INCREASING FARM PRODUCTION AND EARNINGS ON CLAYPAN SOILS IN SOUTHERN ILLINOIS

Circular 762

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Increasing Production and Earnings on Farms in the Claypan Area of Southern Illinois

By J. E. Wills and Fred E. Justus[1]

HOW CAN PRODUCTION and earnings on typical farms in the claypan area of southern Illinois be increased? The purpose of this circular is to answer this question by showing what these farms can produce under just reasonably good management and how much they can be expected to earn.

Farms in the area are either on flat upland, rolling upland, bottomland, or combinations of these types. Four farms that were typical representatives of these types were chosen for study. They will be used as examples of how each was being operated at the time of the study and of how, by using better farming systems, they could be made to earn a great deal more. At least two better plans for each farm will be given.

The plans do not show the top production and earnings for these farms, but those they do show are far above present averages. Most farmers, however, if they follow a farming system that combines good land use with a balanced fertility program and if their efficiency as livestock producers is average or above, should be able to make as much from these farms as the plans show.

None of the plans outlined here for a particular farm will probably exactly apply to another farm of the same type. For instance, the plan given for making a rolling upland farm into a feeder cattle and hog farm was tailored to fit a special farm. Though the general features of this plan might well apply to another farm of this kind, certain portions of it would probably have to be changed to adapt it to a different set of conditions.

Therefore, a farmer needs to study his own farm and analyze his own abilities before he attempts to use any of these plans. He will need to decide what the best use of his land is, what his fertility program should be, what he can afford to do and how fast he can do it, and at

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what kind of farming he is most likely to succeed. After he has come to these decisions, he can take the plan that seems best suited to his farm and to him and adapt it as necessary to fit his own circumstances.

CLASSIFICATION OF FARMS

The farms in the claypan area are classified according to their predominating soil types. The flat upland[1] farms are located on soils with pronounced claypan subsoils. Although many of the soils in this part of the state have claypan subsoils, the claypans are particularly well developed on the flat uplands. These soils are poorly drained, stay wet until late in the spring, and are subject to drouth in summer.

The rolling upland[2] soils vary considerably in slope and in susceptibility to erosion. Serious erosion is common. These rolling upland farms are smaller on the average than those in any of the other groups.

Bottomland soils[3] vary in how often they are flooded and for how long, and the pattern of bottomland farming varies accordingly. Bottomland near larger streams that flood frequently or near streams that remain flooded for relatively long periods is usually farmed by farmers living on higher land. Where farmers do live on these bottomland farms, they produce little livestock and there are few buildings on the farmsteads. If these farms are not farmed by the owner, the land is often field rented. About the only crops grown are corn and soybeans. Yields vary considerably from year to year.

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[1] Flat upland soils slope 1.5 percent or less. The nearly level soils include Rinard, Loy, and Newberry silt loams; the soils sloping 0.5 to 1.5 percent include Cisne and Wynoose silt loams. All these soils are similar in their adaptation to crops and in their management requirements. With a moderately high level of management, productivity indexes for grain and forage crops are 70 to 85, as indicated in Illinois Agricultural Experiment Station publication AG 1443 entitled Illinois Soil Type Descriptions. [Processed, 1950. $2.00.]

[2] The rolling upland soils include gently rolling, rolling, and steeply rolling soils. Gently rolling soils, sloping 1.5 to 3.5 percent, include Bluford and Hoyleton silt loams; rolling soils, sloping 3.5 to 7 percent, include Ava and Richview silt loams; steeply rolling soils, sloping more than 7 percent, include Clement silt loam and Hickory loam. With a moderately high level of management, gently rolling and rolling soils have productivity indexes of 75 to 85 for grain crops and 80 to 85 for forage crops. The steeply rolling soils are not adapted to grain crops; they have productivity indexes of 65 to 75 for forage crops.

[3] The two main bottomland soil types are Bonnie silt loam and Sharon loam. Bonnie silt loam is most frequently found in large bottoms and Sharon in small. Because the frequency of overflow varies widely on these bottomland soils, no general productivity indexes for moderately high levels of management can be given. Under a low level, however, Bonnie silt loam has a productivity index for grain crops of 25 to 45 and Sharon loam an index of 55 to 75.

Bottomland farms near small streams are subject to less serious flooding and flooding comes mainly from headwater rather than backwater. Wheat and legumes can be grown on these farms and livestock programs established.

Some farms are a combination of these various soil types. The most common is bottomland with gently rolling upland, but there are also combinations of flat upland and gently rolling upland, and of flat upland and bottomland soils.

LAND TENURE

Tenure in the claypan area is complex. In Wayne county, for instance, where these typical farms were located, about half of all farmland is rented. The leasing arrangements often make it difficult to plan and carry out a profitable program requiring investment in improvements to land and buildings. A 1948 cross-section survey of the county showed that more than half of the operators of 30 acres or more owned part of the land they farmed and rented part of it. These farms that were owned in part included more than half of the owner-operated land and more than half the rented land covered by the survey. There is a good deal of year-to-year field renting, often from other farmer-operators. With the usual lease, the tenant receives two-thirds of the grain crops, and one-half of hay, clover, and grass-seed crops. Most tenants pay no cash rent for pasture or for the use of buildings.

In presenting various plans for managing and operating representative farms, this study assumes: (1) that a program that is profitable for the farm as a whole is also profitable for both the owner and the operator of the land, and (2) that leasing arrangements can be adjusted in such a way as to assure both parties a fair share of the higher returns from an improved program. *Careful attention must be given to leasing arrangements on each rented farm if sound long-time plans are to be developed and put into practice.*

CROPPING SYSTEMS AND FERTILITY AND LIVESTOCK PROGRAMS

Cropping Systems Vary

Four farms were chosen as representative of the area. In the plans for these farms, cropping systems vary widely, depending on the problem of erosion, risk of flooding, and kind and amount of livestock.

The plans vary from intensive grain rotations with catch crops to rotations of permanent hay or pasture crops. The rotations are built around crops that are profitable in the area — corn, soybeans, wheat, and adapted legumes and grasses. However, rotations that include other crops may be well suited to particular situations on individual farms.

Soil Build-Up and Maintenance Programs Required

A well-balanced program of soil management requires both building up the soil to high productivity and maintaining it in a fertile condition after a high level has been reached. The build-up program includes establishing a good rotation including legumes, and applying limestone, potash, and phosphorus according to needs indicated by soil tests. The fertilizers needed to maintain the program are determined by losses or gains in plant-food elements. The need varies with the cropping system, the yield level, and the method of disposing of the crops.

Before they are treated, almost all Wayne county soils need lime, are deficient in phosphorus and potassium, and are low in organic matter and nitrogen. In the plans presented for these farms, it is assumed that the full build-up treatments of limestone and phosphate are applied during the first cycle of the rotation and that immediately after the build-up is completed the program to maintain fertility is started. Since on these soils it is not considered practical to build up available potassium in the same way as phosphorus, potash treatments are put on a "maintenance plus" basis from the start. During the first cycle, when the rotation is being established, two 200-pound treatments of 60-percent muriate of potash are applied per acre.

Fertility could be built up more slowly, however, by applying somewhat more potassium and phosphorus each year than is removed by the crops grown in that year. Completing the basic build-up program in one rotation cycle has the advantage of increasing productivity more rapidly, but it does require rather large outlays for fertilizers during this period. The build-up of minerals also acts as a reserve that can be drawn on temporarily if economic conditions in a particular year make purchase of the minerals needed to maintain fertility impractical.

In all plans, expenses include the fertilizers needed to maintain fertility, but they do not include the expense of the build-up program. In other words, the estimates of expenses and incomes are for a year following the completion of the build-up program. In one plan, expenses are shown for each year of the build-up program as well as expenses for maintaining fertility after the build-up is completed

(Table 7). In this plan it is assumed that soil tests show that 4 tons of limestone and 1,000 pounds of rock phosphate an acre are needed in the build-up program and that these rates are applied.

In all plans, the fertilizers needed to maintain fertility — nitrogen, phosphate, and potash — are applied at the rates that are needed to produce the following average yields per acre: corn, 65 bushels; soybeans, 25 bushels; wheat, 25 bushels; hay, 2¼ tons; rotation pasture, 120 pasture days; and permanent pasture, 100 pasture days. These yields are conservative in view of results being obtained on claypan soils at experiment fields and by some farmers in the area.

The rotations included in these plans and the amounts of fertilizers per acre needed to maintain the above yields are shown below. In all cases, fertilizers used are 20-percent superphosphate, 60-percent muriate of potash, and ammonium nitrate. Other materials or mixed fertilizers could be used in the maintenance program.

