.3	20.2	Randolph....	33.5	9.8	25.7
Fulton.....	45.9	10.2	18.1	Richland....	27.4	8.0	22.5
Gallatin.....	35.4	7.2	17.7	Rock Island..	51.5	7.3	12.2
Greene.....	43.1	10.8	19.9	St. Clair....	37.4	9.5	21.3
Grundy.....	43.3	8.4	15.8	Saline.....	31.5	6.6	18.2
Hamilton....	26.3	6.0	18.5	Sangamon....	44.4	10.0	17.4
Hancock....	44.4	12.2	22.1	Schuyler....	43.0	11.7	21.0
Hardin.....	28.1	6.9	21.4	Scott.....	43.9	11.1	21.2
Henderson....	48.3	8.7	15.5	Shelby.....	38.7	8.4	16.6
Henry.....	51.4	7.8	12.6	Stark.....	49.1	9.4	15.7
Iroquois....	42.9	7.9	15.5	Stephenson..	52.7	6.8	10.2
Jackson.....	31.9	7.1	20.5	Tazewell....	48.6	8.4	13.7
Jasper.....	31.4	6.9	16.6	Union.....	30.1	6.3	19.8
Jefferson....	24.4	6.5	20.2	Vermilion...	44.0	7.8	14.2
Jersey.....	41.3	10.4	20.6	Wabash.....	38.1	8.1	21.2
Jo Daviess...	50.1	7.2	11.4	Warren.....	50.0	9.4	15.9
Johnson....	25.5	5.4	20.3	Washington..	25.9	9.0	26.3
Kane.....	51.4	7.5	11.7	Wayne.....	25.4	7.1	21.4
Kankakee....	41.9	8.1	15.4	White.....	32.8	7.3	19.0
Kendall.....	46.3	10.1	17.6	Whiteside...	52.6	6.5	10.2
Knox.....	48.3	8.9	14.8	Will.....	40.7	8.3	16.4
Lake.....	42.0	7.4	13.6	Williamson..	25.5	6.4	21.6
LaSalle....	48.7	9.1	15.5	Winnebago...	49.2	6.1	9.6
Lawrence....	32.4	6.3	16.2	Woodford....	50.6	9.0	5.1
				State ^a	43.9	7.2	13.2

^a Based on average annual yields for the state.

Table 2.—Average Soybean Yields in Illinois Counties and Their Variation, 1927-1953

County	Average yield in bushels per acre 1927-53	Standard error of estimate about trend 1927-53	Standard error in column 2 expressed as a per cent of 1949-53 average yield	County	Average yield in bushels per acre 1927-53	Standard error of estimate about trend 1927-53	Standard error in column 2 expressed as a per cent of 1949-53 average yield
Adams.....	19.9	3.3	12.3	Lee.....	20.9	2.0	7.7
Alexander ^a	15.2	2.9	14.6	Livingston....	20.7	2.7	10.1
Bond.....	13.8	2.7	14.7	Logan.....	22.1	2.6	9.0
Boone ^b	19.3	1.9	7.7	McDonough...	22.0	3.2	11.0
Brown.....	18.5	3.1	13.0	McHenry ^d	18.5	2.4	10.0
Bureau.....	21.9	2.2	7.6	McLean.....	22.6	2.9	10.0
Calhoun.....	18.4	2.9	12.7	Macon.....	22.9	2.9	10.1
Carroll ^e	19.4	2.7	11.6	Macoupin....	18.9	2.3	9.3
Cass.....	19.8	3.1	12.0	Madison....	17.5	2.7	12.4
Champaign....	22.9	2.9	10.3	Marion.....	11.9	3.1	21.2
Christian....	22.0	2.7	9.9	Marshall....	21.6	2.9	10.4
Clark.....	15.5	1.7	8.1	Mason.....	17.6	3.2	13.0
Clay.....	11.9	2.4	16.9	Massac ^c	12.8	3.5	21.6
Clinton.....	14.8	3.5	19.7	Menard.....	20.1	3.0	11.0
Coles.....	20.1	2.6	9.8	Mercer ^b	21.2	2.7	10.5
Cook ^d	19.0	2.0	8.5	Monroe ⁱ	16.1	3.6	17.0
Crawford....	14.0	2.5	14.0	Montgomery..	18.5	2.4	9.9
Cumberland...	14.9	2.1	10.5	Morgan.....	21.6	2.8	9.9
DeKalb.....	22.0	2.0	7.4	Moultrie....	21.9	3.5	12.2
DeWitt.....	22.4	2.9	10.4	Ogle ^h	22.1	6.0	21.1
Douglas.....	22.6	2.8	9.9	Peoria.....	22.1	3.1	10.3
DuPage ^d	19.4	2.1	8.5	Perry.....	11.4	3.4	23.6
Edgar.....	21.6	2.6	9.7	Piatt.....	23.6	2.8	9.7
Edwards.....	14.0	2.7	16.1	Pike.....	18.7	2.8	11.2
Effingham....	14.0	2.4	13.0	Pope ^e	12.8	3.1	18.9
Fayette.....	13.2	2.9	16.7	Pulaski ^d	13.8	2.8	15.7
Ford.....	20.8	2.8	10.6	Putnam.....	20.9	2.1	7.3
Franklin....	11.3	2.7	19.0	Randolph....	14.1	3.5	18.6
Fulton.....	21.0	3.2	12.0	Richland....	11.8	2.2	14.7
Gallatin....	14.2	2.3	12.5	Rock Island..	22.3	2.6	9.9
Greene.....	19.3	3.1	12.2	St. Clair....	17.1	3.4	15.5
Grundy ^e	20.2	2.1	8.1	Saline.....	14.0	2.4	13.3
Hamilton....	12.2	2.6	16.7	Sangamon....	21.6	2.8	10.1
Hancock....	20.9	4.0	15.2	Schuyler....	19.5	3.5	13.8
Hardin ^f	12.9	2.4	17.4	Scott.....	19.5	3.1	12.4
Henderson....	21.0	2.5	9.4	Shelby.....	18.3	2.9	12.2
Henry.....	21.9	2.4	8.3	Stark ^h	22.4	2.5	8.7
Iroquois....	20.4	2.7	10.4	Stephenson...	19.6	2.2	9.4
Jackson.....	13.5	2.9	16.9	Tazewell....	22.6	2.6	8.7
Jasper.....	12.9	2.2	12.4	Union ^c	13.7	3.0	17.4
Jefferson....	12.2	2.9	18.8	Vermilion...	21.0	2.5	9.7
Jersey.....	19.7	3.8	15.3	Wabash ^d	15.5	2.9	18.4
Jo Daviess ^g ..	19.5	2.4	10.5	Warren.....	23.2	2.8	9.3
Johnson....	12.3	2.7	19.6	Washington...	12.6	3.7	21.3
Kane.....	20.4	1.5	5.9	Wayne.....	11.7	2.4	16.4
Kankakee....	20.0	2.3	9.0	White.....	13.7	2.6	14.6
Kendall....	20.4	2.3	8.3	Whiteside...	19.9	2.4	9.4
Knox.....	22.1	2.6	8.8	Will.....	19.4	2.0	8.3
Lake ^e	18.4	2.1	9.7	Williamson...	11.5	3.3	23.9
LaSalle....	21.9	2.6	9.1	Winnebago...	18.2	2.1	9.1
Lawrence....	13.1	2.5	15.2	Woodford....	22.9	3.1	10.1
				State ^j	20.0	2.1	9.3

^a No data reported for 1927, 1928, 1932, 1933, and 1935.

^b No data reported for 1928 and 1934.

^c No data reported for 1927 and 1928.

^d No data reported for 1928.

^e No data reported for 1934.

^f No data reported for 1927, 1928, 1930, 1931, 1932, 1933, 1934, 1940, and 1950.

^g No data reported for 1927, 1928, and 1934.

^h No data reported for 1927.

ⁱ No data reported for 1933.

^j Based on average annual yields for the state.

