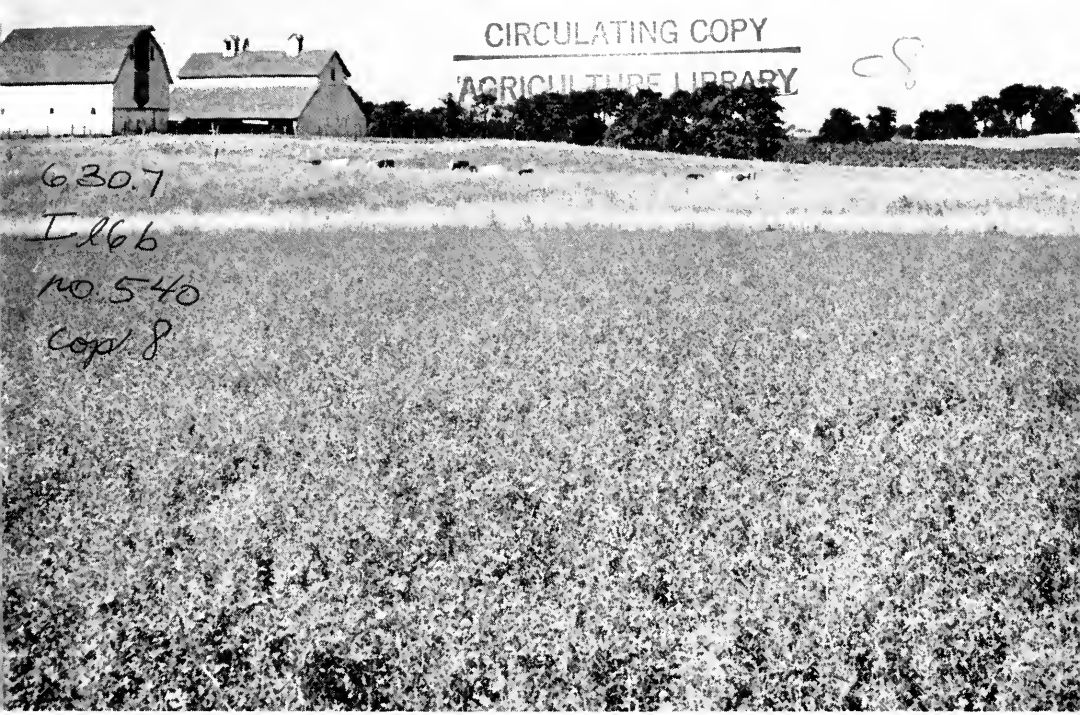

Costs and Benefits from SOIL CONSERVATION in Northeastern Illinois

By E. L. SAUER, J. L. McGURK, and L. J. NORTON

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Costs and Benefits of SOIL CONSERVATION IN NORTHEASTERN ILLINOIS

By E. L. Sauer, J. L. McGurk, and L. J. Norton[1]

NORTHEASTERN ILLINOIS has approximately 2½ million acres of slowly permeable or, as they are sometimes called, "tight soils." These soils are found in parts of eighteen counties, as shown in the map on the next page. The slowness with which water moves through these soils makes farming problems in this area more serious than they are in regions of similar topography where more permeable soils predominate. Even on gentle slopes, erosion is a serious problem. Drainage of level areas is difficult because water moves into tile only slowly — in some areas moderately slowly and in some areas very slowly. On many farms surface ditches must be used to provide drainage. Spring planting is often delayed because the soils stay wet abnormally long.

Most of these problem soils are worth saving for agricultural production. If, however, the land is to remain productive and in condition to provide a reasonable level of living for those who farm it, practices must be used that will conserve the topsoil and increase its productivity. Many of the present farming programs need to be changed, and the necessary changes usually require the outlay of some capital.

Are the benefits from conservation programs in this area worth the trouble and expense involved in establishing them? Can farmers on these soils afford to reduce acreages in grain and increase hay and pasture acreages in order to maintain or increase soil productivity? How much does it cost to establish a complete conservation program? Would livestock farming be as profitable as grain farming? If livestock are necessary in a good

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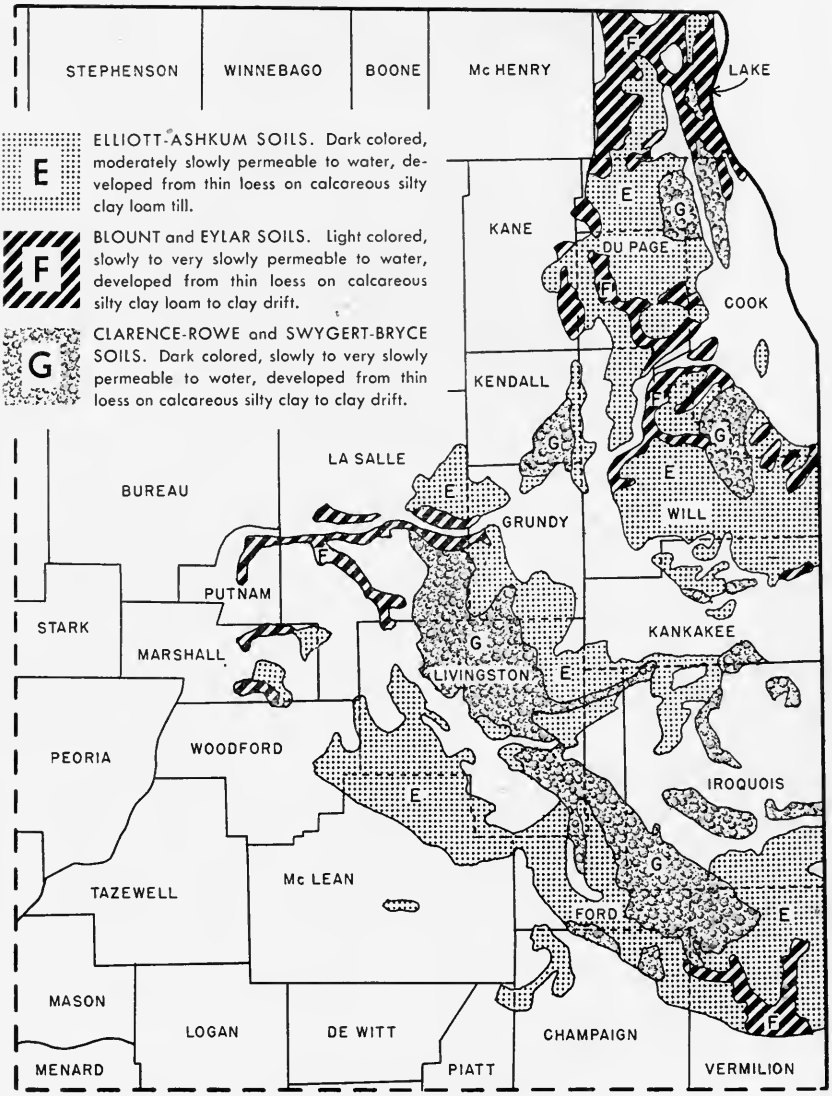


From Soil Association Map of Illinois, May, 1949, prepared in Department of Agronomy, University of Illinois

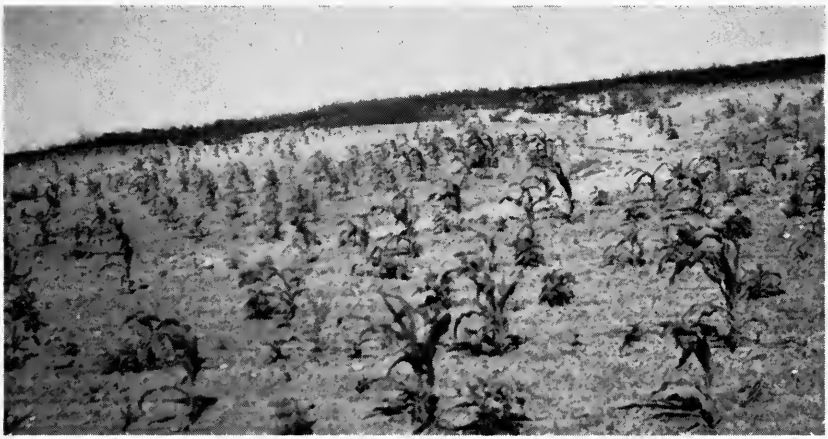
In eighteen counties in northeastern Illinois are extensive areas where a combination of thin topsoil and slowly permeable subsoil creates serious farming problems. Level soils drain poorly, sloping soils erode easily. Financial records summarized in this bulletin show that conservation practices will not only save the soil but will also substantially increase current earnings. (Fig. 1)

conservation program, can and will grain farmers become good livestock men?

This publication attempts to give at least partial answers to some of the above questions. Actual farm records are analyzed to show how certain conservation practices affect production and income; and estimates are given for the costs involved in establishing conservation programs on farms in this area.