Steeply rolling upland soils threatened by serious erosion

Rotation: hay, grass, or permanent pasture
Limestone, rock phosphate, and potash applied when reseeded

Rolling upland soils subject to some erosion unless properly managed

5-year rotation: corn-soybeans-wheat-meadow-meadow

Corn: Superphosphate, 150 pounds
Nitrate, 100 pounds

Wheat: Superphosphate, 200 pounds
Nitrate, 100 pounds
Potash, 200 pounds

Flat upland soils not threatened by serious erosion

3-year rotation: corn-soybeans-wheat-(sweet-clover catch crop)

Corn: Superphosphate, 150 pounds

Wheat: Superphosphate, 150 pounds
Nitrate, 100 pounds
Potash, 125 pounds

4-year rotation: corn-soybeans-wheat-clover

Corn: Superphosphate, 175 pounds

Wheat: Superphosphate, 175 pounds
Nitrate, 100 pounds
Potash, 175 pounds

Bottomland subject to serious flooding

2-year rotation: corn-soybeans-(rye-and-vetch catch crop)

Corn: Superphosphate, 240 pounds
Nitrate, 175 pounds
Potash, 100 pounds

Catch-crop: Nitrate, 60 pounds

Bottomland not subject to serious flooding

5-year rotation: corn-corn-soybeans-wheat-clover

Corn, first year: Superphosphate, 200 pounds
Potash, 100 pounds

Corn, second year: Nitrate, 175 pounds

Wheat: Superphosphate, 200 pounds
Nitrate, 100 pounds
Potash, 100 pounds

Livestock Programs Adapted to Farm

In the alternative livestock plans, the following rates of production are assumed: milk, 6,500 pounds per dairy cow; purchased steers, 500 or 550 pounds of gain per head, depending on the feeding system; beef calves raised on the farm, fed out to 950 pounds; hogs, about 1,400 pounds per litter; and eggs, 14 dozen per hen.

The feeds required for these rates are given below.[1]

	Corn *bu.*	Oats *bu.*	Hay *tons*	Pasture *days*	Protein concentrates *lb.*
Dairy cattle					
Cow, 1	17	19	2¾	200	180
Yearling heifer, 1	9	9	1¾	100	100
Calf, 1	5	5	9/10	65	60
Bull, 1	12	12	2¼	200	150
Beef cattle, breeding herd					
Cow, 1			2	200	
Yearling heifer, 1	5	8	9/10	135	
Calf, 1	4	4	8/10	70	
Bull, 1	10	10	2¼	200	
Feeder cattle					
Steer, 1, pastured and fed 90 days in drylot for 550-pound gain	35		1¼	120	200
Steer, 1, fed full grain ration on pasture for 500-pound gain	50		¾	50	150
Spring pigs[a]					
Hog, 1, market weight 225 pounds	15	2	4 (*lb.*)	10	70
Fall pigs[a]					
Hog, 1, market weight 225 pounds	16	3	40 (*lb.*)		90
Baby chicks,[b] 100 cockerels to fryer size and pullets to 6 months	6	4			1,100 (chick mash)
Laying hens, 100	41	36			3,840 (hen mash)
Horses, 1	12	12	2	180	

[a] Includes feed for breeding stock. [b] Assumes good range.

[1] Standards used were obtained from farm planning handbooks published by colleges of agriculture in Illinois, Missouri, and Kentucky; from data from the Dixon Springs Experiment Station in southern Illinois; and from *Principles of Farm Management* by H. C. M. Case and P. E. Johnston.

Incomes and expenses are based on prices corresponding roughly to 1948 prices. Standards for costs, physical inputs, conversion ratios, and returns are based on data from various sources, including experiment fields, farm account records, and recommendations of specialists, farm advisers, and others. The standards used in budgeting are given on pages 6-8 and 37-38.

FLAT UPLAND FARM

This farm consists of 275 acres in two tracts (Fig. 1) about 2 miles apart. The operator owns the 50 acres in one tract and rents the 225 in the other. The 50 acres are rolling upland composed of Bluford silt loam and Hickory loam, while the rented tract consists of Cisne silt loam, a flat upland soil.

Operator's Plan

Of the 50 acres in one tract, all but 3 are in hay and pasture. However, tilled crops have been grown on the farm in the past. The farmstead and woods take up 3 acres. On the rented part of the farm,

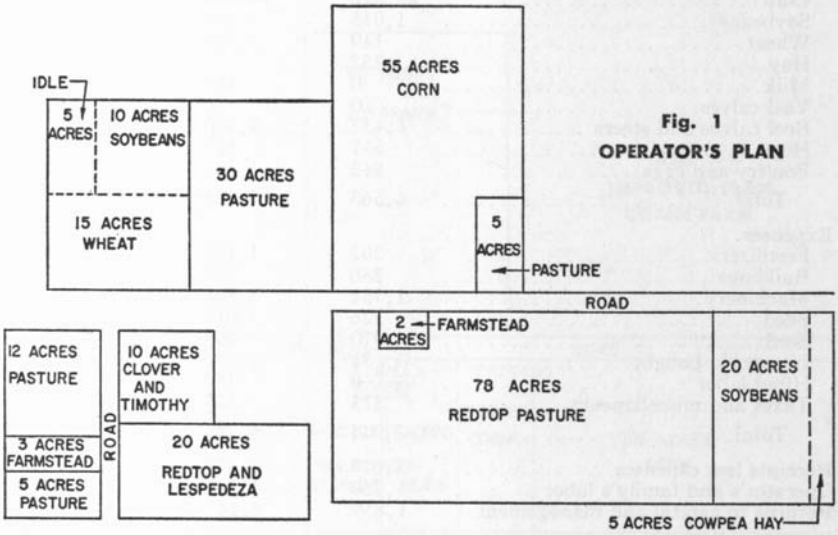

Fig. 1
OPERATOR'S PLAN

the operator produces corn, soybeans, and wheat. Half of this 225 acres is in redtop pasture. Its carrying capacity is very low and it contributes little to the farm's production. The livestock program includes 8 beef cows, 2 litters of pigs, and 150 hens (Table 1).

Table 1.—FLAT UPLAND FARM, 275 Acres: Crop Production, Livestock Program, and Receipts, Expenses, and Returns

(Operator's actual plan of operation and two improved plans of operation)

Item	Actual plan	Improved plan for—	
		Grain farm	Livestock farm
Land use, crop production, and livestock program	*acres*	*acres*	*acres*
Corn	55	75	56
Soybeans	30	74	56
Wheat	15	74	56
Hay	35	22	30
Pasture	130	25	72
Idle land	5	0	0
Woods	2	2	2
Farmstead	3	3	3
	no.	*no.*	*no.*
Dairy cows	0	2	2
Beef cows and calves	8	0	0
Steers, bought	0	20	48
Hogs, litters	2	2	16
Hens	150	200	200
Horses	2	0	0
Receipts	*value*	*value*	*value*
Corn	$2,316	$4,050	$ 308
Soybeans	1,015	3,536	2,706
Wheat	149	2,846	2,178
Hay	252	...	...
Milk	0	416	416
Veal calves	0	76	76
Beef calves and steers	1,432	4,400	11,088
Hogs	557	557	3,713
Poultry and eggs	842	1,282	1,282
Total	6,563	17,165	21,767
Expenses			
Fertilizers	202	1,142	1,036
Buildings	286	435	605
Machinery	1,751	3,504	3,504
Feed	226	1,019	1,455
Seed	70	405	399
Livestock, bought	34	1,856	4,376
Hired labor	0	450	1,500
Taxes and miscellaneous	375	475	475
Total	2,944	9,286	13,350
Receipts less expenses	3,619	7,877	8,417
Operator's and family's labor	1,760	1,760	1,760
Returns to capital and management	1,859	6,117	6,657

Two Improved Plans

Grain farm. In this plan, the 47 acres of the home farm that are now in hay and pasture are fertilized and kept in hay and pasture except when they must be broken up for reseeding or renovating. The topography and problem of erosion are such that the best use of this land is for legume and grass crops, particularly since it is farmed along with the 225 acres of flat land.

The rented 225 acres are run strictly as a grain farm. On the rented land, a 3-year rotation of corn-soybeans-wheat (with a sweet-clover catch crop) is used (Fig. 2). This rotation, making intensive use of the land as it does, can be followed successfully only with a complete fertilizer program. During the first 3 years, while the rotation is being established, enough limestone, phosphate, and potash to build up fertility is spread. After the rotation is established, fertilizers are applied yearly to maintain fertility.