Table 3. — Average Oats Yields in Illinois Counties and Their Variation, 1927-1953

County	Average yield in bushels per acre 1927-53	Standard error of estimate about trend 1927-53	Standard error in column 2 expressed as a percent of 1949-53 average yield	County	Average yield in bushels per acre 1927-53	Standard error of estimate about trend 1927-53	Standard error in column 2 expressed as a percent of 1949-53 average yield
Adams.....	30.7	8.5	25.6	Lee.....	41.2	8.2	17.9
Alexander.....	23.9	5.7	27.7	Livingston....	33.8	9.2	25.8
Bond.....	24.0	9.9	41.9	Logan.....	37.0	9.0	21.3
Boone.....	40.4	8.3	17.4	McDonough..	35.9	9.2	24.7
Brown.....	28.7	9.3	31.0	McHenry.....	42.4	8.4	17.6
Bureau.....	40.5	7.4	16.7	McLean.....	36.2	8.7	22.4
Calhoun.....	26.8	6.3	26.5	Macon.....	36.2	10.3	25.2
Carroll.....	40.5	7.3	16.1	Macoupin....	30.3	7.8	22.4
Cass.....	32.6	7.3	19.9	Madison.....	26.6	7.1	27.5
Champaign....	35.1	8.9	23.8	Marion.....	20.4	6.3	32.1
Christian....	35.0	9.6	23.0	Marshall....	35.9	8.4	20.7
Clark.....	22.5	7.6	35.2	Mason.....	28.1	7.5	24.5
Clay.....	18.5	6.2	36.5	Massac.....	23.8	5.3	24.3
Clinton.....	28.6	8.0	33.9	Menard.....	34.4	8.2	20.4
Coles.....	32.1	8.2	24.1	Mercer.....	34.6	7.9	21.1
Cook.....	40.1	9.5	22.1	Monroe.....	28.7	5.8	24.4
Crawford....	21.4	7.5	37.5	Montgomery..	28.3	8.0	23.3
Cumberland..	21.7	7.8	36.1	Morgan.....	35.8	7.9	18.6
DeKalb.....	46.9	8.8	17.1	Moultrie....	34.0	9.2	25.3
DeWitt.....	34.5	9.4	24.7	Ogle.....	40.3	8.5	19.0
Douglas....	35.3	9.2	24.3	Peoria.....	35.1	9.4	24.2
DuPage.....	43.3	9.7	19.6	Perry.....	19.5	5.3	29.8
Edgar.....	33.3	8.2	24.3	Piatt.....	36.6	9.7	23.2
Edwards....	22.6	8.0	41.7	Pike.....	28.7	7.8	26.9
Efingham....	22.1	7.6	34.2	Pope.....	21.3	5.6	29.8
Fayette....	22.3	6.7	27.9	Pulaski....	24.3	4.8	23.1
Ford.....	33.0	8.5	24.4	Putnam.....	41.2	10.3	23.1
Franklin....	20.2	5.6	29.2	Randolph....	26.9	6.3	26.5
Fulton.....	34.4	8.9	24.9	Richland....	19.5	7.1	34.8
Gallatin....	22.0	6.8	40.0	Rock Island..	41.5	10.3	27.0
Greene.....	30.2	6.5	20.6	St. Clair....	29.3	6.2	24.6
Grundy....	35.3	9.7	25.3	Saline.....	21.7	6.6	38.8
Hamilton....	19.6	5.7	32.8	Sangamon....	37.2	8.8	20.3
Hancock....	33.5	7.6	22.1	Schuyler....	31.3	9.7	28.5
Hardin ^a	18.9	6.1	36.3	Scott.....	31.3	7.6	22.8
Henderson....	34.0	7.6	21.1	Shelby.....	27.6	8.2	27.3
Henry.....	39.0	8.2	19.6	Stark.....	37.0	9.3	22.6
Iroquois....	31.7	8.2	24.3	Stephenson..	41.5	8.7	18.0
Jackson....	25.4	5.7	28.5	Tazewell....	36.8	8.5	21.9
Jasper.....	20.0	6.7	32.5	Union.....	24.0	4.8	21.8
Jefferson....	18.9	5.3	31.9	Vermilion...	32.2	8.8	25.3
Jersey.....	28.0	7.8	27.5	Wabash....	24.4	7.7	49.4
Jo Daviess..	39.8	8.5	18.6	Warren....	36.3	8.7	21.8
Johnson....	22.5	5.5	30.2	Washington..	25.5	6.4	27.6
Kane.....	46.5	9.2	18.3	Wayne.....	19.1	6.3	37.5
Kankakee....	34.4	9.0	22.4	White.....	21.7	6.0	31.6
Kendall....	42.2	8.8	18.8	Whiteside...	40.9	7.8	17.3
Knox.....	35.8	9.1	23.8	Will.....	37.5	9.5	22.4
Lake.....	42.4	8.6	18.9	Williamson..	20.9	5.0	27.5
LaSalle....	39.9	9.3	21.4	Winnebago..	38.5	8.1	18.2
Lawrence....	22.4	6.6	33.0	Woodford...	37.1	9.0	23.0
				State ^b	35.5	7.1	18.1

^a No data reported for 1934.^b Based on average annual yields for the state.

Table 4.—Average Wheat Yields^a in Illinois Counties and Their Variation, 1927-1953

County	Average yield in bushels per acre 1927-53	Standard error of estimate about trend 1927-53	Standard error in column 2 expressed as a percent of 1949-53 average yield	County	Average yield in bushels per acre 1927-53	Standard error of estimate about trend 1927-53	Standard error in column 2 expressed as a percent of 1949-53 average yield
Adams.....	18.3	3.1	12.8	Lee.....	24.5	4.1	14.7
Alexander.....	15.8	3.4	18.9	Livingston....	22.2	3.5	13.5
Bond.....	16.3	3.2	15.5	Logan.....	22.6	4.8	17.5
Boone.....	21.9	4.8	17.5	McDonough..	21.1	3.6	14.2
Brown.....	17.8	3.9	16.1	McHenry.....	23.3	4.7	16.8
Bureau.....	24.5	3.2	11.8	McLean.....	22.6	3.7	13.8
Calhoun.....	19.1	3.7	16.2	Macon.....	22.7	4.3	15.4
Carroll.....	23.3	3.6	14.1	Macoupin....	18.3	4.5	19.4
Cass.....	20.6	3.9	14.9	Madison.....	18.3	3.7	17.6
Champaign....	22.6	3.6	12.9	Marion.....	14.5	3.1	19.1
Christian.....	21.7	4.1	14.5	Marshall....	21.9	4.0	14.4
Clark.....	16.0	3.3	20.1	Mason.....	18.3	3.8	16.4
Clay.....	13.2	3.1	21.5	Massac.....	14.9	2.5	13.9
Clinton.....	16.9	4.2	22.3	Menard.....	20.6	4.3	16.4
Coles.....	19.9	3.3	13.4	Mercer.....	21.8	3.4	15.9
Cook.....	22.9	4.2	16.3	Monroe.....	18.6	4.7	21.6
Crawford.....	15.3	3.2	20.3	Montgomery..	18.5	4.1	16.5
Cumberland... ^b	16.0	3.7	19.5	Morgan.....	21.7	4.3	15.6
DeKalb.....	24.4	5.2	17.6	Moultrie....	21.1	4.0	15.4
DeWitt.....	21.9	4.0	14.9	Ogle.....	22.8	4.5	17.3
Douglas.....	21.7	4.3	15.8	Peoria.....	21.9	3.6	12.9
DuPage.....	24.3	5.0	18.1	Perry.....	13.3	3.5	21.6
Edgar.....	20.7	3.1	13.0	Piatt.....	22.8	4.3	15.0
Edwards.....	15.9	4.1	23.3	Pike.....	17.5	3.5	16.2
Effingham....	15.8	3.8	21.3	Pope.....	13.9	2.8	16.5
Fayette.....	15.0	3.2	18.4	Pulaski.....	15.2	3.4	18.3
Ford.....	22.2	4.2	15.8	Putnam.....	24.5	4.4	17.2
Franklin.....	14.7	3.4	20.7	Randolph....	16.2	3.7	19.1
Fulton.....	20.5	3.8	16.0	Richland....	14.5	3.8	25.0
Gallatin.....	16.2	3.9	20.5	Rock Island..	23.5	4.5	20.1
Greene.....	18.7	4.0	17.4	St. Clair....	18.3	4.1	19.3
Grundy ^b	22.6	3.3	12.4	Saline.....	15.5	3.0	17.2
Hamilton.....	14.5	3.1	19.4	Sangamon....	21.7	4.5	16.8
Hancock.....	19.7	3.5	14.2	Schuyler....	19.2	4.2	16.4
Hardin ^c	14.1	3.8	23.5	Scott.....	19.4	3.9	17.0
Henderson....	20.7	3.6	15.3	Shelby.....	18.3	3.0	13.5
Henry.....	23.5	3.3	13.2	Stark.....	23.4	3.8	12.8
Iroquois....	22.6	3.8	13.6	Stephenson..	20.8	4.2	16.2
Jackson.....	16.1	4.0	23.0	Tazewell....	21.5	3.8	15.1
Jasper.....	14.5	3.3	20.4	Union.....	16.3	3.9	20.7
Jefferson....	14.6	4.0	25.3	Vermilion... ^b	21.6	3.9	14.9
Jersey.....	19.0	4.2	19.8	Wabash.....	16.7	3.8	28.8
Jo Daviess... ^c	20.3	4.3	18.4	Warren.....	22.5	4.4	17.1
Johnson.....	13.9	3.2	19.3	Washington..	15.2	4.2	23.3
Kane.....	25.1	4.9	16.9	Wayne.....	14.1	3.5	22.4
Kankakee....	21.7	3.9	14.9	White.....	14.9	3.8	22.6
Kendall.....	24.3	3.8	13.3	Whiteside... ^c	23.3	3.9	15.2
Knox.....	22.0	3.8	14.2	Will.....	23.4	3.9	13.7
Lake.....	23.5	4.4	15.3	Williamson..	14.1	3.1	18.5
LaSalle.....	23.0	4.8	17.0	Winnebago... ^c	21.6	4.1	15.9
Lawrence....	15.1	3.0	17.2	Woodford... ^c	22.3	3.9	14.7
				State ^d	18.7	2.8	12.6

^a 1927-1949 — Winter wheat only; 1950-1953 — All wheat.