Three Main Soil Groups in the Area

Clarence-Rowe, Swygert-Bryce, and Elliott-Ashkum are the main soil groups in this problem area in northeastern Illinois.[1] These soils have developed from thin loess, a silty wind-blown deposit, on moderately heavy to very heavy-textured plastic glacial till. Soil development and weathering processes, including the formation of the dark



Erosion has taken most of the topsoil and exposed the unproductive till on this field of Clarence silt loam. Such fields are expensive to operate, and yields are not worth much. (Fig. 2)

surface soil, have not gone as far on these soils as on more permeable soils. For this reason the dark surface horizons are thinner than those of many other prairie soils in central Illinois.

Erosion problems are especially serious on these soils for two

[1] Two "timber" types, Blount and Eylar (*see map*) also cover a considerable acreage. They often present even more serious problems than the three groups named above, as their topsoil in many places is even thinner.

Of the black locust trees planted in 1941 on this badly eroded spot of Clarence silt loam, only a few survived. Seven years later, when this picture was taken, the survivors had made practically no growth. (Fig. 3)

Planted on partly eroded Clarence silt loam on the rim of the area shown in Fig. 3, these trees lived and made satisfactory growth through the same seven years. Photographs taken October, 1948. (Fig. 4)

reasons: (1) the subsoil cannot absorb water rapidly and much water therefore runs off the land; and (2) the rapid runoff carries topsoil with it, removes the dark surface soil, and exposes the very unproductive glacial till (Fig. 2). Clarence, Swygert, and Elliott are usually acid; Rowe, Bryce, and Ashkum are frequently acid. All are usually low in phosphorus; hence they respond to liberal applications of lime and phosphate.

Farming problems are most serious on the Clarence-Rowe soils and least serious on Elliott-Ashkum. Clarence, Swygert, and Elliott soil types are found on rolling topography, and consequently erosion is most damaging on these soils (Figs. 3 and 4). Rowe, Bryce, and Ashkum soils, on the other hand, occur on nearly level or depressional areas. On these soils drainage is a major problem. After heavy spring and summer rains, water often stands in ponds, with the result that planting is delayed and crops are frequently drowned out (Fig. 5).

Soil-survey maps for all counties in northeastern Illinois except Cook county have been published by the Illinois Agricultural Experiment Station, Urbana. However, only those for Ford, Iroquois, Livingston, Vermilion, and Kendall counties show the distribution of these three soil groups and identify them by name. Farmers in these and other counties may consult with farm advisers, soil conservationists, or write to the Experiment Station to determine whether their farms have any of these problem soils.

Data Obtained From Six Counties

The farms from which information for this study was obtained are all located on slowly permeable soils in six of the eighteen counties in the problem area — Ford, Iroquois, Livingston, LaSalle, Vermilion,

In depressional areas of Rowe clay loam to clay, fields pond easily and drain off very slowly. Crops drown and yields are low. Two ponds like this cut the income from a 40-acre field approximately 10 percent. (Fig. 5)

and Will. All six counties are in the cash-grain area of the state known as Area 4a, where corn, soybeans, and oats are the main crops. Conclusions regarding the benefits from conservation in these six counties are, however, applicable throughout the problem area.

Farm business records for 105 farms were used. For 65 farms, survey records were obtained for 1945, 1946, and 1947. For 40 farms, Farm-Bureau Farm-Management records were available.[1] Additional information on conservation needs and costs was obtained from county Soil Conservation District offices located in the area.

Comparison of High- and Low-Conservation Farms

Of the 80 farms used in this part of the study, 40 have predominantly Clarence-Rowe soils and 40 have mixed Clarence-Rowe, Swygert-Bryce, and Elliott-Ashkum soils. Each group of 40 farms consisted of 20 pairs of farms, each pair being similar in physical characteristics, land-use capabilities, and size but representing opposite extremes with respect to conservation practices: that is, in amounts of limestone and phosphate that had been applied, rotations that had been followed, and the use made of such specific conservation measures as contouring, grass waterways, and drainage facilities. Three-year averages of selected items for each group of high- and low-conservation farms bring out differences in various costs, in land use, crop yields, livestock efficiency, and earnings (Table 1).

Clarence-Rowe farms. The 20 high-conservation farms on the Clarence-Rowe soils represented a total investment of $7 an acre more than the low-conservation farms, but the inventory value of the land improvements (fertilizers, erosion-control measures, drainage, and fencing) was a third lower.

On the high-conservation farms during the period of this study, more was spent on buildings and land improvements than on the low-conservation farms. Power costs were higher on the high-conservation farms, but labor costs in the two groups were nearly equal.

Fifty-one percent of the tillable land on the high-conservation farms and 55 percent on the low-conservation farms was in soil-depleting crops (corn and soybeans). This is more land in these crops than is recommended in a good long-time program for these soils. Considerably more land was devoted to hay and pasture and soil-building

[1] These records are the supervised farm-account records in a project sponsored jointly by the Farm Bureau and the Agricultural Extension Service, University of Illinois.

Table 1. — Data Concerning 40 High- and 40 Low-Conservation Farms Located on Two Groups of Slowly Permeable Soils in Northeastern Illinois

(Figures are averages for three years 1945-1947)

Item	Clarence-Rowe soils		Clarence-Swygert-Elliott mixed soils[a]	
	20 *high*-conservation farms	20 *low*-conservation farms	20 *high*-conservation farms	20 *low*-conservation farms
Investment per acre				
Inventory value of land	$101	$ 97	$109	$ 95
Inventory value of land improvements	6	9	6	9
Inventory value of buildings	22	19	19	19
Inventory value of machinery, livestock and feeds	42	39	50	37
Total farm investment	$171	$164	$184	$160
Land, building, and power costs per acre (cash and depreciation)				
Buildings	$ 2.11	$ 1.79	$ 1.90	$ 1.86
Land improvements[b]	1.39	1.25	1.62	1.51
Power and machinery costs per crop acre	9.02	8.07	10.55	7.75
Labor cost per crop acre	13.69	13.78	11.79	11.38
Land use and crop yields				
Acres per farm	236	222	294	281
Percent of farm tillable	92	87	90	88
Percent of tillable land in—				
Corn	38	39	41	39
Soybeans	13	16	6	23
Oats	22	23	27	20
Other row or grain crops	1	2	1	1
Hay and pasture	26	20	25	17
Soil-building legumes	(21)	(16)	(20)	(12)
Yields per acre, bushels				
Corn	43	38	50	42
Soybeans	19	19	19	19
Oats	36	36	38	34
Livestock efficiency				
Productive animal units per farm	40	27	52	28
Value of feed fed per acre	$ 22.29	$ 14.85	$ 24.69	$ 12.42
Returns per $100's worth of feed fed	145	143	133	118
Percent of income from livestock	63	48	61	33
Meat produced per acre, pounds	104	62	131	47
Milk produced per acre, pounds	270	136	114	99
Earnings				
Net income per acre[c]	$33.81	$26.42	$36.44	$27.28
Rate earned on investment, percent	14.6	10.1	14.9	11.0

[a] Clarence-Rowe, Swygert-Bryce, Elliott-Ashkum, Blount, Eylar, and other slowly permeable soils.

[b] Includes depreciation on limestone, phosphate, erosion-control structures, tile, fencing, etc., and cash costs of other fertilizers, waterways, drainage repairs, etc.

[c] Includes inventory changes and cash balance.

Fifty years of conservation farming on this field of Clarence-Rowe soils are rewarded by a 60-bushel crop of good-quality corn. The field is planted on the contour. Picture was taken in October, 1948. (Fig. 6)

legumes on the high-conservation farms. Yields of corn on the high-conservation farms exceeded those on the low by 5 bushels. There were no differences for soybeans and oats.

On the high-conservation farms nearly 50 percent more feed was

Fifty years of hard farming on a neighboring farm has left this field of Clarence-Rowe soils eroded and depleted. Result: a 12-bushel crop of poor-quality corn. Picture was taken at same time as the one above. (Fig. 7)

fed, and the acreage of pasture was larger. Returns per $100's worth of feed fed averaged only $2 higher on the high-conservation farms. Approximately 90 percent more meat and milk was produced on the high-conservation farms.

The benefits of conservation farming showed up most clearly in the income figures for these two groups of farms. The high-conservation farms had an advantage of $7.39 more net income per acre than the low-conservation farms. The cash balance per acre and the rate earned on investment were also larger on the high-conservation farms.

Figs. 6 and 7 show the long-time benefits of conservation farming.

Mixed Clarence-Swygert-Elliott farms. The same relationships were found between high-conservation and low-conservation farms on the mixed slowly permeable soils as on the Clarence-Rowe soils. These comparisons also are shown in Table 1.