After the soil has been built up, the annual cost of nitrate, phosphate, and potash on the rented farm is $892. Limestone depreciated at ¼ ton to the acre for the whole farm and other materials needed to maintain fertility are spread on the home farm bringing the total cost to $1,142 (Table 1).

In this plan, only enough livestock to utilize the roughage produced by the 47 acres of pasture on the home farm is handled. Twenty 500-pound steers are bought in the fall, roughed over winter, and fed a full

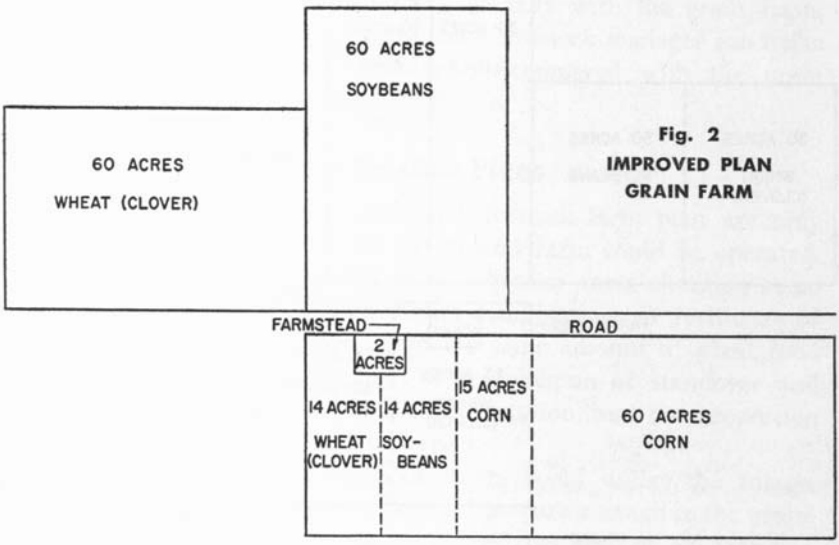

Fig. 2
IMPROVED PLAN
GRAIN FARM

grain ration while on pasture in spring and summer. For home use and for using family labor, 2 dairy cows, 2 litters of pigs, and 200 hens are kept. Supplementary income from the cows, hogs, and hens is significant. Total feed expense runs to $1,019. Feed bought includes oats, protein concentrates, and poultry mash.

Livestock and grain farm. In this plan also the 47 acres in the home farm are fertilized and kept in hay and pasture. On the rented land, a 4-year rotation of corn-soybeans-wheat-clover is followed. This rotation does not make such intensive use of the land as does the plan for a straight grain farm and provides forage for a larger cattle program. Part of the standover clover is a legume-grass mixture and part is red clover for hay (Fig. 3 and Table 1).

During the first 4 years this rotation is followed, as much limestone and phosphate are spread as the soil needs. Thereafter, the fertilizers needed to maintain fertility are spread each year. The total yearly cost of maintaining fertility is $1,036 (Table 1). This cost includes the depreciation of limestone for the whole farm and the cost of phosphate and potash for the 47 acres of pasture on the home farm.

This plan calls for a fairly intensive livestock program. The steer feeding program is increased to 48 head to use the hay and pastures (Table 1). Steers are bought in the fall, roughed over winter, pastured in the spring and summer, and full-fed 90 days in drylot. They are pastured and fed in two lots, one on the owned tract, the other

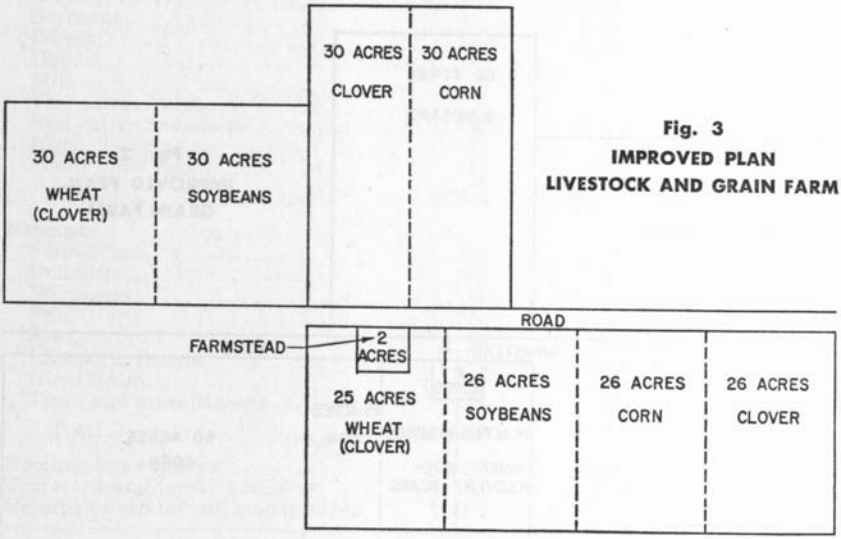

Fig. 3
IMPROVED PLAN
LIVESTOCK AND GRAIN FARM

on the rented land. The hog enterprise is expanded to 16 litters to use all the corn produced on the farm. Two dairy cows and 200 hens are kept.

Expenses for operating this farm as a livestock farm are considerably higher than they are for operating it as a grain farm (Table 1). The purchase of a larger number of steers, the employment of a full-time hired man, and higher feed costs account for the major increases in costs.

Comparison of Plans

After the fertility of this farm is built up, either plan would more than triple net returns (Table 1). The chief reasons for the increase in returns are: (1) the land use and fertilizer program increases the value of the crops; and (2) the livestock program, particularly in the second plan, is fitted to the farm and efficiently managed.

Comparison of these two plans shows that an operator may have considerable choice in the selection of a system that will succeed on this farm. Net returns do not differ greatly under either plan. If this farm included only the 225 acres of flat upland soil, it could be operated successfully as a straight grain farm with the land used as indicated in the first plan.

A farmer choosing between these plans should be influenced by his ability as a livestock manager — by his ability to convert feed into livestock products. Unless he has at least average ability as a livestock man, he will probably be better off financially with the grain farm. But a farmer who has superior ability as a livestock manager can make the livestock system more profitable, as compared with the grain system, than the figures in Table 1 indicate.

Other Possible Plans

The grain-farm plan and grain-and-livestock-farm plan are only two of many ways in which this flat upland farm could be operated. Either plan could be modified to fit a particular farm situation or to fit conditions in a particular year. Other combinations of fertilizers or mixed fertilizers that provided about the same amount of plant food could be used to keep up fertility. A combination of standover and catch-crop legumes could be used in the rotation, and the proportion of individual grain crops could be varied.

A herd of beef cows instead of steers could utilize the forage, especially in the second plan. The hay-and-pasture acreage in the grain-farm plan is hardly large enough for a beef-cow herd of efficient size. The cow herd reduces the risk involved in buying steers and requires

less capital. But it also gets less feed to market through cattle. Different systems of feeding steers could be used.

This particular farm is not well adapted to dairying because it is in two tracts and neither has a barn that could be remodeled practically for market-milk production. Under different conditions a dairy herd could be successfully fitted to the farm. The number of hogs could be increased or decreased, depending on the outlook and the ability of the farmer to carry out an efficient hog program.

ROLLING UPLAND FARM

This farm is typical of rolling upland farms, though comparatively large for the type. It is operated by the owner and contains 185 acres of which 170 are in cultivation (Fig. 4). About 155 acres are Bluford silt loam and 30 acres Hickory loam. Of these 30 acres, 10 are in woods.

Operator's Plan

The farm is now being operated far below its potential capacity and its income is low. Only 36 acres are in grain crops; 134 acres are in hay and pasture. Very little fertilizer has been used and yields are low. Livestock include 2 milk cows, 1 heifer, 6 litters of pigs, 150 hens, and 2 horses (Table 2).