^b No data reported for 1934.
^c No data reported for 1950.

^d Based on average annual yields for the state.

Table 5. — Average Hay Yields in Illinois Counties and Their Variation, 1927-1953

County	Average yield in tons per acre 1927-53	Standard error of estimate about trend 1927-53	Standard error in column 2 expressed as a percent of 1949-53 average yield	County	Average yield in tons per acre 1927-53	Standard error of estimate about trend 1927-53	Standard error in column 2 expressed as a percent of 1949-53 average yield
Adams.....	1.35	.218	13.9	Lee.....	1.55	.139	7.1
Alexander.....	1.55	.234	14.3	Livingston....	1.51	.211	12.3
Bond.....	1.19	.183	13.9	Logan.....	1.35	.173	12.2
Boone.....	1.79	.245	10.0	McDonough..	1.39	.190	12.0
Brown.....	1.36	.222	14.3	McHenry.....	1.72	.239	11.1
Bureau.....	1.54	.150	8.3	McLean.....	1.52	.190	11.0
Calhoun.....	1.62	.237	12.6	Macon.....	1.37	.192	13.9
Carrroll.....	1.56	.135	7.1	Macoupin....	1.39	.175	11.2
Cass.....	1.35	.207	14.4	Madison.....	1.57	.180	10.4
Champaign....	1.47	.198	12.4	Marion.....	.84	.055	5.9
Christian.....	1.32	.186	13.2	Marshall....	1.51	.205	11.5
Clark.....	1.15	.123	9.2	Mason.....	1.43	.210	12.4
Clay.....	.80	.180	20.7	Massac.....	1.10	.184	14.8
Clinton.....	1.39	.209	12.6	Menard.....	1.38	.178	11.9
Coles.....	1.32	.173	12.4	Mercer.....	1.47	.161	9.5
Cook.....	1.49	.186	9.9	Monroe.....	1.60	.271	14.9
Crawford....	1.13	.161	12.6	Montgomery..	1.29	.144	10.1
Cumberland...	1.09	.139	11.0	Morgan.....	1.40	.209	14.4
DeKalb.....	1.60	.194	10.1	Moultrie....	1.31	.174	12.9
DeWitt.....	1.50	.176	11.1	Ogle.....	1.54	.180	9.5
Douglas.....	1.38	.268	17.0	Peoria.....	1.46	.179	10.8
DuPage.....	1.53	.182	9.3	Perry.....	1.03	.243	21.9
Edgar.....	1.29	.188	13.9	Piatt.....	1.40	.193	13.5
Edwards.....	1.01	.178	16.2	Pike.....	1.50	.205	11.6
Effingham....	1.05	.142	11.6	Pope.....	.97	.166	15.2
Fayette.....	1.02	.159	13.7	Pulaski.....	1.16	.168	13.3
Ford.....	1.44	.226	14.0	Putnam.....	1.55	.146	7.8
Franklin.....	.97	.193	18.6	Randolph....	1.45	.245	15.6
Fulton.....	1.45	.209	12.3	Richland....	.82	.167	18.6
Gallatin.....	1.18	.205	15.3	Rock Island..	1.58	.128	6.1
Greene.....	1.51	.180	10.8	St. Clair....	1.60	.185	10.3
Grundy.....	1.46	.210	11.9	Saline.....	1.07	.175	15.0
Hamilton.....	.88	.197	20.1	Sangamon....	1.38	.159	10.5
Hancock.....	1.32	.179	12.2	Schuyler....	1.33	.237	16.5
Hardin.....	1.02	.228	21.5	Scott.....	1.56	.178	9.9
Henderson....	1.47	.171	9.9	Shelby.....	1.21	.134	10.2
Henry.....	1.62	.144	7.4	Stark.....	1.48	.160	9.5
Iroquois....	1.51	.222	13.7	Stephenson...	1.70	.240	10.9
Jackson.....	1.26	.171	11.2	Tazewell....	1.57	.149	8.3
Jasper.....	.91	.135	13.0	Union.....	1.17	.208	16.4
Jefferson....	.87	.177	17.7	Vermilion...	1.38	.179	12.1
Jersey.....	1.65	.189	9.9	Wabash.....	1.27	.195	17.9
Jo Daviess...	1.63	.235	11.6	Warren.....	1.40	.179	11.6
Johnson.....	.96	.169	16.7	Washington...	1.15	.181	13.4
Kane.....	1.68	.193	9.5	Wayne.....	.80	.186	20.9
Kankakee....	1.39	.183	11.2	White.....	1.09	.187	15.2
Kendall.....	1.52	.178	10.1	Whiteside...	1.62	.192	9.5
Knox.....	1.48	.171	9.6	Will.....	1.47	.189	10.7
Lake.....	1.63	.250	12.1	Williamson...	1.00	.186	16.9
LaSalle.....	1.56	.163	8.7	Winnebago...	1.65	.171	8.1
Lawrence....	1.09	.162	14.5	Woodford...	1.61	.214	11.1
				State.....	1.36	.120	7.3

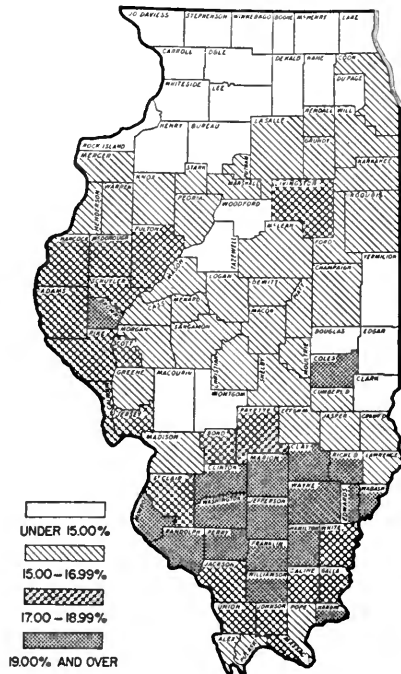
a Based on average annual yields for the state.

five crops studied. For example, in Clinton county during the period 1949-1953, of the land devoted to the five crops, corn represented 27.43 percent; wheat, 24.39 percent; soybeans, 21.97 percent; oats, 13.90 percent and hay, 12.31 percent.

The second step was to multiply these percentages by their respective yield variabilities (Col. 3, Tables 1-5). Thus (still using Clinton county as an example), we multiplied 27.43% by 26.5 (weight for corn \times Col. 3 of Table 1) = 7.27, 21.97% \times 19.7 = 4.33 for soybeans, etc.

Finally these weighted yield variabilities for each crop are added (7.27 + 4.33, etc.) to get a county average yield variability — in the case of Clinton county, 23.30.

A general pattern of increasing yield variability occurs as we move from the northern part of the state to the southern part (Fig. 2). Counties in northwestern Illinois are characterized by high yield stability while in the counties in southern Illinois (excluding the extreme southern tip of the state) a higher degree of variability is noted.



Average crop-yield variability. (Fig. 2)

Following is the ranking of counties in order of decreasing variability:

<i>Rank</i>	<i>County</i>	<i>Average crop yield variability</i>	<i>Rank</i>	<i>County</i>	<i>Average crop yield variability</i>
1	Clinton.....	23.30	52	Lawrence.....	16.25
2	Washington.....	22.56	53	Stark.....	16.25
3	Coles.....	22.43	54	Warren.....	16.15
4	Wabash.....	22.42	55	Iroquois.....	16.11
5	Perry.....	22.27	56	Jasper.....	16.03
6	Hardin.....	21.49	57	Macon.....	16.03
7	Randolph.....	21.30	58	Cook.....	15.90
8	Clay.....	21.09	59	LaSalle.....	15.89
9	Brown.....	20.65	60	Marshall.....	15.86
10	Jefferson.....	20.58	61	DeWitt.....	15.75
11	Richland.....	20.35	62	Crawford.....	15.69
12	Williamson.....	20.24	63	Logan.....	15.57
13	Monroe.....	20.16	64	Cass.....	15.44
14	Marion.....	20.05	65	Knox.....	15.44
15	Franklin.....	19.95	66	Shelby.....	15.43
16	Edwards.....	19.83	67	McLean.....	15.37
17	Wayne.....	19.53	68	Morgan.....	15.35
18	Hamilton.....	19.06	69	Cumberland.....	15.25
19	Schuyler.....	18.95	70	Kankakee.....	15.21
20	Bond.....	18.90	71	Christian.....	15.20
21	Jackson.....	18.77	72	Menard.....	15.15
22	White.....	18.76	73	Champaign.....	15.13
23	Johnson.....	18.72	74	Mercer.....	15.09
24	Fayette.....	18.66	75	Putnam.....	15.07
25	Hancock.....	18.47	76	Henderson.....	15.05
26	St. Clair.....	18.44	77	Piatt.....	15.00
27	Union.....	18.43	78	Sangamon.....	15.00
28	Pike.....	18.35	79	Montgomery.....	14.85
29	McDonough.....	18.20	80	Douglas.....	14.68
30	Gallatin.....	18.10	81	Lake.....	14.59
31	Jersey.....	18.10	82	Macoupin.....	14.43
32	Livingston.....	17.87	83	Edgar.....	13.99
33	Adams.....	17.83	84	Vermilion.....	13.99
34	Calhoun.....	17.76	85	DuPage.....	13.84
35	Massac.....	17.66	86	Tazewell.....	13.83
36	Scott.....	17.53	87	McHenry.....	13.81
37	Fulton.....	17.31	88	Henry.....	13.51
38	Saline.....	17.16	89	Jo Daviess.....	13.40
39	Madison.....	16.95	90	Boone.....	13.15
40	Peoria.....	16.94	91	Kane.....	13.02
41	Pope.....	16.82	92	DeKalb.....	12.95
42	Grundy.....	16.79	93	Clark.....	12.94
43	Mason.....	16.79	94	Stephenson.....	12.85
44	Ford.....	16.78	95	Ogle.....	12.73
45	Greene.....	16.76	96	Bureau.....	12.63
46	Alexander.....	16.70	97	Rock Island.....	12.33
47	Pulaski.....	16.47	98	Whiteside.....	12.13
48	Effingham.....	16.45	99	Winnebago.....	11.86
49	Kendall.....	16.42	100	Lee.....	11.61
50	Moultrie.....	16.32	101	Woodford.....	11.38
51	Will.....	16.31	102	Carroll.....	10.62