On the high-conservation farms the investment per acre was greater, and larger amounts per acre were spent for buildings and land improvements. A much smaller proportion of tillable land was used for intertilled crops — corn and soybeans. Much higher acre-yields of corn and oats were obtained, but there was no difference in soybean yields. More livestock were kept on the high-conservation farms, as indicated by the higher percentage of total income from livestock on these farms and the greater amounts of meat and milk produced per acre. Returns per $100's worth of feed fed were $15 higher on the high-conservation farms, and the net income and cash balance per acre were also higher.

Effect of Soil Type on Income and Farm Organization

To determine how soil type influences farm organization and income, all 105 farm business records for 1947 were placed in three groups according to the soil classes they represented: Clarence-Rowe, Swygert-Bryce, and mixed slowly permeable soils. Farms with no soil type predominating were placed in the latter group. Comparisons between these three groups can be seen in Table 2.

The inventory value of land and the total farm investment per acre were highest ($115 and $200) in the mixed-soils group and lowest ($88 and $151) in the Clarence-Rowe group.

On the Clarence-Rowe farms $1.61 an acre was spent for building improvements, whereas on the mixed-soils farms and the Swygert-Bryce farms $2.61 and $1.86 an acre were spent respectively. For land improvements also, less was spent on the Clarence-Rowe farms than on the farms of either of the other two groups.

On both the Clarence-Rowe and the Swygert-Bryce farms 55 percent of the tillable land was in corn and soybeans; on the mixed soils, 50 percent. Both these figures are too high for good land-use programs

Table 2. — Business Records of 105 Farms Located on Three Groups of Slowly Permeable Soils in Northeastern Illinois

(Values are for 1947)

Item	Clarence-Rowe soils	Swygert-Bryce soils	Mixed slowly permeable soils[a]
Size of farm and investment per acre per farm			
Number of farms	44	29	32
Acres per farm	264	269	262
Inventory value of land	$ 88	$110	$115
Inventory value of land improvements	6	7	6
Inventory value of buildings	17	23	24
Inventory value of machinery, livestock and feed	40	52	55
Total farm investment	$151	$192	$200
Land and building costs per acre per farm (cash and depreciation)			
Buildings	$1.61	$1.86	$2.61
Land improvements[b]	1.25	1.87	1.87
Land use and crop yields			
Percent of farm tillable	84	90	93
Percent of tillable land in–			
Corn	38	40	41
Soybeans	17	15	9
Oats	20	22	24
Other row or grain crops	3	1	1
Hay and pasture	22	22	25
Yields per acre, bushels			
Corn	33	44	42
Soybeans	18	21	20
Oats	26	31	33
Livestock efficiency and numbers			
Productive animal units per farm			
Cattle	16	20	20
Hogs	10	15	14
All livestock	31	42	38
Value of feed fed per acre	$ 17.96	$ 24.07	$ 27.47
Returns per $100's worth of feed fed	$117	$136	$127
Percent of income from livestock	40	48	51
Earnings			
Net income per acre[c]	$ 21.87	$ 42.89	$ 40.10
Cash balance per farm	5 278	7 584	7 565
Cash balance per acre	19.99	28.19	28.87
Rate earned on investment, percent	14.4	22.3	20.1

[a] Clarence-Rowe, Swygert-Bryce, Elliott-Ashkum, Blount, Eylar, and other slowly permeable soils.

[b] Includes depreciation on limestone, phosphate, erosion-control structures, tile, fencing, etc., and cash costs of other fertilizers, waterways, drainage repairs, etc.

[c] Includes inventory changes and cash balance.

designed to maintain soil productivity. The corn yields on the Clarence-Rowe farms was 11 bushels an acre lower than on the Swygert-Bryce farms and 9 bushels less than on the mixed soils.

Returns per $100's worth of feed fed were less on the Clarence-Rowe farms ($117) than on the Swygert-Bryce farms ($136) or the mixed soils ($127). Clarence-Rowe farms also had less livestock per farm.

Farms on the Swygert-Bryce soils and the mixed soils had considerably higher earnings than the farms on the Clarence-Rowe soils. Swygert-Bryce farms had a net income advantage of $21 an acre over Clarence-Rowe farms, and their cash balance was approximately $8 an acre higher. Rate earned on invested capital was much higher on the Swygert-Bryce and mixed soils than on the Clarence-Rowe soils.

Table 3. — Thirty-one Farms With Highest Proportion of Tillable Land in Hay and Pasture Compared With 31 Farms With Lowest Proportion: Farms Located on Slowly Permeable Soils in Northeastern Illinois

(Selected from a total of 93 farms. Figures are averages for three years 1945-1947)

Item	High one-third of farms	Low one-third of farms
Land use and crop yields		
Number of farms	31	31
Acres per farm	248	289
Percent of farm tillable	89	90
Percent of tillable land in–		
Corn	37	42
Soybeans	8	21
Oats	24	21
Other row or grain crops	2	1
Hay and pasture	29	15
Yields per acre, bushels		
Corn	47	43
Soybeans	20	20
Oats	40	36
Livestock efficiency		
Productive animal units per 100 acres	18.1	10.4
Value of feed fed per acre	$ 24.45	$ 13.60
Returns per $100's worth of feed fed	$144	$124
Percent of income from livestock	65	33
Meat produced per acre, pounds	110	63
Milk produced per acre, pounds	275	93
Earnings		
Net income per farm[a]	$8 056	$9 118
Net income per acre[a]	32.49	31.55
Cash balance per farm	5 031	6 298
Cash balance per acre	20.30	21.79
Rate earned on investment, percent	13.3	14.7

[a] Includes inventory changes and cash balance.

Effect of Proportion of Land in Hay and Pasture

How did the proportion of tillable land in hay and pasture influence farm organization and income? This question is answered by comparing the records of the 31 farms with the highest percentage of such land and the 31 farms with the lowest percentage. Data for the three years 1945-1947 are given in Table 3.

The high group had 29 percent of their tillable land in hay and pasture and 45 percent in corn and soybeans. The low group had only 15 percent of their tillable land in hay and pasture, but 63 percent in corn and soybeans. The high group had a yield advantage of 4 bushels an acre for both corn and oats. Soybean yields were the same in both groups of farms.

Returns per $100's worth of feed fed were $20 higher on the farms with the most hay and pasture. These farms also received a higher percentage of their income from livestock and produced more meat and milk per acre. Figs. 8 and 9 show the cattle on two of these farms.

The farms high in hay and pasture had only a very small advantage in net income per acre (94 cents), but this advantage will likely increase over the years since the programs on these farms are

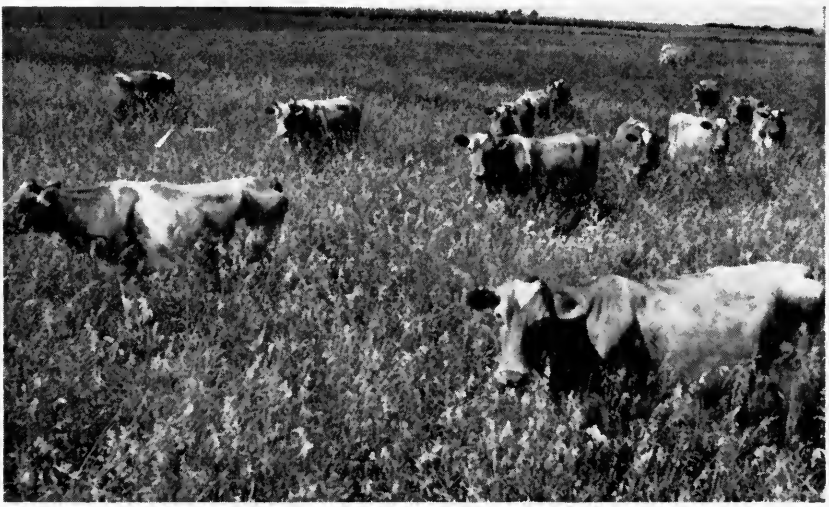
A herd of beef cattle has proved a profitable venture as part of the pasture plan on this Swygert silt loam farm. Financial returns have been very good, soil fertility has been built up, and the erosion problem solved. This is the fifth year of meadow in an eight-year rotation of corn, soybeans, and wheat followed by five years of mixed legume-grass meadow. (Fig. 8)

just getting started. The productivity of the soil is being better maintained by the growing of more hay, pasture, and livestock.

The farms low in hay and pasture had a higher cash balance per acre and earned a higher rate on the investment. But if these farms continue to grow their present high proportion of intertilled crops, their soils will deteriorate more rapidly than the soils on the farms with more land in hay and pasture. The difference in earnings will then be substantially in favor of the farms with the higher percentage of tillable land in hay and pasture.