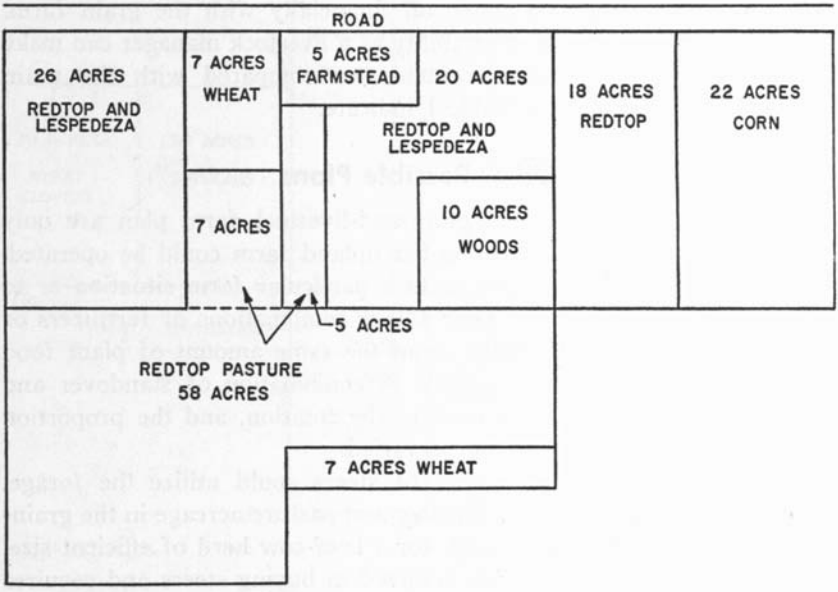

Fig. 4. — OPERATOR'S PLAN

Land Use and Fertilizer Program for Improved Plans

The land use and fertilizer program in each of three plans for operating this farm are the same. Twenty acres of steeply rolling and eroded land are in permanent pasture. A 5-year rotation of corn-soybeans-wheat-meadow-meadow is followed on the 150 acres not subject to serious erosion (Fig. 5 and Table 2).

The amounts of limestone, rock phosphate, and potash needed to build up fertility are applied (for discussion, see pages 6 and 27). After these basic treatments have been applied, fertility is maintained by spreading fertilizers each year (for amounts, see page 7).

The yearly cost of fertilizers is $679 (Table 2). This cost includes the fertilizers spread on the 150 acres in the rotation, depreciation of limestone on 170 acres, and the cost of phosphate and potash used to maintain fertility on the 20 acres in permanent pasture.

Three Improved Plans

Feeder cattle and hog farm. In this plan, enough cattle and hogs are fed to use the forage crops and corn that are produced (Table 2). Forty high-quality steers are bought in the fall, roughed over winter, pastured in the spring and summer without grain, and full-fed 90 days in drylot. Four litters of pigs are farrowed in the spring. Two milk

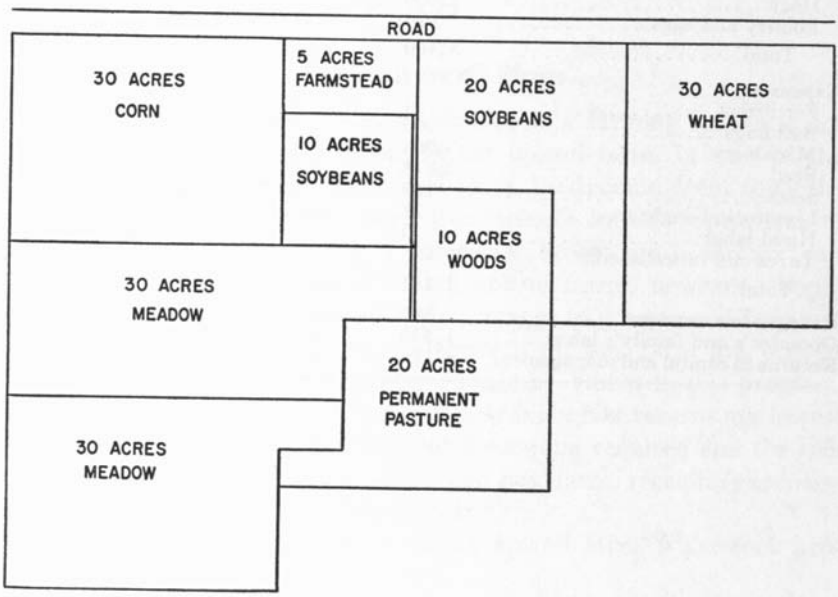

Fig. 5. — ALL IMPROVED PLANS

Table 2. — ROLLING UPLAND FARM, 185 acres: Crop Production, Livestock Program, and Receipts, Expenses, and Returns

(Operator's actual plan of operation and three improved plans of operation)

Item	Actual plan	Improved plan for		
		Feeder cattle and hog farm	Beef cow and hog farm	Dairy and hog farm
Land use, crop production, and livestock program	*acres*	*acres*	*acres*	*acres*
Corn	22	30	30	30
Soybeans	0	30	30	30
Wheat	14	30	30	30
Hay	46	25	25	25
Pasture	88	55	55	55
Woods	10	10	10	10
Farmstead	5	5	5	5
	no.	*no.*	*no.*	*no.*
Dairy cows	2	2	2	20
Beef cows with calves	0	0	13	0
Steers, bought	0	40	0	0
Hogs, litters	6	4	15	16
Hens	150	200	200	200
Horses	2	0	0	0
Receipts	*value*	*value*	*value*	*value*
Soybeans	$ 0	$1,445	$1,445	$1,445
Wheat	0	1,163	1,163	1,163
Hay	350	...	...	...
Milk	320	416	416	4,160
Veal calves and cull cows	76	76	356	1,032
Steers	0	9,240	2,310	0
Hogs	1,860	928	3,342	3,713
Poultry and eggs	494	1,282	1,282	1,282
Total	3,100	14,550	10,314	12,795
Expenses				
Fertilizers	34	679	679	679
Buildings	200	414	414	618
Machinery	963	1,710	1,710	1,725
Feed	678	1,056	1,172	1,668
Seed	125	203	203	203
Livestock, bought	28	3,656	56	56
Hired labor	0	0	150	1,500
Taxes and miscellaneous	285	385	385	385
Total	2,131	8,103	4,769	6,834
Receipts less expenses	787	6,447	5,545	5,961
Operator's and family's labor	1,540	1,540	1,540	1,540
Returns to capital and management	−753	4,907	4,005	4,421

cows are kept and the poultry flock is increased to 200 hens. This livestock program requires the purchase of additional feeds — oats, protein concentrates, and poultry mash. These feeds will cost a little over $1,000 (Table 2). The largest single item of expense ($3,656) is the cost of the steers (Table 2).

Beef cow and hog farm. This plan features a herd of 13 beef cows, 15 litters of pigs, 2 milk cows, and 200 hens (Table 2). Here, too, the object is to use the forage and corn on the farm. The beef calves are born in the early spring and after they are weaned, they are handled as are the steers in the preceding plan. Ten litters of pigs will be farrowed in the spring and 5 in the fall. With this plan, expenses are relatively low. Aside from the investment in machinery, the largest single item of expense is for feeds — oats, protein concentrates, and poultry mash (Table 2).

Dairy and hog farm. To use the forage and corn produced, 20 dairy cows, 16 litters of pigs, and 200 hens are kept (Table 2). A new barn must be built to establish the dairy enterprise. The building expense shown in Table 2 includes only the annual charge for the new barn after it is built. (For a discussion of this capital investment, see page 29.) To carry out this plan, more feed than the farm produces will be needed. The cost of additional corn, and of oats, protein concentrates, and poultry mash will be about $1,670. The dairy program requires the help of a hired man for the whole year. Among expenses, his wages are a major item (Table 2).

Comparison of Plans

On this rolling upland farm, the choice of a farming system is not as wide and as varied as it is on the flat upland farm. In each of the plans for farming the rolling upland farm, the income from soybeans and wheat is less than that from livestock. If intensive practices to control erosion are followed, a somewhat larger grain acreage can be grown on this farm. Some rolling upland farms, however, should have a still larger proportion of their acreages in grasses and legumes.

Net returns to capital and management on this farm are highest from the feeder cattle and hog plan (Table 2). But with this program, capital requirements and risk are relatively high. Net returns are lowest from the beef-cow and hog farm, but the capital required and the risk are also relatively low. On the dairy and hog farm, receipts, expenses, and net returns are intermediate (Table 2).

To utilize the resources of a rolling upland farm, a livestock pro-

gram is necessary. A farmer's success on such a farm and his success with any of the plans presented here depends a good deal on his efficiency as a livestock producer.

Other Possible Plans

Various livestock systems can be used successfully on this farm, as the figures in Table 2 show. Each of the three plans previously discussed could be modified to fit a different situation without a major change in net returns. Hog numbers could be increased or decreased. If the number were increased, some corn would have to be bought; if the number were decreased, some corn could be sold. The poultry flock could also be increased, especially on the dairy and hog farm. Here an increase would more fully utilize the labor of the full-time hired man.

BOTTOMLAND FARM

Flood Risks and Drainage Problems

Bottomland farms vary a good deal in flood hazards, in drainage, and in soil characteristics. The risks from floods on these farms has not been definitely measured in these plans. On some farms it is quite high. It is believed, however, that the indicated crop yields can be attained as a long-time average. On the farm used as the basis for these plans, the 1948 corn crop averaged 60 bushels an acre. Very little had been done with a soil-fertility program. But in bottomland areas, conditions vary considerably from farm to farm. The frequency and duration of floods need to be carefully appraised when plans for individual farms are being made.