The relative variability of crops within any county may be compared by using Column 3 of Tables 1-5.

A comparison of the relative variability of crop yields over the state may be obtained from the state data given in the last line of Tables 1 through 5. Using these state averages we find that oats have the most variable yields; corn is second; wheat, third; soybeans, fourth; and hay the most stable.

Part II — EFFECT OF CROP DIVERSIFICATION ON FARM INCOME AND INCOME VARIABILITY

In Part I our primary purpose was the comparison of counties with respect to crop yield variabilities. To make such a comparison meaningful, yield variabilities were expressed as percentages of an average yield (standard error of estimate of yield per acre divided by average yield per acre, 1949-1953).

In Part II, however, interest is in the effect of crop diversification on (a) average level of income per acre, and (b) variability of income per acre in a particular county. Since we do not attempt to compare counties in this analysis, the measure of variability is expressed in actual dollars per acre and not as a percent of the average level of income per acre for any period.

In considering the income¹ and income variability effects of diversification, two pairs of crops are studied. The first of these is corn and soybeans, frequent competitors for the acreage allotted to cultivated crops. The following analysis shows the effect on income variability of dividing an acreage in different proportions between these two crops. The choice of a small-grain crop usually lies between oats and wheat. Accordingly, the effect of diversification upon year-to-year income variability of these crops is also compared.

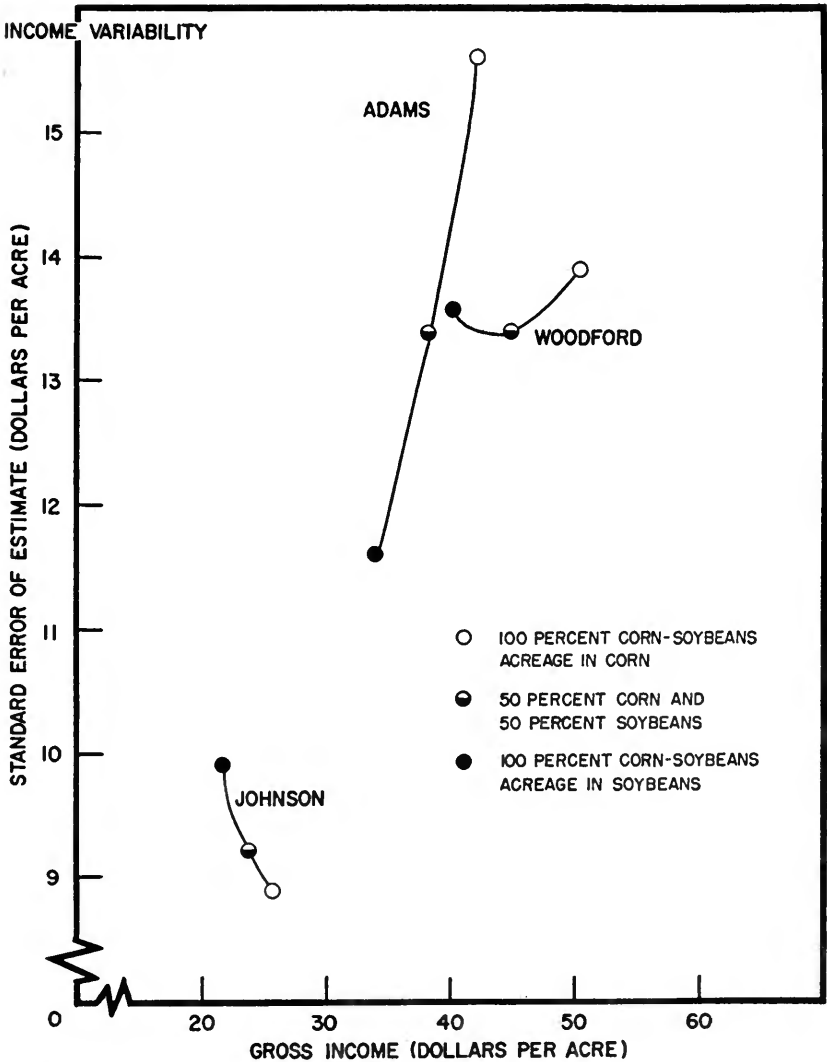
Gross income is used because both crops considered within a class (cultivated or small grain) require approximately the same tillage and harvesting operations. Seed and fertilizer costs may vary slightly between crops within a class but it is not believed that omission of these costs along with other operating costs will alter the conclusions of the analysis. Appropriate cost-of-production data are not available for a time period of sufficient length to display the variability which is our focus of attention in this study.²

¹ Prices used to compute gross incomes are those reported by the Cooperative Crop Reporting Service. Prices for Crop Reporting Districts were used for counties within that district.

² Although cost-of-production studies have been conducted by the Illinois Agricultural Experiment Station since 1913, the period of time the study has been located in any one area of the state, almost without exception, has been quite limited.

The applicability of the results of the following analysis based on county yield data to any particular farm within a county depends, of course, on the similarity between conditions on that farm and the average of the county.

Corn and soybeans. What has been the relation between income variability and diversification between corn and soybeans? Using the



Effect of corn-soybeans combination on income and income variability in three counties, 1927-1953. (See Table 6.) (Fig. 3)

standard error of estimate about the trend¹ as a measure of income variability, the effect on income and its variability of substituting soybeans for corn is presented in Table 6. Income variability weighed against average level of income may be an aid in selecting the best crop combination for a particular farmer.

Three general types of relationships are noted between income variability and the manner in which corn-soybean land is divided between these two crops. In Figure 3, data are presented for three counties representing these general relationships. Adams county represents the most common relationship — a shift from 100 percent corn to 100 percent soybeans reduces both gross income and income variability throughout the entire range of combinations. Seventy-nine of the 102 counties had a relationship of this nature during the period studied.

Woodford county displays a U-shaped relationship. A combination of corn and soybeans resulted in less income variability than either extreme of specialization. In the case of Woodford county, 38 percent of the corn-soybean acreage devoted to corn would have minimized income variability in the 27-year period considered. Twenty-one counties had income data corresponding to this general U-shaped pattern (Table 6). Substitution of soybeans for corn beyond the minimum variability point not only increased variability, but generally decreased income in these counties.²

The twenty-one counties displaying the U-shaped relationship between average level of income and its variability may be further subdivided into two groups based on whether minimum variance occurred with more or less than 50 percent of the corn-soybean acreage in corn. Following are the counties in each of these groups.

*Minimum income variability
between 50 percent and
100 percent corn*

Grundy
Massac
Moultrie
Ogle
Pulaski
Union
Williamson

*Minimum income variability
between 50 percent and
100 percent soybeans*

Alexander McLean
Coles Marshall
Douglas Mason
Edgar Monroe
Jackson St. Clair
Jasper Warren
Livingston Woodford

¹ The standard error of estimate of income about the trend ($S_{y,t}$) is the square root of $[q^2S_{c,t}^2 + (1-q)^2S_{b,t}^2 + 2r_{cb,t}q(1-q)S_{c,t}S_{b,t}]$ where q is the proportion of the land devoted to corn, $S_{c,t}$ and $S_{b,t}$ are the standard error of estimate about trend of gross income from corn and soybeans respectively, and $r_{cb,t}$ is the partial correlation coefficient between gross incomes from corn and soybeans.

² In Alexander county, gross income per acre increased slightly as soybeans replaced corn.