Comparison of High- and Low-Livestock Farms

To utilize the larger amounts of grasses and legumes grown under a conservation program, more livestock may be necessary. Since some farmers feel that a reduction in grain acreage means reduced income, they are often reluctant to increase their acreages of legumes and their numbers of livestock beyond a minimum. Also, some farmers are not livestock-minded and do not care to raise livestock; others have not had enough experience or training to be good livestock men. Table 4



A high-producing dairy herd is making good use of a heavy crop of mixed alfalfa and bromegrass, an excellent soil-building combination. The farm is located on Swygert-Bryce soils. Earnings are steadily climbing above those of the average farm in the area. (Fig. 9)

shows what happened on six groups of farms in 1947 that had contrasting amounts of livestock.

In the Clarence-Rowe group, the high-livestock farms received 70 percent of their income from livestock, the low-livestock farms only 26 percent. The pattern was similar for the other two soil groups.

The high-livestock farms were smaller and had a smaller percentage of tillable land than the farms with little livestock. They also had less tillable land in soil-depleting crops and more in hay and pasture.

Table 4. — Farms With Most Animal Units per 100 Acres Compared With Farms With Fewest: Total of 70 Farms Grouped According to Soil Type, Northeastern Illinois

(Figures are for 1947)

Item	Clarence-Rowe soils		Swygert-Bryce soils		Mixed slowly permeable soils	
	High 15 in animal units	Low 15 in animal units	High 10 in animal units	Low 10 in animal units	High 10 in animal units	Low 10 in animal units
Number of farms	15	15	10	10	10	10
Acres per farm	232	279	232	287	223	315
Livestock efficiency						
Animal units per 100 acres	22	6	30	7	28	6
Feed fed per acre	$ 31.90	$ 9.72	$ 48.40	$ 10.25	$ 35.02	$11.60
Returns per $100's worth of feed fed	$120	$100	$146	$116	$142	$97
Percent of income from livestock	70	26	82	18	76	20
Land use and crop yields						
Percent of farm tillable	84	89	80	96	89	94
Percent of tillable land in–						
Corn	34	40	35	40	36	45
Soybeans	14	21	7	22	3	11
Oats	22	17	26	18	24	23
Other row or grain crops	3	4	6	...	4	2
Hay and pasture	27	18	26	20	33	19
Yields per acre, bushels						
Corn	41	29	48	46	49	42
Soybeans	20	18	24	22	24	22
Oats	31	22	35	29	38	29
Land and building costs per acre (cash and depreciation)						
Buildings	$2.36	$1.31	$2.81	$1.39	$3.44	$1.92
Land improvements[a]	1.17	1.11	2.60	1.58	2.02	1.56
Earnings						
Net income per acre[b]	$29.20	$16.45	$52.51	$44.02	$53.86	$34.29
Cash balance per acre	23.67	14.62	29.19	26.92	27.48	25.55
Rate earned on investment, percent	17	12	27	24	25	18

[a] Includes depreciation on limestone, phosphate, erosion-control structures, tile, fencing, etc., and cash costs of other fertilizers, waterways, drainage repairs, etc.

[b] Includes inventory changes and cash balance.

On the Clarence-Rowe soils the high group had 48 percent of their tillable land in corn and soybeans, the low group had 61 percent. On the Swygert-Bryce soils the high group had 42 percent in corn and soybeans, the low group had 62 percent. Crop yields per acre were considerably higher on the high-livestock farms. On the Clarence-Rowe soils the high-livestock farms had 12 more bushels of corn to the acre, 9 more bushels of oats, and 2 more bushels of soybeans.

On the high-livestock farms more was spent on buildings and land improvements during the year covered by the records, including more for limestone, phosphate, and other fertilizer.

Net income per acre was considerably higher on the high-livestock farms in all three soil groups: $12.75 higher on the Clarence-Rowe farms, $8.49 higher on the Swygert-Bryce farms, and almost $20 higher on the farms with mixed soils.

Part of this larger net income on the high-livestock farms resulted from the higher returns per $100's worth of feed fed. These higher returns from feed are almost certainly due, in part, to the larger quantities of better-quality roughage produced on these farms. The higher crop yields reflect the soil-building effect of the legumes and grasses and the availability of more manure.

Future price relationships between crops and livestock may of course change the income advantage which the high-livestock farms have over the low farms. In 1947 Illinois farm prices had the following indexes, based on prices for 1935-1939 as equal to 100: (1) *for crops*—corn 288, soybeans 364, oats 313, and hay 180; (2) *for livestock*—hogs 294, beef cattle 262, milk 238, butterfat 256, eggs 216, and chickens 180.

Records for 93 farms, covering the three years 1945-1947 (Table 5), show contrasts similar to those disclosed by the more detailed study of the 1947 records. On most items the margin in favor of the high-livestock farms is greater for the three-year period than for 1947 alone.

Costs of Conservation Farming

Any conservation program calls for a considerable outlay of money. Besides the expenses for soil treatment and for measures to conserve soil and water, capital outlays for livestock, buildings, fences, and machinery must usually be made. It is often necessary or desirable for farm owners or operators to borrow in order to make the needed improvements. Since lack of capital may be a factor in delaying conservation practices on many farms, it was thought worth while to find

Table 5. — Thirty-One Farms With Most Animal Units per 100 Acres Compared With 31 Farms With Fewest: Farms Located on Slowly Permeable Soils in Northeastern Illinois

(Selected from a total of 93 farms. Figures are averages for three years 1945-1947)

Item	High one-third of farms	Low one-third of farms
Number of farms	31	31
Acres per farm	238	304
Livestock efficiency		
Animal units per 100 acres	25.2	7.2
Value of feed fed per acre	$ 33.81	$ 10.18
Returns per $100's worth of feed fed	$143	$115
Percent of income from livestock	75	27
Land use and crop yields		
Percent of farm tillable	85	90
Percent of tillable land in–		
Corn	40	40
Soybeans	10	18
Oats	23	22
Other crops	2	2
Hay and pasture	25	18
Yields per acre, bushels		
Corn	49	44
Soybeans	22	20
Oats	46	33
Land and building costs per acre (cash and depreciation)		
Buildings	$ 2.87	$ 1.59
Land improvements[a]	1.64	1.48
Earnings		
Net income per acre	$39.75	$28.37
Cash balance per acre	23.94	18.79
Rate earned on investment, percent	16.9	13.5

[a] Includes depreciation on limestone, phosphate, erosion-control structures, tile, fencing, etc., and cash costs of other fertilizers, waterways, drainage repairs, etc.

out just what are the amounts usually required for conservation purposes on farms in this area.

Farmers' estimates of conservation needs. From the same farmers who submitted data for the 1947 farm-business survey, information was obtained concerning the improvements they thought were needed in order to establish a sound farming system on their farms. These estimates, converted to 1948 dollar values, are summarized in Table 6.

For 69 farms the value of the limestone, phosphate, and potash estimated as needed was $2,384 per farm, or an average of $8.73 an acre for the entire farm. These fertility costs represented 36 percent

of the total cost of establishing a conservation program. Twenty-two percent of this cost was for rock phosphate. Of the water-disposal needs, these farmers felt that tiling was most important; $1.88 an acre was estimated for this purpose. More than $1,000 a farm, or $4.01 an acre, was estimated for building improvements. The livestock these farmers felt would be desirable would cost $5.22 an acre, which is 21 percent of the total cost for the adjustment program.

Table 6. — Estimated Cash Cost of Making All Farming Adjustments Needed for Adoption of a Conservation Program on Slowly Permeable Soils in Northeastern Illinois

(Based on opinions of operators of 69 farms totaling 18,815 acres and averaging 273 acres per farm, 1948 prices used)

	Cost per farm	Cost per acre	Percent of total
Fertility costs			
Limestone	$ 809	$2.96	12.2
Rock phosphate	1 443	5.29	21.7
Potash	132	.48	2.0
Total	$2 384	$8.73	35.9
Water-disposal costs			
Tiling	$ 512	$1.88	7.8
Grass waterways			
Seed	9	.03	.1
Construction	49	.18	.7
Erosion-control structures	109	.40	2.1
Total	$ 679	$2.49	10.7
Building, fencing, and equipment costs			
Fencing			
Woven wire	$ 310	$1.14	4.7
Barbed wire	119	.44	1.8
Water supply	123	.45	1.8
Repair or remodel buildings	702	2.57	10.5
New buildings	394	1.44	5.9
Livestock equipment	39	.14	.6
Machinery	449	1.64	6.7
Total	$2 136	$7.82	32.0
Livestock costs			
Dairy cattle	$ 576	$2.11	8.7
Beef cattle	305	1.12	4.6
Feeder cattle	466	1.71	7.0
Sheep	41	.15	.6
Hogs	36	.13	.5
Total	$1 424	$5.22	21.4
Total costs	$6 623	$24.26	100.0

The average cost per farm for all the adjustments which, in the opinions of the operators, should be made on these farms, was estimated at $6,623, or $24.26 an acre. Of this total, $12.80 was for establishing the conservation plan and $11.46 was for buildings, machinery, and livestock needed to put the plan into effect. Almost all this amount is needed at the start of the program and does not include the yearly expenditures which must be made for maintenance even after a complete conservation program has been established.