Drainage on some of these bottomland farms also presents problems. How well the land drains after flooding or during rainy seasons and whether the drainage can be improved are important questions. On the answers depend the possibility of getting crops planted under favorable conditions, the prospects for satisfactory crop yields, and the probable success of livestock production.

This particular bottomland farm is subject to occasional overflow. Though wheat and standover legumes can be grown, the risk is rather high. Of the three plans for operating this farm to be presented here, *only the plan for the corn-and-soybean farm is recommended.* A bottomland farm of similar acreage and layout but less subject to overflow could be operated by either of the other plans.

Operator's Plan

The 280 acres in this farm are all bottomland soil types. Forty acres of woods and 60 acres of idle cropland are typical of bottomland farms. The farm is rented on a crop-share basis and operated chiefly as a grain farm. Two acres are in soybean hay and 40 in very poor pasture

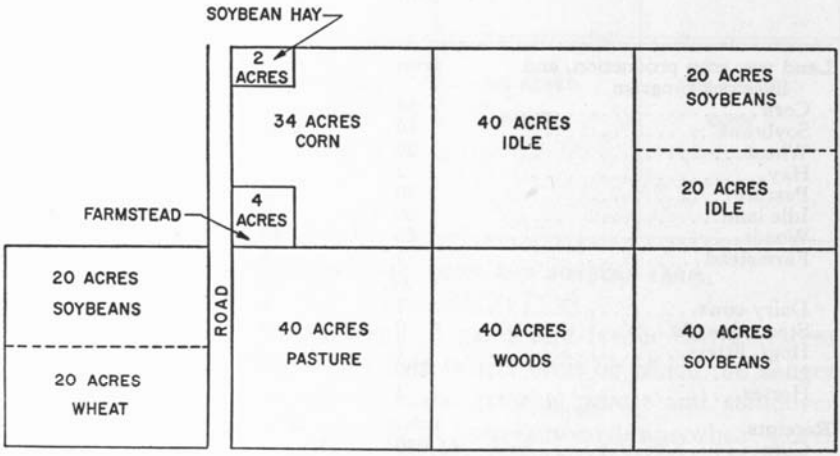

Fig. 6. — OPERATOR'S PLAN

(Fig. 6). Little has been done to improve the soil and the buildings are in poor condition. Livestock include 7 milk cows, 1 litter of pigs, 200 hens, and 2 horses (Table 3).

Three Improved Plans

Corn and soybean farm. As noted above, operating this bottomland farm as a corn and soybean farm is recommended. The plan includes a 2-year rotation of corn and soybeans (Table 3 and Fig. 7) with a rye-and-vetch catch crop to supply organic matter and improve soil tilth. This is an intensive cropping system requiring heavy applications of fertilizers. After the soil has been built up, keeping up fertility will require applying fertilizers every year in the amounts given on page 7. The annual cost of these fertilizers, including depreciation of limestone, is $1,948 (Table 3).

Under this plan, the livestock to be kept will be mainly for home use and will include 2 dairy cows, 2 litters of pigs, and 200 hens (Table 3). Three acres of soybeans provide hay and 5 acres of soybeans and sudan grass furnish pasture.

Table 3. — BOTTOMLAND FARM, 280 acres: Crop Production, Livestock Program, and Receipts, Expenses, and Returns

(Operator's actual plan of operation and three improved plans of operation)

Item	Actual plan	Improved plan for—		
		Corn and soybean farm	Grain and feeder cattle farm	Grain and cattle and hog farm
Land use, crop production, and livestock program	*acres*	*acres*	*acres*	*acres*
Corn	34	120	95	95
Soybeans	80	108	47	47
Wheat	20	0	47	47
Hay	2	3	18	18
Pasture	40	5	29	29
Idle land	60	0	0	0
Woods	40	40	40	40
Farmstead	4	4	4	4
	no.	*no.*	*no.*	*no.*
Dairy cows	7	2	2	2
Steers, bought	0	0	42	20
Hogs, litters	1	2	8	28
Hens	200	200	200	400
Horses	2	0	0	0
Receipts	*value*	*value*	*value*	*value*
Corn	$2,050	$9,304	$3,935	$3,145
Soybeans	2,419	5,207	2,255	2,255
Wheat	446	0	1,815	1,815
Milk	1,232	416	416	416
Veal calves and cull cows	482	76	76	76
Steers	0	0	9,240	4,620
Hogs	268	520	1,856	6,398
Poultry and eggs	800	1,282	1,282	2,484
Total	7,697	16,805	20,875	21,209
Expenses				
Fertilizers	266	1,948	1,199	1,199
Buildings	442	442	616	616
Machinery	1,980	2,655	2,973	2,973
Feed	252	717	1,119	1,620
Seed	50	436	311	311
Livestock, bought	57	56	3,836	1,898
Hired labor	0	300	500	1,500
Taxes and miscellaneous	380	480	480	480
Total	3,427	7,034	11,034	10,597
Receipts less expenses	4,270	9,771	9,841	10,612
Operator's and family's labor	1,760	1,760	1,760	1,760
Returns to capital and management	2,510	8,011	8,081	8,852

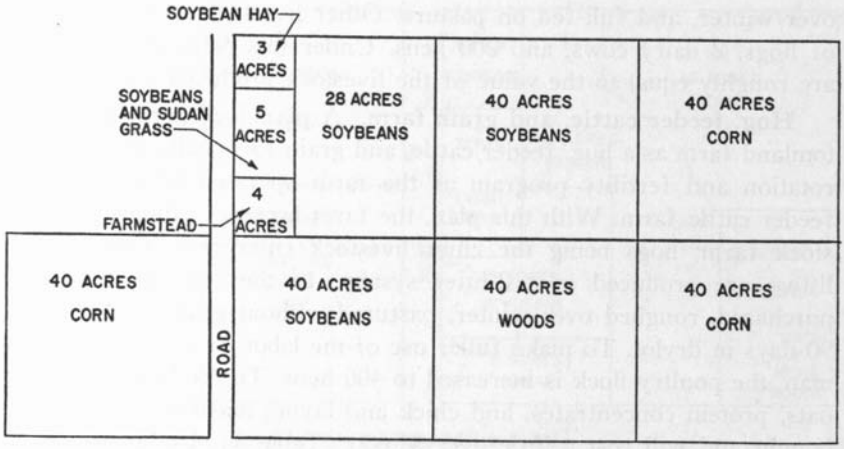

Fig. 7. — IMPROVED PLAN: CORN AND SOYBEAN FARM

Grain and feeder cattle farm. A grain and feeder cattle system of farming is well adapted to a bottomland farm on which the danger of flooding is small enough to make growing wheat and standover legumes practicable. The rotation is corn-corn-soybeans-wheat-clover (Fig. 8). To keep up fertility with this cropping system will require applications of fertilizers every year (for amounts, see page 7). The annual cost, including depreciation of limestone, is $1,199 (Table 3).

According to this plan, feeder cattle utilize the standover legumes. Forty-two head of 500-pound steers are bought in the fall, roughed

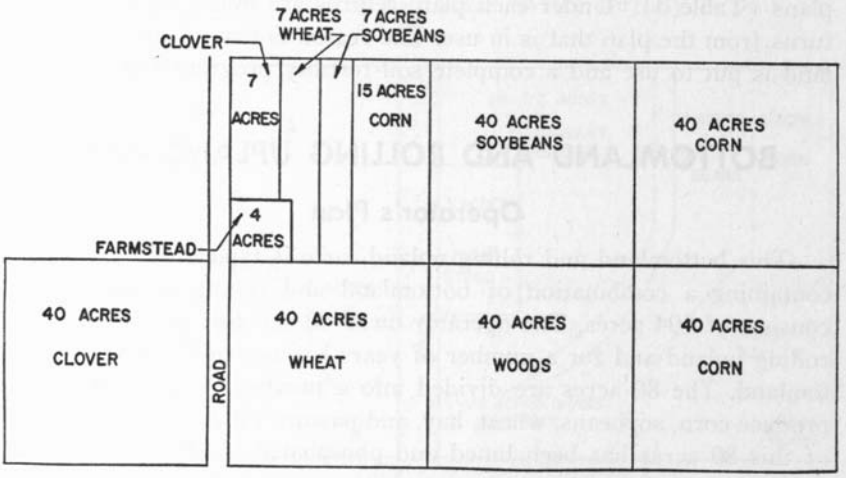

Fig. 8. — IMPROVED PLANS: GRAIN AND FEEDER CATTLE FARM OR HOG, FEEDER CATTLE, AND GRAIN FARM

over winter, and full-fed on pasture. Other livestock include 8 litters of hogs, 2 dairy cows, and 200 hens. Under this plan, sales of grain are roughly equal to the value of the livestock produced (Table 3).