Table 6. — Average Gross Incomes per Acre and Standard Errors of Estimate per Acre With Various Combinations of Corn and Soybeans in Illinois Counties, 1927-1953

(Average gross income figures in bold-face type)

County	Corn Soybeans	Percent				
		100	75	50	25	0
		0	25	50	75	100
Adams.....	\$41.94	\$39.96	\$37.99	\$36.01	\$34.03	
	15.59	14.43	13.40	12.41	11.59	
Alexander*.....	28.99	29.01	29.03	29.04	29.06	
	12.85	11.10	9.83	9.24	9.48	
Bond.....	31.61	29.71	27.81	25.91	24.01	
	12.74	11.62	10.82	10.04	9.55	
Boone ^b	50.79	46.64	42.48	38.33	34.18	
	15.23	13.86	12.61	11.51	10.61	
Brown.....	39.80	37.79	35.77	33.76	31.74	
	15.09	14.02	13.12	12.27	11.67	
Bureau.....	52.76	49.20	45.63	42.07	38.50	
	15.48	14.53	13.72	13.10	12.63	
Calhoun.....	43.58	40.47	37.36	34.24	31.13	
	14.76	13.35	12.21	11.17	10.53	
Carroll ^e	55.05	49.74	44.42	39.10	33.79	
	16.43	14.87	13.41	12.07	10.89	
Cass.....	45.97	42.98	40.00	37.01	34.02	
	15.36	14.22	13.25	12.42	11.83	
Champaign.....	48.45	45.91	43.38	40.84	38.30	
	13.69	13.05	12.56	12.26	12.15	
Christian.....	45.77	43.57	41.36	39.16	36.96	
	15.05	13.88	12.93	12.25	11.89	
Clark.....	36.97	34.51	32.06	29.60	27.14	
	10.86	10.32	9.98	9.63	9.51	
Clay.....	26.65	25.11	23.57	22.03	20.49	
	13.15	11.96	10.90	9.94	9.19	
Clinton.....	31.59	30.10	28.60	27.11	25.62	
	13.31	12.41	11.68	11.12	10.77	
Coles.....	43.19	41.01	38.84	36.66	34.48	
	11.99	11.32	10.91	10.73	10.88	
Cook ^d	42.03	39.69	37.36	35.02	32.68	
	12.97	11.89	10.97	10.27	9.84	
Crawford.....	36.00	33.03	30.06	27.10	24.13	
	13.05	11.90	10.93	9.96	9.25	
Cumberland.....	34.61	32.52	30.42	28.33	26.24	
	11.78	11.02	10.39	9.87	9.53	
DeKalb.....	54.77	50.54	46.30	42.07	37.83	
	15.24	14.30	13.54	12.85	12.40	
DeWitt.....	46.19	44.05	41.92	39.78	37.64	
	13.08	12.44	12.00	11.75	11.74	
Douglas.....	47.47	45.03	42.58	40.14	37.70	
	12.80	12.04	11.67	11.48	11.73	
DuPage ^d	46.34	43.20	40.06	36.91	33.77	
	14.47	13.23	12.13	11.20	10.50	
Edgar.....	46.29	43.80	41.31	38.82	36.33	
	12.57	12.00	11.72	11.56	11.74	
Edwards.....	34.66	32.20	29.74	27.28	24.82	
	14.77	13.52	12.41	11.52	10.88	
Effingham.....	31.28	29.58	27.88	26.17	24.47	
	12.06	11.38	10.86	10.44	10.21	
Fayette.....	29.43	27.90	26.36	24.83	23.30	
	11.81	11.24	10.77	10.37	10.18	

(See page 20 for footnotes)

Table 6. — Continued

County	Corn Soybeans	Percent								
		100	75	50	25	0				
		0	25	50	75	100				
Ford.....	44.43	42.14	39.86	37.58	35.29	12.87	12.37	12.00	11.74	11.64
Franklin.....	25.50	24.16	22.82	21.47	20.13	9.84	9.47	9.20	9.04	8.98
Fulton.....	45.71	43.17	40.62	38.08	35.53	14.54	13.68	12.93	12.24	11.71
Gallatin.....	36.25	33.45	30.65	27.85	25.05	12.56	11.62	10.83	10.22	9.81
Greene.....	43.48	40.93	38.38	35.84	33.29	15.64	14.69	14.00	13.32	12.94
Grundy ^o	43.93	38.78	33.64	28.50	23.36	12.38	12.23	12.33	12.67	13.22
Hamilton.....	27.39	25.92	24.46	22.99	21.52	11.30	10.57	9.92	9.37	8.95
Hancock.....	44.05	41.81	39.57	37.32	35.08	15.05	13.95	12.95	12.15	11.50
Hardin ^f	29.02	28.11	27.20	26.29	25.38	11.01	10.04	9.32	8.88	8.79
Henderson.....	47.77	44.68	41.59	38.50	35.41	14.31	13.38	12.62	12.05	11.71
Henry.....	50.98	47.82	44.66	41.50	38.34	13.79	13.29	12.92	12.74	12.71
Iroquois.....	43.18	41.04	38.90	36.75	34.61	13.45	12.66	12.04	11.64	11.46
Jackson.....	32.24	30.24	28.24	26.25	24.25	10.70	10.36	10.19	10.18	10.34
Jasper.....	32.49	30.14	27.79	25.44	23.09	13.41	10.78	9.20	9.11	10.65
Jefferson.....	25.57	24.56	23.54	22.52	21.51	10.81	10.49	10.21	10.01	9.87
Jersey.....	41.47	39.56	37.64	35.73	33.82	13.87	13.18	12.61	12.16	11.86
Jo Daviess ^g	50.29	46.27	42.24	38.22	34.20	14.96	13.36	11.93	10.75	9.89
Johnson.....	25.56	24.56	23.57	22.58	21.58	8.89	8.96	9.15	9.47	9.91
Kane.....	52.64	48.33	44.03	39.72	35.41	14.41	13.43	12.40	11.85	11.32
Kankakee.....	42.68	40.54	38.40	36.25	34.11	13.28	12.71	12.27	11.94	11.75
Kendall.....	47.42	44.53	41.64	38.74	35.85	13.48	12.55	11.84	11.30	11.05
Knox.....	48.19	45.66	43.13	40.59	38.06	13.87	13.36	13.05	12.85	12.76
Lake ^o	43.86	40.72	37.58	34.44	31.30	13.88	12.58	11.42	10.46	9.75
LaSalle.....	49.22	46.47	43.73	40.98	38.23	13.81	13.16	12.68	12.41	12.34
Lawrence.....	32.72	30.22	27.71	25.20	22.70	13.15	11.94	10.97	10.10	9.58

(See page 20 for footnotes)

Table 6.—Continued

County	Corn Soybeans	Percent								
		100	75	50	25	0				
		0	25	50	75	100				
Lee.....	52.09	48.13	44.18	40.22	36.26	15.59	14.60	13.63	12.93	12.28
Livingston.....	44.02	41.87	39.72	37.56	35.41	12.49	12.15	11.94	11.85	11.91
Logan.....	48.90	46.04	43.18	40.33	37.47	15.40	14.32	13.39	12.62	12.07
McDonough.....	46.90	44.55	42.21	39.85	37.51	14.81	13.97	13.24	12.71	12.34
McHenry ^d	48.21	44.22	40.23	36.24	32.26	13.37	12.48	11.79	11.33	11.15
McLean.....	48.13	45.67	43.21	40.74	38.28	13.40	13.08	12.90	12.85	12.95
Macon.....	46.71	44.54	42.36	40.18	38.01	14.61	13.57	12.73	12.17	11.89
Macoupin.....	39.47	37.69	35.92	34.14	32.36	14.67	13.41	12.37	11.32	10.56
Madison.....	37.46	35.57	33.68	31.79	29.90	13.66	13.11	12.66	12.09	11.66
Marion.....	24.99	23.92	22.86	21.80	20.73	11.56	11.10	10.74	10.49	10.36
Marshall.....	47.11	44.56	42.01	39.46	36.91	13.75	13.39	13.18	13.10	13.16
Mason.....	36.93	35.36	33.78	32.21	30.64	12.32	12.07	11.92	11.89	11.98
Massac ^e	31.61	29.46	27.32	25.18	23.04	9.55	9.45	9.50	9.71	10.06
Menard.....	44.85	42.32	39.80	37.27	34.74	14.64	13.89	13.27	12.82	12.53
Mercer ^b	48.95	45.78	42.61	39.44	36.27	14.69	13.48	12.39	11.46	10.74
Monroe ⁱ	38.07	35.84	33.60	31.36	29.12	12.40	12.08	11.96	12.04	12.32
Montgomery.....	38.97	37.14	35.32	33.50	31.67	14.10	12.27	10.63	9.07	7.88
Morgan.....	46.96	44.44	41.92	39.39	36.87	15.55	14.59	13.82	13.19	12.80
Moultrie.....	43.71	42.03	40.35	38.67	36.99	11.86	11.63	11.71	11.93	12.42
Ogle ^b	52.93	49.43	45.94	42.44	38.94	15.74	15.73	16.07	16.71	17.65
Peoria.....	46.80	43.20	39.60	36.01	32.41	14.42	14.10	13.88	13.75	13.73
Perry.....	24.99	23.80	22.62	21.43	20.24	9.83	9.85	9.97	10.17	10.47
Piatt.....	49.76	47.14	44.52	41.89	39.27	14.28	13.60	13.05	12.67	12.45
Pike.....	42.26	39.84	37.42	35.01	32.59	15.14	14.11	13.32	12.53	12.04
Pope ^e	28.27	26.84	25.42	23.99	22.57	10.23	9.72	9.34	9.10	9.01
Pulaski ^d	28.91	27.81	26.71	25.61	24.51	8.31	8.10	8.24	8.69	9.42