Conservation costs based on actual plans. Data from 48 conservation plans for farms with Swygert-Bryce and Clarence-Rowe soils were obtained from the offices of three soil-conservation districts in northeastern Illinois. District technicians and the farmers worked out these plans together. The limestone and fertilizer applications are based on recommendations of farm advisers and the Agricultural Experiment Station. These plans cover items to be completed within five years, largely in the first three years (Table 7).

Table 7. — Estimated Quantities and Cost of Materials Needed to Carry Out Conservation Plans on 48 Farms on Slowly Permeable Soils in Northeastern Illinois

(Items to be completed in first five years. Costs are based on 1948 prices. Farms averaged 213 acres)

	Average per farm		Cost per acre	Cost per crop acre	Percent of total
	Amount	Cost			
Limestone, tons	398	$1 294	$ 6.08	$ 7.61	26.8
Phosphate, tons	104	2 282	10.72	13.44	47.4
Potash, tons	8.6	515	2.42	3.03	10.7
Mixed fertilizer, pounds	198	53	.25	.31	1.1
Waterway seeding, acres	3.9	30	.14	.18	.6
Waterway construction, feet	5 611	156	.73	.92	3.2
Permanent pasture seeding, acres	17	108	.51	.64	2.3
Permanent hay seeding, acres	8	55	.26	.32	1.1
Soil-bank seeding, acres	.1	1	....	....	....
Terraces, feet	1 510	17	.08	.10	.4
Ditching, feet	162	16	.08	.10	.4
Working spoil banks, feet	254	18	.09	.10	.4
Tiling, feet	213	44	.21	.26	.9
Catch basins, number[a]	.1	....	....	....	....
Dams, number	.3	78	.37	.46	1.6
Drop boxes, number	.1	10	.05	.06	.2
Tile headwall	.1	2	.01	.01	....
Tree planting, acres	2	26	.12	.15	.5
Concrete flume, number	.1	2	.01	.01	.1
Ponds, number	.1	16	.08	.10	.4
Multiflora rose, feet	1 080	11	.05	.06	.2
Wildlife planting, number	1	6	.03	.04	.1
Fencing					
Woven wire, rods	....	....	....	....	....
Barbed wire, rods	136	78	.37	.46	1.6
Total costs	....	$4 818	$22.66	$28.36	100.0

[a] Catch basins were recommended on only one of the 48 farms.

The average estimated cash cost of establishing the conservation plans totaled $4,818 a farm, or $22.66 an acre. Rock phosphate represented 47 percent of this total; limestone, phosphate, and potash together accounted for 85 percent. These fertility items are needed on every farm, though the rest of the practices are not. The next largest item of cost was for grass waterways, the estimate for which was, however, only 3.2 percent of the total. While the cost for the rest of the conservation items would not average large, a considerable outlay would be required on some farms for some of them.

Table 8. — Distribution of 48 Farms According to Estimated Cash Cost of Conservation Plans: Farms Located on Slowly Permeable Soils in Northeastern Illinois

Total cost per acre for first five years	Number of farms	Total cost per acre for first five years	Number of farms
Under $14.99	1	$25.00 to $27.49	7
$15.00 to $17.49	2	$27.50 to $29.99	4
$17.50 to $19.99	6	Above $30	3
$20.00 to $22.49	17		—
$22.50 to $24.99	8	All farms	48

According to these estimates, most of these 48 farmers would have to spend a total of $17.50 to $27.50 an acre to carry their conservation programs through the first five years (Table 8).

Table 9. — Comparison of Cash Costs[a] of Establishing Actual Conservation Programs, With Farmers' Estimates: Farms Located on Slowly Permeable Soils in Northeastern Illinois

(Figures are for 1948)

Item	Estimated costs of *actual* conservation plans for 48 farms averaging 213 acres			Estimated costs on 69 farms averaging 273 acres, based on *operators' opinions*		
	Cost per farm	Cost per acre of total farm	Percent of total	Cost per farm	Cost per acre of total farm	Percent of total
Fertility costs						
Limestone	$1 294	$ 6.08	27	$ 809	$ 2.96	23
Rock phosphate	2 282	10.72	47	1 443	5.29	41
Potash	515	2.42	11	132	.48	4
Mixed fertilizer	53	.25	1	.....	.....	..
Total	$4 144	$19.47	86	$2 384	$ 8.73	68
Water-disposal costs						
Tiling	$ 44	$ .21	1	$ 512	$ 1.88	15
Ditching	35	.18	1	.....	.....	..
Grass waterways	186	.87	4	58	.21	2
Terraces	17	.08	..	.....	.....	..
Erosion-control structures	107	.51	2	109	.40	3
Total	$ 389	$ 1.85	8	$ 679	$ 2.49	20
Erosion-control plantings						
Hay and pasture seedings besides rotation hay and pasture	$ 164	$ .77	3	.....	.....	..
Trees, multiflora rose, and other shrubs	43	.20	1	.....	.....	..
Total	$ 207	$ .97	4	.....	.....	..
Fencing						
Woven wire	$ 78	$ .37	2	$ 310	$ 1.14	9
Barbed wire	.....	.....	..	119	.44	3
Total	$ 78	$ .37	2	$ 429	$ 1.58	12
Total cash costs	$4 818	$22.66	100	$3 492	$12.80	100

[a] In computing these costs, current farm prices for limestone, phosphate, and all other materials were applied to the quantities indicated as needed for establishing conservation programs on these farms.

The additional buildings, livestock, and machinery that must usually go with a conservation plan would cost approximately half as much as the conservation measures themselves.

Comparison of actual plans and farmers' estimates. The estimated cash costs of the 48 actual conservation plans and the estimates for the 69 farms included in the farmers' opinion survey are brought together in Table 9 on page 581.

The actual plans call for much larger applications of limestone, phosphate, potash, and mixed fertilizer than do the farmers' estimates. Observations in this area indicate that farmers here tend to apply too little limestone and phosphate to secure the good stands and yields of legumes that are basic to any soil-fertility and conservation program.

The farmers in the opinion survey felt that they needed much more tiling than was recommended in the actual conservation plans. The actual plans emphasized grass waterways, terraces, open ditches, and contour farming[1] more than did the farmers' estimates.

Actual capital expenditures. For 100 farms in this area actual capital expenditures for land improvements, buildings, livestock, and machinery are summarized in Table 10 for the three years 1945-1947. These farms are separated on the basis of tenure into rented farms, owner-operated farms, and farms operated by part-owners.

The average yearly expenditure for land improvements on these farms was $1.65 an acre, which is not nearly enough to correct present deficiencies and maintain improvements. The amount indicated by the farmers in the opinion survey as needed, $12.80, is still too low, as may be seen by comparing this figure with the estimate of $22.66 based on actual conservation plans.

For machinery an average of $3.54 per acre was spent, or more than twice as much as on land improvements. This may indicate a poor use of capital on these farms. Long-time returns might be greater if more were invested in land improvements and less in machinery.

On the owner-operated farms an average of $10.28 an acre was spent yearly for livestock; whereas only $3.46 an acre was spent on the tenant farms and $7.87 on the farms operated by part-owners. In the opinion survey the tenant farmers indicated greater amounts needed for livestock than were indicated by the owner operators.

The total annual spendings for capital purposes on all 100 farms during 1945-1947 averaged $12.09 an acre, or $3,210 a farm. It is

[1] Ashkum is the only major soil studied for which tile can be recommended. They do not work satisfactorily in Rowe and Bryce, and they are not usually necessary in Clarence, Swygert, and Elliott.