Hog, feeder cattle, and grain farm. A plan for operating a bottomland farm as a hog, feeder cattle, and grain farm calls for the same rotation and fertility program as the farm operated as a grain and feeder cattle farm. With this plan, the farm becomes primarily a livestock farm, hogs being the chief livestock enterprise. Twenty-eight litters are produced in a 2-litter system. In the fall, 20 steers are purchased, roughed over winter, pastured without grain, and full-fed 90 days in drylot. To make fuller use of the labor of a full-time hired man, the poultry flock is increased to 400 hens. To feed this livestock, oats, protein concentrates, and chick and laying mash will have to be bought and will cost a little over $1,600 (Table 3). Under this plan, receipts from livestock are greater than receipts from grain (Table 3).

Comparison of Plans

As previously noted, the corn and soybean farm plan is the only plan recommended for a bottomland farm subject to severe flooding. But any of these three plans, or modifications of them, can be used successfully on a farm on which the danger from flood is not great.

In each plan the program of land use is set up for high grain acreages and high production. The livestock programs vary. The first plan calls for practically no livestock, the other plans for fairly intensive livestock systems. Net returns do not differ greatly under the three plans (Table 3). Under each plan, returns are much higher than returns from the plan that is in use. The reason is that all the productive land is put to use and a complete soil-fertility program followed.

BOTTOMLAND AND ROLLING UPLAND FARM

Operator's Plan

This bottomland and rolling upland farm is typical of those farms containing a combination of bottomland and rolling upland soil. It consists of 194 acres. The operator owns 80 acres of gently-to-steeply rolling upland and for a number of years has rented 114 acres of bottomland. The 80 acres are divided into a number of small fields that produce corn, soybeans, wheat, hay, and pasture (Fig. 9). Roughly half of this 80 acres has been limed and phosphated. In 1948, the survey

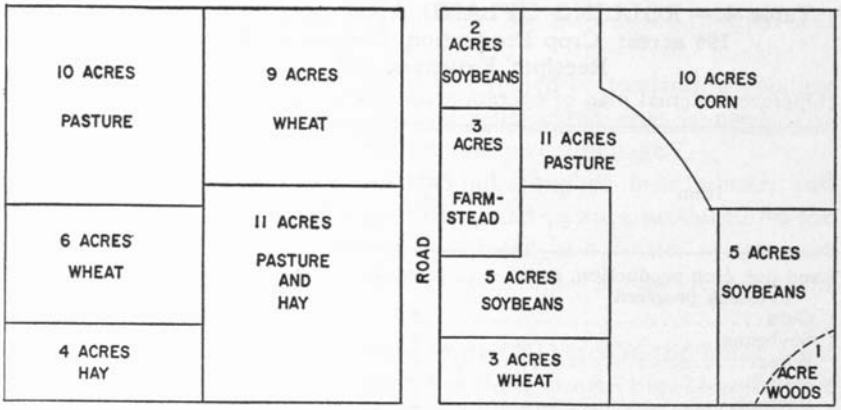

Fig. 9. — OPERATOR'S PLAN

year, 28 acres of the rented bottomland were idle while the rest was in corn, soybeans, and wheat. The rented land (not shown in Fig. 9) is adjacent to and readily accessible from the 80 acres. Livestock on the farm include 2 dairy cows, 2 litters of pigs, 150 hens, and 2 horses (Table 4).

Three Improved Plans

Livestock and grain farm. On the 80 acres the operator owns, 34½ acres of steeply rolling land are put in permanent pasture (Fig. 10). A 5-year rotation of corn-soybeans-wheat-meadow-meadow is followed on 40 acres. The farmstead, a grass waterway, and an acre of woods make up the remaining 5½ acres. After fertility is built up,

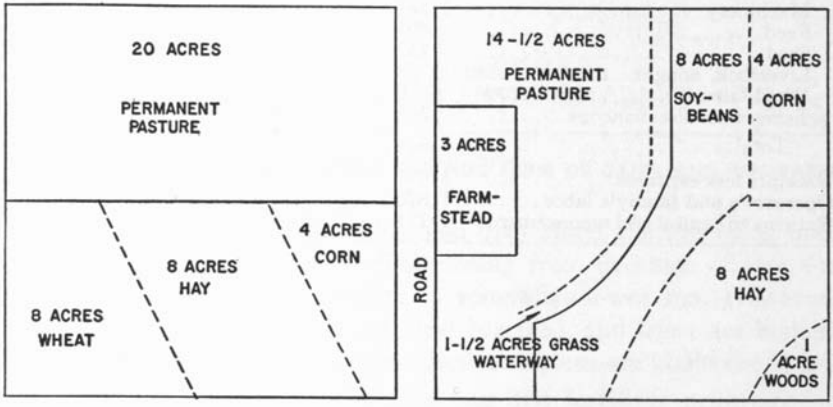

Fig. 10. — IMPROVED PLAN: LIVESTOCK AND GRAIN FARM

Table 4.—ROLLING UPLAND AND BOTTOMLAND FARM, 194 acres: Crop Production, Livestock Program, and Receipts, Expenses, and Returns

(Operator's actual plan of operation and three improved plans of operation)

Item	Actual plan	Improved plan for—		
		Grain and livestock farm	Feeder cattle and hog farm	Dairy and hog farm
Land use, crop production, and livestock program	*acres*	*acres*	*acres*	*acres*
Corn	52	65	57	57
Soybeans	47	65	57	57
Wheat	26	8	0	0
Hay	8	16	26½	26½
Pasture	29	34½	48	48
Idle land	28	0	0	0
Farmstead, woods, and waterway	4	5½	5½	5½
	no.	*no.*	*no.*	*no.*
Dairy cows	2	2	2	20
Steers, bought	0	26	42	0
Hogs, litters	2	16	16	16
Hens	150	200	400	200
Horses	2	0	0	0
Receipts	*value*	*value*	*value*	*value*
Corn	$2,701	$2,031	$ 581	$2,029
Soybeans	2,021	3,126	2,768	2,768
Wheat	446	297	0	0
Milk	320	416	416	4,160
Veal calves and cull cows	60	76	76	1,032
Steers	0	6,006	9,702	0
Hogs	557	3,713	3,713	3,713
Poultry and eggs	800	1,282	2,483	2,282
Total	6,905	16,947	19,739	14,984
Expenses				
Fertilizers	360	1,157	1,072	1,072
Buildings	306	435	435	543
Machinery	1,581	2,290	2,290	2,390
Feed	607	1,295	1,976	1,483
Seed	137	258	281	281
Livestock, bought	28	2,396	3,878	56
Hired labor	0	600	1,500	1,500
Taxes and miscellaneous	395	495	495	495
Total	3,414	8,926	11,927	7,820
Receipts less expenses	3,491	8,021	7,812	7,164
Operator's and family's labor	1,320	1,320	1,320	1,320
Returns to capital and management	2,171	6,701	6,492	5,844

annual treatments to maintain fertility on the land in the rotation will be needed. For amounts needed, see page 7.

Because wheat is a high risk on the rented bottomland, a rotation of corn and soybeans with a rye-and-vetch catch crop is used. The amounts of fertilizers needed annually are given on page 7.

Twenty-six steers, bought in the fall, roughed over winter, and full-fed 90 days in drylot utilize the hay and pasture produced on the home farm. And 16 litters of hogs produced in a 2-litter system, use most of the operator's share of the corn crop. The operator keeps 2 milk cows and 200 hens.

Cattle and hog farm. In this plan, the 80 acres in the home farm are put into hay and pasture and kept in these crops (Fig. 11 and Table 4) except as they have to be broken up for renovation or reseeding. The rented land is farmed as described above. Feeder cattle are handled as in the preceding plan, but the number is increased to 42 head. Sixteen litters of hogs utilize most of the remaining corn crop, including the landlord's share. To use the labor of a full-time hired man, the poultry flock is increased to 400 hens. The operator keeps 2 milk cows.