(See page 20 for footnotes)

Table 6. — Concluded

County	Corn Soybeans	Percent				
		100	75	50	25	0
		0	25	50	75	100
Putnam.....	51.17	48.12	45.07	42.02	38.97	
	14.84	14.04	13.36	12.88	12.56	
Randolph.....	34.10	31.76	29.41	27.06	24.72	
	13.03	12.06	11.32	10.84	10.66	
Richland.....	27.98	26.13	24.28	22.43	20.58	
	12.69	11.62	10.64	9.78	9.08	
Rock Island.....	50.54	46.81	43.08	39.35	35.62	
	15.88	14.84	13.85	13.07	12.38	
St. Clair.....	38.14	36.16	34.18	32.20	30.22	
	13.44	12.90	12.54	12.38	12.43	
Saline.....	32.42	30.52	28.61	26.70	24.80	
	11.51	10.86	10.38	10.07	9.96	
Sangamon.....	45.06	42.94	40.82	38.69	36.57	
	15.08	13.88	12.97	12.20	11.81	
Schuyler.....	42.76	40.29	37.82	35.34	32.87	
	14.07	13.13	12.31	11.66	11.17	
Scott.....	43.39	40.86	38.32	35.79	33.26	
	13.93	13.25	12.75	12.53	12.52	
Shelby.....	39.23	37.21	35.19	33.17	31.15	
	12.09	11.43	11.20	10.58	10.46	
Stark ^b	49.43	46.74	44.06	41.38	38.70	
	14.86	14.11	13.48	12.97	12.61	
Stephenson.....	53.67	48.63	43.58	38.54	33.49	
	15.72	14.34	13.12	11.96	11.05	
Tazewell.....	49.15	46.54	43.94	41.33	38.72	
	14.84	14.09	13.47	12.99	12.67	
Union ^c	29.46	28.21	26.97	25.72	24.48	
	8.43	8.30	8.41	8.77	9.34	
Vermilion.....	44.93	42.58	40.22	37.87	35.52	
	14.00	13.36	12.87	12.52	12.34	
Wabash ^d	39.42	36.32	33.22	30.12	27.02	
	16.13	14.13	12.52	11.45	11.08	
Warren.....	49.66	47.09	44.52	41.94	39.37	
	14.23	13.78	13.53	13.35	13.38	
Washington.....	27.03	25.92	24.80	23.68	22.57	
	12.57	12.02	11.60	11.32	11.20	
Wayne.....	26.77	25.24	23.70	22.17	20.64	
	12.72	11.52	10.42	9.48	8.73	
White.....	33.77	31.38	28.99	26.60	24.21	
	13.36	12.50	11.71	11.04	10.48	
Whiteside.....	53.31	48.65	43.99	39.34	34.68	
	16.60	15.23	14.00	12.92	12.13	
Will.....	42.01	39.87	37.72	35.58	33.43	
	13.91	12.86	12.03	11.25	10.76	
Williamson.....	25.91	24.56	23.20	21.85	20.50	
	9.75	9.71	9.81	10.06	10.46	
Winnebago.....	50.36	45.55	40.89	36.15	31.41	
	14.71	13.47	12.46	11.43	10.71	
Woodford.....	50.33	47.60	44.86	42.12	39.39	
	13.89	13.57	13.40	13.40	13.58	

Footnotes refer only to soybeans.

^a No data reported for 1927, 1928, 1932, 1933, and 1935.^b No data reported for 1928 and 1934.^c No data reported for 1927 and 1928.^d No data reported for 1928.^e No data reported for 1934.^f No data reported for 1927, 1928, 1930, 1931, 1932, 1933, 1934, 1940, and 1950.^g No data reported for 1927, 1928, and 1934.^h No data reported for 1927.ⁱ No data reported for 1933.

Two counties — Johnson and Perry — experienced increasing variability and decreasing income as soybeans were substituted for corn throughout the entire range. Soybeans would not appear to be a good substitute for corn in terms of both income and its variability in these two counties.

In about three-fourths of the counties increased income was accompanied by increased variability through the complete range of alternative combinations from 100 percent soybeans to 100 percent corn. However, variability increases at a more rapid rate than does average income as corn is substituted for soybeans.

For example, in Adams county the increase in the standard error of estimate per dollar of income gained by moving from 100 percent soybeans to 25 percent corn — 75 percent soybeans is \$0.41; from this combination to 50 percent in each crop, \$0.50; from 50 percent in each to 75 percent corn — 25 percent soybeans, \$0.52; and from the latter to 100 percent corn, \$0.59 (Fig. 3).

Whether the gains in increased stability from diversification between corn and soybeans are sufficient to offset the possible income decrease is a matter that will depend on the ability and willingness of the individual farmer to accept the consequences of income variability. The livestock system, as well as the labor supply, will of course also play a role in the selection of the cultivated crops.

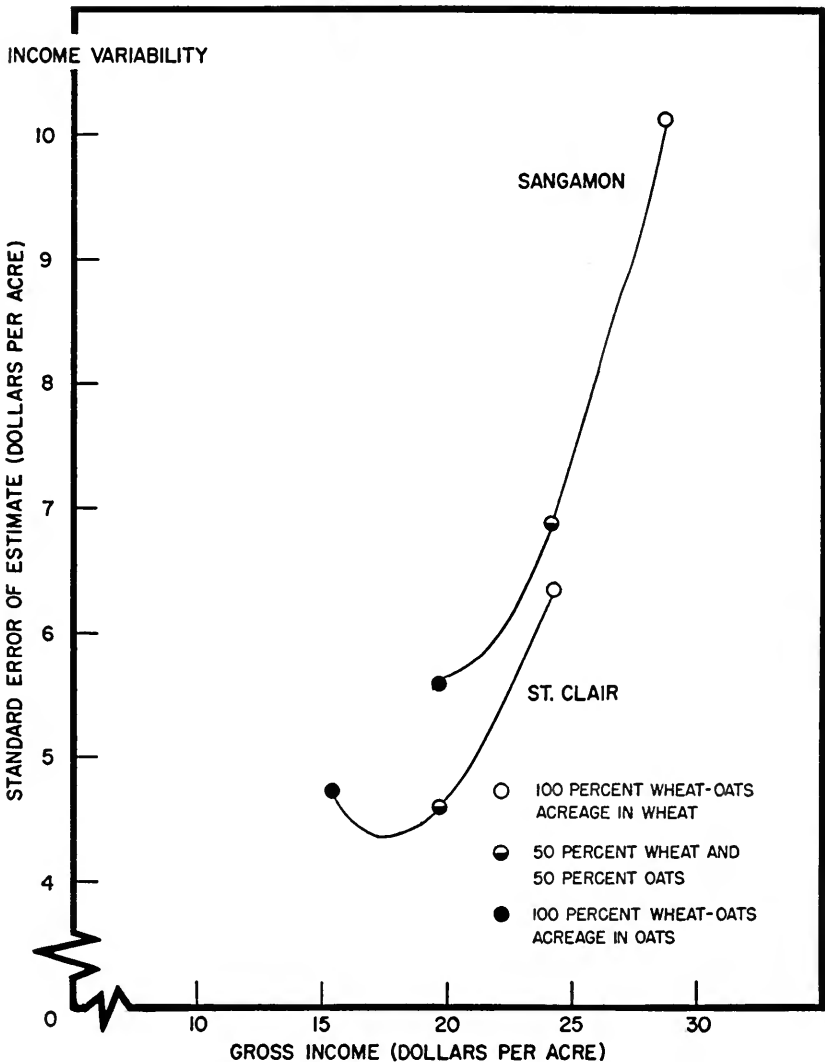
Oats and wheat. In Table 7 the effect of substitution of oats for wheat on income and its variability is shown. In the following counties (see Fig. 4 for the example of St. Clair county), income variability was minimized by a combination of approximately 75 percent oats and 25 percent wheat:

Edwards	Lawrence	Perry
Effingham	Macoupin	Pope
Gallatin	Madison	Randolph
Jackson	Marion	St. Clair
Jersey	Menard	Wabash
Johnson	Monroe	Washington
Lake	Ogle	White

In Clinton county, a 50-50 combination served to minimize income variability during this period. In the remaining 80 counties, 100 percent oats would have kept income variability at a minimum. An example of this relationship is in Sangamon county (Fig. 4).