Table 10. — Capital Expenditures for 100 Farms Grouped According to Tenure: Farms Located on Slowly Permeable Soils in Northeast Illinois (1945, 1946, 1947)

Item	1945 expenditures		1946 expenditures		1947 expenditures		Average for 3 years	
	Per acre	Per farm	Per acre	Per farm	Per acre	Per farm	Per acre	Per farm
Rented farms								
Land improvements	$ 1.50	$ 423	$ 1.65	$ 450	$ 1.47	$ 406	$ 1.54	$ 426
Buildings	1.04	293	.37	101	1.48	408	.96	267
Livestock	2.35	661	4.87	1 336	3.16	874	3.46	957
Machinery	2.45	690	3.39	931	5.18	1 430	3.67	1 017
Total	$ 7.34	$2 067	$10.28	$2 818	$11.29	$3 118	$ 9.63	$2 667
Owner-operated farms								
Land improvements	$ 1.91	$ 386	$ 1.88	$ 381	$ 1.78	$ 331	$ 1.86	$ 366
Buildings	.45	92	.77	156	1.52	283	.91	177
Livestock	11.28	2 280	11.34	2 296	8.23	1 531	10.28	2 036
Machinery	2.19	442	4.18	846	3.70	689	3.36	659
Total	$15.83	$3 200	$18.17	$3 679	$15.23	$2 834	$16.41	$3 238
Part-owner-operated farms								
Land improvements	$ 1.38	$ 430	$ 1.43	$ 441	$ 2.57	$ 748	$ 1.79	$ 540
Buildings	.87	271	.70	215	1.33	387	.97	291
Livestock	6.52	2 039	7.89	2 428	9.19	2 910	7.87	2 459
Machinery	2.65	827	2.59	798	5.03	1 464	3.42	1 030
Total	$11.42	$3 567	$12.61	$3 882	$18.12	$5 509	$14.05	$4 320
All farms								
Land improvements	$ 1.53	$ 417	$ 1.60	$ 429	$ 1.82	$ 470	$ 1.65	$ 438
Buildings	.89	243	.55	146	1.44	373	.96	254
Livestock	5.18	1 417	6.97	1 862	5.67	1 463	5.94	1 581
Machinery	2.47	675	3.27	875	4.88	1 260	3.54	937
Total	$10.07	$2 752	$12.39	$3 312	$13.81	$3 566	$12.09	$3 210

doubtful whether these expenditures were distributed in such a way as to add most to income and long-time farm productivity.

That conservation farming requires greater capital expenditures than nonconservation farming is shown by the fact that on the 40 high-conservation farms included in Table 1 (page 569) more was spent annually for limestone, phosphate, and fertilizer than on the 40 low-conservation farms. Total capital expenditures were also greater on the high-conservation farms. These higher conservation and capital expenditures show up in the higher inventory values for land and higher total farm investment per acre for the high-conservation farms compared with the low-conservation farms.

Financing Conservation Plans

Many farmers lack adequate capital to finance a complete land-improvement program. Before borrowing for such a program, a farmer wishes to know whether he will be able to repay the loan and interest from the expected returns. Also, the lender wants to be sure that the loan can be repaid from the returns from the investment.

Two farms on Clarence-Rowe soils selected for study. Conservation plans drawn up for two Clarence-Rowe farms show how a budgeting program can be worked out that will be satisfactory to both borrower and lender. The costs of the plans and the returns that might be expected are shown in Tables 11 and 12. An element of conservatism was introduced into the estimates by using 1946 costs in computing capital requirements and 1936-1942 prices in valuing the expected increases in production. All crops were converted into dollar values.

Both farms are owner-operated and are mortgaged. Past management was typical of this area. The soil had been quite heavily cropped, fertility had been depleted, and erosion had taken its toll.

In the spring of 1946 conservation plans for these farms were worked out by a soil-conservation technician and the operators of the farms. Rotations were set up and new field arrangements planned. Grass waterways, contouring, and erosion-control structures were established where needed. Soils were tested, and long-time plans for applying fertilizers were set up.

Costs and benefits on Farm 1. Farm 1 is a 160-acre farm near Clarence, Illinois, with predominantly Clarence and Rowe soils. Erosion is a problem on this farm. The land is tiled but, as on most Clarence-Rowe farms, drainage through the tile is not satisfactory. A three-year rotation of corn, oats, and clover was planned. A field arrangement was laid out for cropping across the slope. Fertilizer plans called for applying an average of 2½ tons of limestone and 1,000 pounds of rock phosphate per acre on the entire farm over a four-year period.

The total anticipated cost of this conservation plan was $3,216, or $20.10 an acre (Table 11), this cost to be distributed over a five-year period, the funds to be advanced as needed.

To compute the increase in income expected from the plan, the average annual gross value of the crops produced before the start of the plan was subtracted from the anticipated value of the crops to be produced after the plan was in effect. The yields expected thereafter are based on a study of crop yields on Clarence-Rowe soils under good management.[1]

The disbursement and repayment schedule for Farm 1 (Table 12, page 586) is based on the assumption that capital will be borrowed as needed to finance the plan, and that the increase in the value of the crops will be used for payment of interest and principal on the loan.

[1] ODELL, R. T., How Productive Are the Soils of Central Illinois? Ill. Agr. Exp. Sta. Bul. 522, 1947.

For the first three years the new income resulting from the plan would not be as great as the capital outlays made during those years. After the third year, it would exceed the capital outlay, so that payments could then be made on the unpaid balance of the loan. By 1954 all of the capital advanced for the plan can be repaid out of new income. After that, all the increase can be used by the farm operator for any purpose he chooses. Thus a lender would have to advance capital for only the first three years of the plan, after which payments could be made on the principal and the loan would be repaid in five years more, or in eight years from the beginning of the plan.

Table 11. — Yearly Cash Cost of Conservation Plans on Two Farms Located on Slowly Permeable Soils in Northeastern Illinois

Cost items	1946	1947	1948	1949	1950	Total
Farm 1, 160 acres						
Grass waterways	$320	...	...	...	...	$ 320
Outlet structure	441	...	...	...	...	441
Sod flumes	20	...	...	...	...	20
Rock phosphate	112	$288	$360	$192	...	952
Limestone	...	75	104	299	$481	959
Fencing	...	72	144	72	...	288
Leveling ditch bank	...	100	...	...	...	100
Tiling	...	136	...	...	...	136
Total	$893	$671	$608	$563	$481	$3 216
Farm 2, 168 acres						
Grass waterways	$280	$ 256	...	...	...	$ 536
Rock phosphate	144	288	$ 584	$176	...	1 192
Limestone	309	577	325	...	...	1 211
Fencing	90	...	108	...	...	198
Total	$823	$1 121	$1 017	$176	...	$3 137

Costs and benefits on Farm 2. Farm 2 is a 168-acre farm near Loda, Illinois, mostly on Clarence and Rowe soils on rolling land that tends to erode seriously.

A four-year rotation of corn, oats, and two years of alfalfa-brome is planned for this farm. The steeper slopes are to be put into permanent hay and pasture, and grass waterways are to be established in all the draws where there is danger of gullies forming. All crops planted on slopes are to be planted on the contour. Limestone and phosphate will be applied according to test.

Capital requirements of this plan, computed in the same manner as for Farm 1, were $3,137 per farm, or $18.67 an acre, excluding maintenance charges (Table 11).

Table 12. — Probable Increase in Income, Capital Requirements, and Loan Repayment on Two Farms Located on Slowly Permeable Soils in Northeastern Illinois

	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955
Farm 1, 160 acres										
Anticipated value of crops										
Corn	$1 314	$1 378	$1 526	$1 489	$1 675	$1 600	$1 340	$1 340	$1 712	$1 563
Oats	369	284	548	520	506	632	603	506	506	646
Clover	520	890	760	940	860	720	900	1 040	840	720
Total	$2 203	$2 552	$2 834	$2 949	$3 041	$2 952	$2 843	$2 885	$3 058	$2 929
Preplan income	2 276	2 276	2 276	2 276	2 276	2 276	2 276	2 276	2 276	2 276
Increase in income	$ −73	$ 276	$ 558	$ 673	$ 765	$ 676	$ 567	$ 609	$ 782	$ 653
Cost of plan	893	671	608	563	481	193[a]	193	193	193	193
Increase in income above costs	$−966	$−395	$ −50	$ 110	$ 284	$ 483	$ 374	$ 416	$ 589	$ 460
Interest on loan at 5 percent	.....	48	70	76	75	64	43	27	7	.....
Year-end loan balance	966	1 409	1 529	1 495	1 286	867	536	147	.....	.....
Farm 2, 168 acres										
Anticipated value of crops										
Corn	$1 285	$ 1 254	$1 043	$1 005	$1 266	$1 042	$1 415	$1 005	$1 266	$1 042
Oats	84	853	463	393	379	477	393	534	379	477
Alfalfa	275	.....	935	1 980	1 815	1 788	1 677	1 705	1 815	1 788
Clover	260	160	540	.....	.....	.....	.....	.....	.....	.....
Soybeans	1 181	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total	$3 085	$ 2 267	$2 981	$3 378	$3 460	$3 307	$3 485	$3 244	$3 460	$3 307
Preplan income	2 328	2 328	2 328	2 328	2 328	2 328	2 328	2 328	2 328	2 328
Increase in income	$ 757	$ −61	$ 653	$1 050	$1 132	$ 979	$1 157	$ 916	$1 132	$ 979
Cost of plan	823	1 121	1 017	176	210[b]	210	210	210	210	210
Increase in income above costs	$ −66	$−1 182	$−364	$ 874	$ 922	$ 769	$ 947	$ 706	$ 922	$ 769
Interest on loan at 5 percent	.....	3	63	84	44	.....	.....	.....	.....	.....
Year-end loan balance	66	1 251	1 678	888	10	.....	.....	.....	.....	.....