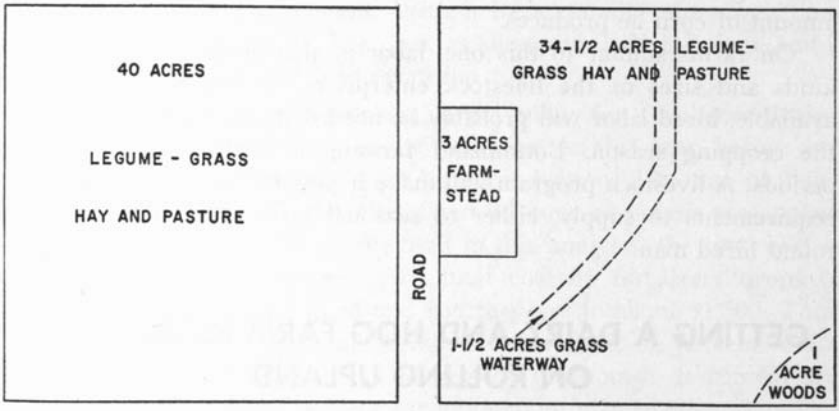

Fig. 11. — IMPROVED PLANS: CATTLE AND HOG FARM OR DAIRY AND HOG FARM

Receipts are higher under this plan than under the preceding one, a higher proportion of the receipts coming from livestock (Table 4). The cost of maintaining fertility is somewhat lower too. However, expenses for purchased livestock, and for feed, and labor are higher. The result is that net returns from these two plans are about the same.

Dairy and hog farm. The land use and fertilizer program for this dairy and hog farm (Table 4) are the same as they are for the

cattle and hog farm. The feeder cattle are replaced by a herd of 20 dairy cows. Sixteen litters of hogs a year are farrowed and 200 hens are kept, so that most of the operator's share of the corn crop is fed. Under this plan, net returns are somewhat lower than they are under either of the plans using feeder cattle (Table 4).

Farm Adapted to Several Farm Systems

Farms composed of both bottomland and rolling upland soils offer wide possibilities for general farming systems in which both grain and livestock are important sources of income. The hay and pasture crops produced on the rolling upland may be successfully utilized by either feeder or dairy cattle, as in the plans outlined here. With the cropping-system plans for a feeder cattle or dairy farm, a herd of beef cows could be used. Returns from a herd of beef cows would probably be lower than returns from feeder cattle, but capital requirements and risk would also be reduced. Although each of the plans outlined here calls for 16 litters of hogs, the size of the hog enterprise could be either larger or smaller, depending on how successful the farmer is with hogs and how closely he wants to fit the number of hogs to the amount of corn he produces.

On farms similar to this one, labor is also likely to influence the kinds and sizes of the livestock enterprises. Unless family labor is available, hired labor will probably be needed during at least a part of the cropping season. Bottomland farming is characterized by rush periods. A livestock program will make it possible to adjust total labor requirements to supply, either to seasonal hired workers or a year-round hired man.

GETTING A DAIRY AND HOG FARM ESTABLISHED ON ROLLING UPLAND

Of all the plans presented for the various farms, the plan for establishing a dairy and hog farm on the rolling upland farm is hardest to put into operation because it requires so much capital. The operator's capital is limited. Before he can completely turn this farm into a dairy and hog farm, he must build up fertility on 170 acres, buy or build up a herd of 20 dairy cows, and build a new dairy barn.

Two plans for converting this farm are given here. Certain features of these plans can also be used to convert farms in the other groups into livestock farms.

Plan One

Improvements will start in midyear with crops on the land as shown in Fig. 4, page 14. The first year therefore does not represent a full year of improvement. Main features of this plan are as follows:

1. During the first 4 years, soil fertility is built up. Four tons of limestone, 1,000 pounds of rock phosphate, and 400 pounds of muriate of potash per acre (potash in 2 applications of 200 pounds) are spread (Table 5). Beginning with the first full year after improvements are started, grain acreage is relatively large for 4 years in essentially a corn-soybeans-wheat-clover rotation (Table 6). The 5-year rotation of corn-soybeans-wheat-meadow-meadow begins with the sixth year.

2. Beginning with the fourth year, hog production increases to 16 litters. This is the first year enough corn is produced for a hog enterprise of this size.

3. The dairy barn is built in the fifth year.

4. The dairy herd is being built up. Eight heifer calves have been bought and the heifer calves born on the farm have been saved. By the fifth year, the herd contains 10 producing cows. In the sixth year, 4 more cows are bought. With heifers coming into production, the herd is built up to 20. The plan, as shown in Tables 2, 5, 6, and 7 has been carried out and is in operation.

This plan obviously requires a large outlay for fertilizers during the first 4 years, particularly in the first year. In this year, before any benefits are received from higher crop production, 388 tons of limestone, 48.5 tons of rock phosphate, and 9.7 tons of potash are applied (Tables 5 and 7). At the prices used in this analysis, the total cost is about $2,750. In the second year, total cost of fertilizers drops to about $1,600, and in the third and fourth years to about $1,300. Total cost for the 4 years is about $6,950. Of this total, 57 percent is for limestone and rock phosphate, 22 percent for potash, 9 percent for superphosphate, and 12 percent for ammonium nitrate.

Livestock present no particular problems during these years of changeover, aside from problems of efficient production, especially of hog production. In the first full year, 3 litters of hogs are farrowed in the spring and 6 in the fall. In the next year, 6 spring litters and 8 fall litters are farrowed. In still the next year, 8 spring and fall litters bring hog production up to the size called for in the final plan.

The hay produced under the present plan of operation (Fig. 2) will be carried over to fill the needs of the next year, when there are no standover legumes in the rotation (Table 6). In the third year (second

Table 5. — ROLLING UPLAND FARM: Crop Rotation and Soil Treatments Needed to Establish Dairy and Hog Farm — Plan One

(Fertilizers applied at following rates: lime, 4 tons per acre; rock phosphate, 1000 pounds per acre; 60-percent muriate of potash, 200 pounds per acre; 20-percent superphosphate and ammonium nitrate applied per acre at rates indicated)

Field	Acres	First year	Second year	Third year	Fourth year	Fifth year	Sixth year
1	30	**Wheat,** 7 acres **Redtop,** 23 acres No treatment	**Corn** Superphosphate, 200 lb. Potash Nitrate, 175 lb.	**Soybeans** Lime R. phosphate Potash	**Wheat** Nitrogen, 100 lb.	**Legumes and grass** No treatment	**Corn** Superphosphate, 150 lb.
2	30	**Redtop** Lime R. phosphate Potash	**Wheat** Nitrate, 100 lb.	**Legumes and grass** No treatment	**Corn** Superphosphate, 150 lb. Potash	**Soybeans** Superphosphate, 200 lb. Potash	**Wheat** Nitrate, 100 lb.
3	30	**Corn,** 22 acres **Redtop,** 8 acres No treatment	**Soybeans** Lime R. phosphate Potash	**Wheat** Nitrate, 100 lb.	**Legumes and grass** No treatment	**Corn** Superphosphate, 150 lb. Potash	**Soybeans** Superphosphate, 200 lb. Potash
4	30	**Redtop** R. phosphate Lime Potash	**Wheat and sweet clover** Nitrate, 100 lb.	**Corn** Superphosphate, 150 lb. Nitrate, 100 lb.	**Soybeans** Superphosphate, 200 lb. Potash	**Wheat** Nitrate, 100 lb.	**Legumes and grass** No treatment
5	30	**Redtop** Lime R. phosphate Potash	**Wheat and sweet clover** Nitrate, 100 lb.	**Corn** Superphosphate, 150 lb. Nitrate, 100 lb.	**Soybeans** Superphosphate, 200 lb. Potash	**Wheat** Nitrate, 100 lb.	**Legume** No treatment
6a	7	**Wheat** Lime R. phosphate Potash	**Permanent pasture** No treatment	**Permanent pasture** No treatment	**Permanent pasture** Superphosphate, 200 lb. Potash, 200 lb.	**Permanent pasture** No treatment	**Permanent pasture** No treatment
6b	13	**Redtop** No treatment	**Redtop pasture** No treatment	**Redtop pasture** No treatment	**Seeded to pasture** Lime R. phosphate Potash	**Permanent pasture** No treatment	**Permanent pasture** No treatment

Table 6. — ROLLING UPLAND FARM: Acres in Various Crops During Period Needed to Establish Dairy and Hog Farm — Two Plans

Crop	First year[a]	Second year[b]	Third year[c]	Fourth year	Fifth year	Sixth year[d]
Plan 1	*acres*	*acres*	*acres*	*acres*	*acres*	*acres*
Corn	22	30	60	30	30	30
Soybeans	0	30	30	60	30	30
Wheat	14	90	30	30	60	30
Hay and pasture, total	134	20	50	50	50	80
Rotation hay and pasture	(e)	0	30	30	30	60
Improved permanent pasture	(e)	7	7	20	20	20
Unimproved permanent pasture	(e)	13	13	0	0	0
Plan 2						
Corn	22	30	30	30	30	30
Soybeans	0	30	30	30	30	30
Wheat	14	90	30	30	30	30
Hay and pasture, total	134	20	80	80	80	80
Rotation hay and pasture	(e)	0	60	60	60	60
Improved permanent pasture	(e)	7	20	20	20	20
Unimproved permanent pasture	(e)	13	0	0	0	0

[a] Not a full transition year. Crops as in operator's plan (see Fig. 2).
[b] First full year of transition.
[c] Final rotation established in Plan 2.
[d] Final rotation established in Plan 1.
[e] Total acreage not broken down.

full year), livestock will not utilize all the legumes produced and what is not used will be left on the land. Beginning with the fourth year, the hay and pasture produced will be only slightly above the amounts needed by livestock.