As in the case of corn and soybeans, a reduction of average income accompanies the reduction of income variability in the majority of situ-

ations. This sacrifice in income must be considered, as well as such factors as the relative desirability of oats and wheat as nurse crops. Furthermore, government wheat acreage allotments have not permitted free substitution of wheat for oats in recent years. Seeding winter wheat on land in corn is not always possible due to the time of corn harvest. This may further restrict the range of choice between wheat and oats.



Effect of wheat-oats combination on income and income variability in two Illinois counties, 1927-1953. (See Table 7.) (Fig. 4)

Table 7.—Average Gross Incomes per Acre and Standard Errors of Estimate per Acre With Various Combinations of Wheat and Oats in Illinois Counties, 1927-1953

(Average gross income figures in bold-face type)

County	Wheat Oats	Percent				
		100	75	50	25	0
		0	25	50	75	100
Adams.....	\$24.84	\$22.43	\$20.02	\$17.61	\$15.20	8.29 7.04 5.98 5.20 4.89
Alexander.....	20.88	18.73	16.59	14.44	12.29	5.40 4.64 4.04 3.69 3.67
Bond.....	22.21	19.68	17.14	14.61	12.08	7.75 6.24 5.03 4.25 4.21
Boone.....	30.48	28.52	26.56	24.61	22.65	11.91 10.67 9.64 8.92 8.57
Brown.....	24.52	21.88	19.25	16.61	13.97	9.21 7.63 6.32 5.27 4.89
Bureau.....	32.48	29.64	26.81	23.97	21.13	10.77 10.96 8.57 7.68 7.06
Calhoun.....	25.45	22.37	19.29	16.21	13.13	9.12 7.28 5.66 4.40 3.99
Carroll.....	30.50	28.22	25.95	23.68	21.40	10.27 9.44 8.72 8.14 7.73
Cass.....	27.77	24.96	22.14	19.32	16.51	9.75 8.00 6.49 5.20 4.61
Champaign.....	30.64	27.31	23.98	20.65	17.32	10.43 8.90 7.10 6.14 5.04
Christian.....	29.19	26.49	23.80	21.10	18.40	9.44 7.95 6.79 6.01 5.92
Clark.....	20.45	18.15	15.85	13.55	11.25	7.91 6.64 6.25 4.88 4.69
Clay.....	17.47	15.42	13.36	11.31	9.26	6.40 5.51 4.75 4.07 3.67
Clinton.....	22.06	20.29	18.52	16.76	14.99	6.36 5.10 4.36 4.39 5.17
Coles.....	26.72	24.14	21.56	18.97	16.39	8.46 7.21 6.18 5.39 5.08
Cook.....	30.97	28.58	26.18	23.78	21.39	9.67 8.85 8.23 7.90 7.87
Crawford.....	19.64	17.38	15.12	12.85	10.59	5.69 4.87 4.30 4.95 3.99
Cumberland.....	21.33	18.76	16.18	13.61	11.04	7.59 6.37 5.31 4.47 4.09
DeKalb.....	33.08	31.03	28.98	26.93	24.88	11.36 9.91 8.77 7.97 7.72
DeWitt.....	29.67	26.55	23.42	20.30	17.18	11.34 9.43 7.70 6.26 5.37
Douglas.....	29.19	26.38	23.56	20.75	17.94	10.18 8.43 6.93 5.77 5.30
DuPage.....	32.95	30.59	28.22	25.86	23.50	11.36 10.21 9.26 8.59 8.25
Edgar.....	27.30	24.72	22.13	24.72	16.96	9.33 7.93 6.77 5.97 5.70
Edwards.....	20.58	18.38	16.18	13.98	11.78	5.36 4.63 4.10 3.87 3.96
Effingham.....	20.83	18.49	16.14	13.80	11.46	7.34 6.16 5.36 4.76 4.81
Fayette.....	20.05	17.96	15.37	13.78	11.69	7.73 6.51 5.50 4.84 4.68

Table 7.—Continued

County	Wheat Oats	Percent				
		100	75	50	25	0
		0	25	50	75	100
Ford.....		30.03	26.60	23.18	19.75	16.32
		10.54	8.68	6.99	5.61	4.80
Franklin.....		19.50	17.31	15.12	12.94	10.75
		6.12	5.02	4.02	3.20	2.75
Fulton.....		27.21	24.67	22.14	19.60	17.06
		9.89	8.44	7.16	6.12	5.52
Gallatin.....		21.43	18.94	16.44	13.94	11.45
		6.18	5.34	4.70	4.39	4.46
Greene.....		24.71	22.32	19.92	17.53	15.14
		8.22	6.68	5.38	4.48	4.30
Grundy ^a		31.22	28.05	24.88	21.70	18.53
		11.27	9.54	8.01	6.78	6.05
Hamilton.....		19.07	16.88	14.68	12.49	10.30
		5.61	4.86	4.24	3.81	3.62
Hancock.....		26.62	24.09	21.57	19.04	16.51
		9.32	7.93	6.70	5.77	5.26
Hardin ^b		18.39	16.38	14.36	12.35	10.33
		6.29	5.60	5.07	4.76	4.72
Henderson.....		27.36	24.73	22.10	19.47	16.84
		9.59	8.28	7.15	6.18	5.57
Henry.....		30.58	27.95	25.32	22.68	20.05
		9.96	8.80	7.86	7.13	6.76
Iroquois.....		30.91	27.16	23.42	19.67	15.92
		10.75	8.90	7.23	5.88	5.11
Jackson.....		21.07	19.11	17.15	15.19	13.23
		5.65	4.97	4.50	4.32	4.47
Jasper.....		19.18	16.94	14.70	12.46	10.22
		6.91	5.63	4.70	4.01	3.67
Jefferson.....		19.01	16.76	14.50	12.25	10.00
		5.97	4.97	4.16	3.67	3.64
Jersey.....		24.73	22.01	19.30	16.59	13.88
		8.00	6.28	4.86	4.04	4.26
Jo Daviess.....		27.23	25.67	24.12	22.56	21.00
		10.24	9.17	8.29	7.64	7.30
Johnson.....		18.72	17.00	15.28	13.57	11.85
		5.59	5.18	4.92	4.80	4.86
Kane.....		34.26	31.87	29.48	27.09	24.70
		11.76	10.42	9.24	8.40	7.89
Kankakee.....		29.47	26.52	23.56	20.61	17.66
		10.29	8.73	7.34	6.23	5.58
Kendall.....		33.26	30.54	27.82	25.10	22.38
		10.47	9.22	8.15	7.37	6.94
Knox.....		29.85	26.86	23.87	20.87	17.88
		8.07	7.24	6.55	6.02	5.71
Lake.....		32.30	29.94	27.58	25.22	22.86
		10.09	9.49	9.13	9.05	9.25
LaSalle.....		31.68	29.00	26.31	23.63	20.94
		11.22	10.92	8.31	7.30	6.82
Lawrence.....		19.80	17.66	15.53	13.40	11.26
		6.17	5.28	4.67	4.49	4.74

^a No wheat yield reported for 1934.^b No oats yield reported for 1934; no wheat yield reported for 1950.

Table 7.—Continued

County	Wheat Oats	Percent								
		100	75	50	25	0				
		0	25	50	75	100				
Lee.....	32.95	30.15	27.34	24.54	21.73	11.39	10.14	9.04	7.95	7.11
Livingston.....	29.89	26.62	23.34	20.06	16.79	10.37	8.73	7.22	5.98	5.16
Logan.....	30.17	27.27	24.38	21.48	18.58	11.05	9.15	7.46	6.19	5.61
McDonough.....	28.21	25.57	22.92	20.28	17.63	9.64	8.15	6.84	5.85	5.34
McHenry.....	32.30	30.00	27.69	25.39	23.08	13.00	11.49	10.29	9.50	9.25
McLean.....	30.75	27.56	24.37	21.18	17.99	11.85	9.79	7.89	6.31	5.30
Macon.....	30.54	27.42	24.30	21.18	18.06	10.77	8.92	7.44	6.27	5.96
Macoupin.....	24.36	22.17	19.98	17.78	15.59	7.98	6.42	5.18	4.44	4.53
Madison.....	23.99	21.31	18.64	15.96	13.28	4.61	3.81	3.20	2.94	3.10
Marion.....	18.98	16.83	14.68	12.53	10.38	5.93	5.01	4.34	3.99	4.10
Marshall.....	30.03	27.14	24.25	21.36	18.47	10.98	9.47	8.11	7.06	6.41
Mason.....	24.32	21.71	19.10	16.48	13.87	8.14	6.74	5.58	4.80	4.61
Massac.....	19.84	18.02	16.20	14.37	12.55	5.49	4.79	4.25	3.94	3.92
Menard.....	27.76	25.16	22.57	19.98	17.38	10.28	8.39	6.86	5.95	5.98
Mercer.....	28.30	25.70	23.10	20.50	17.90	9.91	8.68	7.61	6.79	6.32
Monroe.....	24.70	22.31	19.92	17.53	15.14	6.07	5.26	4.78	4.75	5.17
Montgomery.....	25.06	22.57	20.08	17.59	15.10	8.50	6.83	5.30	3.99	3.28
Morgan.....	28.81	26.20	23.59	20.98	18.37	10.05	8.36	6.94	5.87	5.48
Moultrie.....	28.38	25.62	22.86	20.09	17.33	10.00	8.42	7.07	5.98	5.46
Ogle.....	30.61	28.56	26.51	24.46	22.41	11.12	10.47	10.07	9.95	10.13
Peoria.....	30.10	27.03	23.96	20.89	17.82	10.98	9.49	8.15	7.06	6.33
Perry.....	17.94	16.09	14.24	12.39	10.54	6.04	5.03	4.27	3.96	4.16
Piatt.....	30.96	27.80	24.64	21.47	18.31	10.76	8.94	7.34	6.15	5.63
Pike.....	23.49	21.17	18.86	16.54	14.22	8.27	6.76	5.46	4.53	4.25
Pope.....	18.85	16.98	15.12	13.25	11.38	5.45	4.95	4.61	4.47	4.53
Pulaski.....	20.31	18.37	16.44	14.50	12.56	5.79	5.02	4.40	3.99	3.85