[a] For 1951 and following years this is the cost of maintaining fertilizer applications.
[b] For 1950 and following years this is the cost of maintaining fertilizer applications.

Using the same procedure as for Farm 1, a schedule for disbursements and repayments was calculated (Table 12). Again the cost would exceed the increase in income for the first three years, but the fourth year a payment of $874 could be made on the interest and principal, and in six years the loan could be repaid.

Both farms — how capital could be used. The expected returns from investment in land improvements on these farms appear to make long-term loans a safe risk. After three years, payment could be made on the principal. Total principal and interest could be repaid in nine years on Farm 1 and six years on Farm 2. These farmers would have to wait for several years to benefit directly from the new income, but while they were repaying the loans they would be increasing their net worth by improving the productivity, and hence the value, of their farms.

No attempt was made to estimate the increase in income to be expected from livestock enterprises made possible by the larger amounts and better quality of hay and pasture produced. Nor was the cost of buying additional roughage-consuming livestock or of improving buildings for more livestock considered. Additional capital might have to be advanced by lenders for these purposes. On farms where the buildings are not adequate for intensive livestock farming, adjustments might be made in the amount and class of livestock kept. Feeder or beef cattle could be kept in buildings not suitable for dairy cattle. Another alternative would be to borrow capital for buildings needed and repay it from the income from the livestock enterprise.

These plans are for owner-operated farms, and income estimates are based on crop production on the entire farm. On farms rented on crop shares a problem arises in charging the costs of and assessing the benefits from an improved farm plan. Normally the landlord makes most capital improvements, but he gets only half of the new income. If part of the increase is derived from livestock, the landlord might receive even less than half the increase unless a livestock-share lease was used. Methods can be worked out, however, for each individual farm that will divide the costs and benefits of a conservation plan equitably between the landlord and the tenant.[1]

[1] The Illinois livestock-share farm lease and the Illinois crop-share cash farm lease, developed at the College of Agriculture, University of Illinois, will be useful in making these adjustments. Information concerning these lease forms can be obtained from your local farm adviser or by writing to the College of Agriculture, Urbana, Illinois.

Study of a Livestock Farm and a Grain Farm

Since conservation farming in northeastern Illinois usually means planting fewer acres to corn and soybeans and using more for hay and pasture, a comparison has been made between two actual farms, one operated for many years as a grain farm and the other as a livestock farm. These farms are both located on predominantly Clarence-Rowe soils in Vermilion county. Records on land use, yields, and income are shown in Figs. 10 to 12 on the following pages.

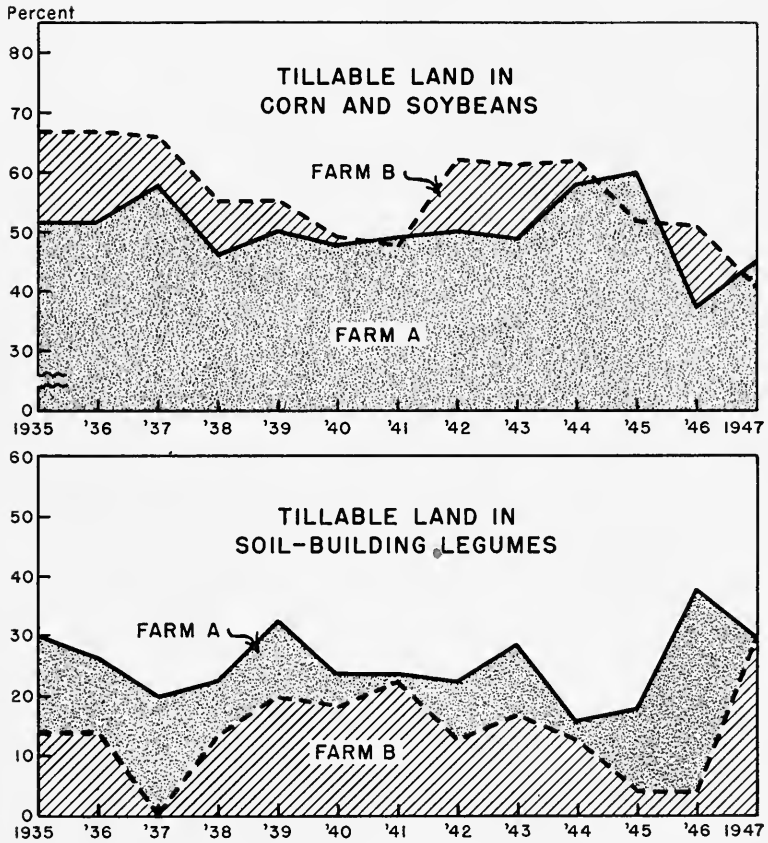
Farm A (the livestock farm) consists of 186 acres, 157 tillable and the rest is permanent pasture. Farm B (the grain farm) has 160 acres, 144 of which are tillable. The livestock farm was probably better managed during the period it was being studied. However, the grain farm has a higher soil-productivity rating.

Land use. On the livestock farm half the tillable land, as an average, was planted to corn and soybeans each year from 1935 to 1947; on the grain farm 57 percent was so planted (Fig. 10). On both farms a good land-use program would require that less land be used for soil-depleting crops. On the livestock farm a larger proportion of the corn crop was fed to cattle and hogs than on the grain farm.

The livestock farm had an average of 23 percent of its tillable land in soil-building legumes, whereas only 14 percent was in legumes on the grain farm (Fig. 10). This greater amount of hay and pasture on the livestock farm was utilized as roughage for livestock.

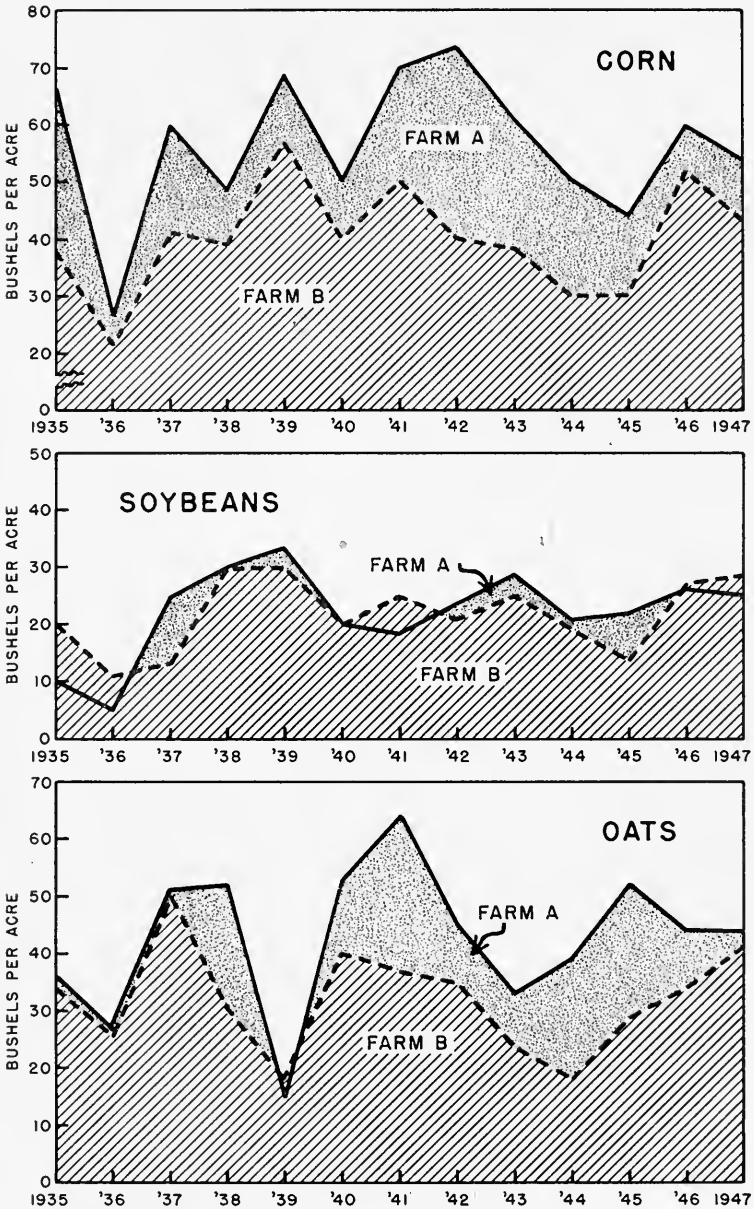
Crop yields. Corn yields averaged 56 bushels an acre on Farm A, only 40 bushels on Farm B. While average soybean yields for the thirteen years were the same on both farms — 22 bushels an acre — the livestock farm had 10 bushels a year more of oats. The trends in corn, soybean, and oat yields are shown in Fig. 11. The advantage of Farm A in corn and oat yields has become greater with the passing of time, indicating that soil productivity has been better maintained on this farm. Crop yields on Farm A compare favorably with those for Vermilion county farm account keepers, who averaged 56 bushels of corn, 40 bushels of oats, and 24 bushels of soybeans during the same years.

Capital expenditures for land improvements. For the entire thirteen years $3,819, or $20.53 an acre, was spent on the livestock farm for land improvements; whereas $2,511, or $15.69 an acre, was spent on the grain farm. On the livestock farm $7.22 an acre was spent for limestone and phosphate, on the grain farm $5.44 an acre was spent for this purpose.

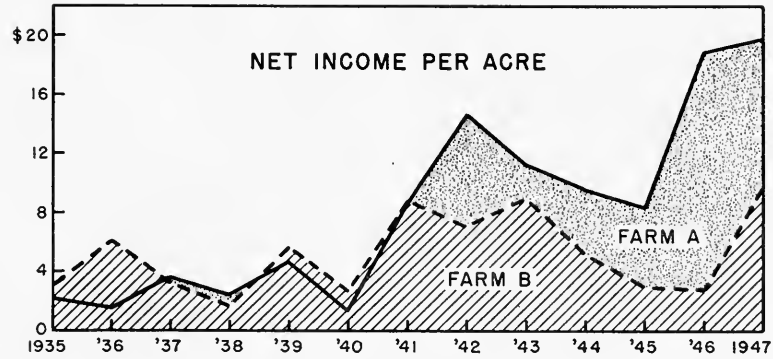


Percent of tillable land in corn and soybeans and in soil-building legumes on two Vermilion county farms during the years 1935 to 1947. Farm A is a livestock farm of 186 acres. Farm B is a grain farm of 160 acres. On both farms too many acres are used for corn and soybeans. (Fig. 10)

Net income. The more desirable land-use program, the higher crop yields, and the greater capital expenditures on the livestock farm are reflected in the better income from this farm for the last six years as compared with the income from the grain farm (Fig. 12). For four of the first six years the grain farm had a higher net income per acre, but since 1942 the reverse has been true. Since 1935 the average yearly net income has been $5.80 an acre on the livestock farm and $4.17 on the grain farm. This long-time advantage in net income per acre and the increasing spread between the incomes from these two farms reflect the difference in the farming systems followed.



Corn, soybean, and oat yields on same farms as shown in Fig. 10. On the livestock farm (Farm A) these crops have averaged 56, 22, and 43 bushels respectively during these years. On the grain farm (Farm B) they have averaged 40, 22, and 32 bushels an acre. (Fig. 11)



The net income per acre on these two Vermilion county farms has been steadily in favor of the livestock farm (Farm A) since 1942. (Fig. 12)

Conclusions About Conservation Farming

Practical and profitable. A study of more than 100 farms located on slowly permeable soils in northeastern Illinois indicates that conservation measures are not only effective in maintaining soils for future use but they are also an important factor in increasing farm income. Investments to improve the land, such as those for limestone, phosphate, and mixed fertilizers, will pay off in larger crop yields and in hay and pasture of higher quality. The same total amount of grain can be produced on fewer acres, and thus more acres can be shifted to hay and pasture. This shift will allow livestock-minded operators to have more roughage-consuming livestock, which in turn will make it possible to still further build up the productivity of the soil.

More expensive but brings greater returns. On the 20 high-conservation farms on Clarence-Rowe soils, an average of 48 cents more an acre a year was spent for lime, phosphate, and mixed fertilizers during 1945-1947 than on the 20 low-conservation farms. In addition, 21 percent of the land on the high-conservation farms was in soil-building legumes, compared with 16 percent on the low-conservation farms. What were the results? Corn yielded 5 bushels more an acre on the high-conservation farms, though there was no difference in oat and soybean yields. More livestock and the higher corn yield caused the yearly net income to average $7.39 an acre higher on the high-conservation farms.

On the 20 high-conservation farms located on Clarence-Rowe, Swygert-Bryce, Elliott-Ashkum, mixed slowly permeable soils, 75 cents more an acre a year was spent for lime, phosphate, and mixed fertilizer

than on the low-conservation farms. On the high-conservation farms 20 percent of the land was in soil-building legumes, compared with only 12 percent on the low-conservation farms. Corn and oats yielded 8 and 4 bushels more per acre. Soybean yields were about equal. Net income was $9.16 more an acre a year. Annual costs per acre for buildings, for other land improvements, and for power and machinery were slightly higher, but labor costs were about the same.

More livestock usually needed. To utilize the additional hay and pasture produced under a good conservation program, the number of roughage-consuming animals may need to be increased. The number and kind of livestock to be kept will depend, among other things, on the size and condition of present buildings, the funds or credit available for constructing new buildings, and the experience and preference of the operator. On the smaller farms, dairy cattle are the logical choice if the buildings are suitable and the operator has the ability to handle dairy cattle, for dairy cows normally produce more income per animal than do beef cows. However, the decision which to use is one to be made by each individual operator in light of his own resources.

On seventy farms grouped by amount of livestock kept on each, those with the most livestock had the higher crop yields, a smaller percentage of land in corn and soybeans, and substantially higher earnings. The advantage of increasing the amount of livestock in order to utilize the additional amounts of hay and pasture grown under conservation farming is clearly indicated in these comparisons.

Lease adjustments can be worked out. On rented farms, if livestock are to be increased and grain acreages reduced, livestock-share leases may have to replace crop-share-cash leases in some instances. Landlords and tenants both would benefit by the use of a livestock-share lease. Certainly conservation practices can be more readily adopted under such a system, and landlords would be more willing to make necessary building improvements. Longer-term leases would also be desirable. When a tenant has made improvements, the lease should include specific provision for compensating him for the remaining value of the improvements at the time he moves. Such a provision would make tenants more willing to invest in long-time improvements.

Time needed to realize benefits. Most farmers in the past appear to have invested too little in land improvements, and some may have put too much into machinery and buildings. The result is a

partial depletion of fertility and lower incomes than if more adequate investments had been made to improve the land. Returns from land improvements are not realized as quickly as are the returns from certain other investments. In fact, the net cash income may actually decrease during the first two or three years of a conservation program. However, after the initial period the increase in returns usually more than justifies the initial outlay and the period of waiting.

When borrowing is justified. Good farmers whose land has not been depleted and eroded beyond recovery can justify borrowing funds with which to make needed improvements in their farming plans. The terms and amount of each such loan need to be geared to fit the individual farm and the farm plan. Lending agencies should consider loans for this purpose a sound investment when they are made to competent operators on inherently productive farms, since their purpose is to maintain soil productivity and increase the net income.

Because returns from these investments cannot be expected to accrue in one or two years, but to be realized over a period of years, lenders make a mistake if they try to place these loans on a strictly short-term basis. The best way is to budget the loan and advance the money for each purpose only as the money is needed. Repayment schedules should be set up to coincide approximately with the increases in returns to be expected from the investment. This means that the amounts of principal to be repaid during the first two or three years should be less than in the later years when there has been time for the plan to increase the productivity of the soil.

The photographs on the following pages demonstrate still further the necessity for well-planned conservation farming on the tight soils in northeastern Illinois, and the dollar-and-cents benefits to be derived from it. Scenes similar to these can be found in any part of Illinois, but in no other area of this size do they represent so serious a condition. Here it is imperative that all the remaining topsoil be "kept at home," or the land will be permanently lost to agricultural production.

Valuable topsoil is being washed away from this field of soybeans planted up and down the slope. Grass in the natural waterway would have prevented some of the cutting erosion. Terracing and contour planting would have done the rest. The soil here is Swygert silt loam. (Fig. 13)

When corn is planted up and down the slope on the slowly permeable soils in northeastern Illinois, the losses of topsoil are enormous. Note rills between rows and piling up of silt in the foreground. (Fig. 14)

Financial records show that contouring and terracing increase farm earnings on rolling land. They save soil and water, lower operating costs 5 to 10 percent, and increase crop yields 10 to 20 percent. These thriving soybeans were planted on the contour on a terraced field. (Fig. 15)

This wide grass waterway on Rowe silt loam not only helps control erosion, but has produced 1½ tons of hay an acre a year, as an average, since it was established. Thus we have two benefits for the price of one. (Fig. 16)

A washed out tile line makes greater inroads each year into farm income. Crops and cropland are lost, and repair becomes more costly. A grass waterway in this natural drainageway would have prevented this gully. Tile seldom work in these slowly permeable soils. (Fig. 17)

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