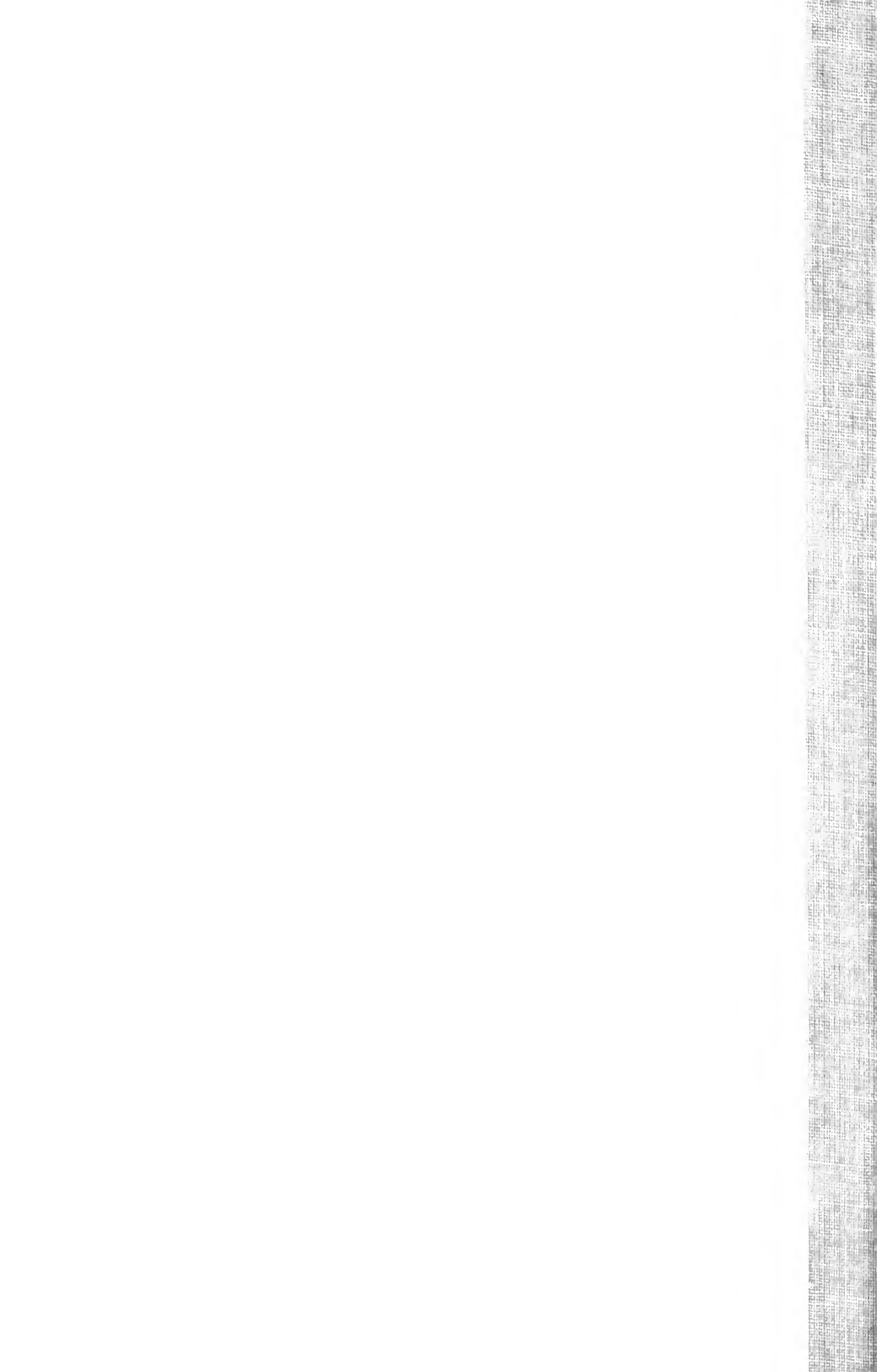
Table 7. — Concluded

County	Wheat Oats	Percent								
		100	75	50	25	0				
		0	25	50	75	100				
Putnam.....	30.99	28.61	26.22	23.84	21.45	10.79	9.66	8.66	7.88	7.33
Randolph.....	21.71	19.87	18.02	16.18	14.34	6.11	5.14	4.54	4.44	4.88
Richland.....	18.75	16.49	14.22	11.96	9.70	5.74	4.96	4.28	3.74	3.42
Rock Island.....	28.44	25.98	23.51	21.05	18.58	10.32	9.14	8.14	7.26	6.71
St. Clair.....	24.29	22.06	19.82	17.58	15.35	6.35	5.29	4.59	4.38	4.75
Saline.....	20.43	18.14	15.85	13.56	11.27	5.71	5.05	4.57	4.29	4.26
Sangamon.....	28.90	26.46	24.03	21.60	19.16	10.12	8.36	6.90	5.87	5.60
Schuyler.....	25.92	23.30	20.67	18.05	15.42	9.42	7.80	6.44	5.45	5.15
Scott.....	25.31	22.89	20.47	18.05	15.63	7.92	6.45	5.23	4.50	4.46
Shelby.....	24.53	21.94	19.35	16.76	14.17	8.15	6.96	5.91	5.09	4.62
Stark.....	32.07	28.83	25.60	22.36	19.12	12.38	10.51	8.90	7.73	7.20
Stephenson.....	28.22	26.72	25.23	23.73	22.23	10.50	9.57	8.76	8.19	7.84
Tazewell.....	29.05	26.38	23.71	21.04	18.37	11.18	9.40	7.83	6.60	5.92
Union.....	21.52	19.29	17.07	14.84	12.61	6.03	5.15	4.44	4.01	3.93
Vermilion.....	29.25	25.96	22.67	19.38	16.09	10.25	8.48	6.90	5.70	5.13
Wabash.....	21.63	19.49	17.34	15.20	13.05	6.03	5.56	5.29	5.24	5.42
Warren.....	29.65	26.78	23.92	21.06	18.19	9.83	8.47	7.32	6.34	5.78
Washington.....	20.16	18.52	16.87	15.22	13.58	6.50	5.27	4.44	4.27	4.84
Wayne.....	18.41	16.30	14.19	12.08	9.97	5.27	4.57	3.97	3.54	3.33
White.....	19.60	17.58	15.56	13.53	11.51	5.45	4.83	4.38	4.19	4.26
Whiteside.....	30.74	28.42	26.09	23.76	21.44	10.13	9.21	8.37	7.75	7.35
Will.....	32.16	29.16	26.16	23.15	20.15	10.12	8.98	8.07	7.35	7.03
Williamson.....	19.07	17.09	15.11	13.13	11.15	5.68	5.02	4.50	4.19	4.14
Winnebago.....	28.90	26.82	24.74	22.66	20.58	8.96	8.89	7.84	7.52	7.39
Woodford.....	30.19	27.30	24.41	21.52	18.63	8.49	7.50	6.72	6.23	6.09

SUMMARY

County average corn, soybean, wheat, oats, and hay yields were studied for the period 1927-1953 to determine the relative variability of yields among areas and among crops. Yield dependability affects crop choice, land values, crop insurance programs, credit arrangements, and other aspects of the farm business. The five major crops ranked as follows in order of decreasing yield variability: oats, corn, wheat, soybeans, and hay. In general, yield stability for all crops increased in moving from southern Illinois to northern Illinois.

Diversification between corn and soybeans in acreage of cultivated crops resulted in three patterns of effect on income variability. The most common pattern was that of a reduction in both average income and its variability as soybeans are substituted for corn. The gains from diversification between wheat and oats were of two general types. The large majority of the counties displayed a reduction in both income variability and average income as oats replaced wheat in the land devoted to small grain.



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