Adequate hay and pasture favor raising heifer calves to increase the dairy herd to 20 cows. Two cows were on the farm when the plan was started. If 4 heifer calves are bought in the third year and 4 in the fourth, 10 cows and heifers will freshen in the fifth year when the barn is built. If 4 more cows are bought after the barn is built, 20 cows will freshen in the sixth year. Until the new barn is ready for use, the operator will not be able to meet the requirements of the fluid milk market and until the time at which he can meet the requirements will continue to sell butterfat. In the second and third years, 3 cows will be milked and in the fourth year, 4 cows.

At 1947 prices, it has been estimated that adequate facilities for producing high-quality milk could be built with an initial investment of $316 per cow.[1] Although careful planning and attention to low-cost

[1] R. N. Van Arsdall, D. B. Ibach, and Thayer Cleaver. Economic and Functional Characteristics of Farm Dairy Buildings. Ill. Agr. Exp. Sta. Bul. 570. 1953.

construction would be required, the barn needed in this plan would cost $6,300, according to estimates. The barn would include shelter for the herd, feed storage, and milking and milk-handling facilities for producing Grade A milk.

Table 7. — ROLLING UPLAND FARM: Estimated Annual Income and Expenses During Period Required to Establish Dairy and Hog Farm — Two Plans

Item	First year	Second year	Third year	Fourth year	Fifth year	Sixth year
			Plan 1			
Receipts						
Crop sales	$ 210	$4,077	$5,113	$4,039	$3,829	$2,608
Livestock and livestock product sales	2,750	3,051	4,662	5,804	7,138	10,187
Total	2,960	7,128	9,775	9,843	10,967	12,795
Expenses						
Fertilizers	2,759	1,591	1,314	1,289	662	679
Buildings and machinery	1,563	1,935	1,960	1,985	8,285	2,343
Feed and seed	1,103	1,067	1,331	1,539	1,537	1,871
Livestock bought	28	56	356	356	56	856
Other farm expenses	285	585	735	735	1,885	1,885
Total farm	5,738	5,234	5,696	5,904	12,425	7,634
Living and personal	1,300	2,000	2,000	2,000	2,000	2,000
Interest	0	200	200	100	0	200
Total	7,038	7,434	7,896	8,004	14,425	9,834
Money borrowed	4,000	0	0	0	4,000	0
Principal repaid	0	0	2,000	2,000	0	2,000
			Plan 2			
Receipts						
Crop sales	210	4,059	2,610	2,608	2,608	2,608
Livestock and livestock product sales	2,750	3,756	11,129	9,722	10,199	10,187
Total	2,960	7,815	13,739	12,330	12,807	12,795
Expenses						
Fertilizers	2,759	1,962	1,054	560	697	679
Buildings and machinery	1,563	1,935	1,960	1,985	8,285	2,343
Feed and seed	1,103	1,072	1,425	1,411	1,539	1,871
Livestock bought	28	2,756	2,606	2,156	56	856
Other farm expenses	285	585	735	735	1,885	1,885
Total farm	5,738	8,310	7,780	6,847	12,462	7,634
Living and personal	1,300	2,000	2,000	2,000	2,000	2,000
Interest	0	200	325	125	0	100
Total	7,038	10,510	10,105	8,972	14,462	9,734
Money borrowed	4,000	2,500	0	0	2,000	0
Principal repaid	0	0	4,000	2,500	0	2,000

On the basis of estimates of annual expenses and income of most farmers on typical rolling upland farms, this plan is feasible. Such a plan would, however, mean using borrowed capital. If, for example, at the beginning of the changeover period, the farmer has no available capital over and above what he needs for living and operating under his present plan, he would need to borrow $4,000 in the first year to make fertilizer treatments, put in 90 acres of wheat, and pay for additional fertilizers and operating expenses before he harvests his wheat in the second year (Table 7). If he needs $2,000 a year for living and personal expenses (much more than the farm has provided under the present plan), he will repay none of the loan during the second year. But he can repay half of it in the third year and half in the fourth and still have $2,000 each year for living and personal expenses. In the fifth year when he builds the barn, he will need a second loan of $4,000. He can repay half of this in the sixth year and half in the seventh.

Plan Two

This plan is similar to Plan One in that in the first year the soil treatments and in the second year the crops are the same, the dairy herd is built up in the same way, and the barn built in the fifth year. It differs from Plan One in the following respects:

1. The 5-year rotation, corn-soybeans-wheat-meadow-meadow, is established sooner — at the beginning of the third year. In the third, fourth, and fifth years the rotation includes 60 acres of standover legumes instead of 30. This rotation reduces by 30 acres corn, soybeans, or wheat (Table 6).

2. The 13 acres for permanent pasture are fertilized and seeded in the second instead of the fourth year.

3. A temporary steer-feeding program uses the hay and pasture until the dairy herd is built up. If enough stubble clover can be harvested the second year to winter a first drove of steers, 30 will be bought. If stubble clover cannot be harvested or if the crop will not provide enough hay for 30 steers, this part of the program can be dropped the second year or the number of steers reduced. But since steers are to be bought in the fall, roughed over winter, pastured without grain, and full-fed 90 days in drylot, the hay and pasture produced in the third year will not be fully utilized on the farm as feed. In the fall of the third year, 25 steers will be bought and in the fall of the fourth year, 20.

4. Hog numbers are increased more slowly and do not total 16 litters until the sixth year.

Estimates of annual income and expenses indicate that this plan is also feasible. Total cost of fertilizers during the first 4 years will be about $6,350 (Table 7) as against $6,950 in Plan One, and the cost is concentrated mainly in the first 2 years. An initial loan of $4,000 is required as in Plan One, and a second loan of $2,500 will be needed to buy steers the second year. The $4,000 loan will be repaid in the third year and the $2,500 in the fourth. If living and personal expenses are the same as in the preceding plan, a loan of only $2,000 will be needed when the barn is built, and it could be repaid in the sixth year (Table 7).

Although financial progress is somewhat more rapid in this plan than in the preceding one, many farmers will not like it because of the larger loan needed in the first 2 years and because of the added risk of the steer-feeding program.

IMPROVED FARM PLANS PRESENT SPECIAL LEASING PROBLEMS

On three of the four representative farms for which improved farming plans have been presented, part or all the land is rented. Since the most common leasing practices[1] in the area have been established by custom to fit a low level of soil fertility and production and low capital inputs per farm, establishing a farming program on rented land that makes the best use of the resources of a farm may present some special problems.

The flat upland farm is used to show the nature of these problems and to show how they may be solved. Of the 275 acres in this farm,

[1] A 1951-1952 survey of leasing practices in southern Illinois showed that 50 percent of all leases reported were crop-share leases and that no cash rent was paid, while 26 percent were crop-share-and-cash leases and that on these farms the average cash rent was $159 a year. On both groups of farms the following provisions were the most common (figures in parentheses are the percentages of farms reporting a particular division of crops or expenses).

Landlord's share of crops: corn, one-third (92); soybeans, one-third (88); wheat, one-third (87); hay, one-half (63). **Landlord's share of soil-treatment expenses:** limestone, all plus trucking and spreading (81); rock phosphate, all plus trucking and spreading (64); mixed fertilizers, one-third of material (55). **Landlord's share of seed costs:** corn, none (94); soybeans, none (90); wheat, none (84); alfalfa, none (46); clover, all (83). **Landlord's share of harvesting expenses:** picking corn, none (94); combining soybeans, one-third (59); combining wheat, one-third (53); baling hay, one-half (70).

225 acres — all the grain-producing land — are rented. To increase net earnings from this farm, the soil must be built up. The investment in needed fertilizers is large and is probably the biggest obstacle in the way of a change of plan. If all the land in this farm needs full build-up treatments of 4 tons of limestone, 1,000 pounds of rock phosphate, and 400 pounds of muriate of potash per acre, the cost on the rented land will be about $7,500. If the landlord pays all the cost of limestone and rock phosphate and one-third the cost of potash, his share of the build-up cost amounts to about $6,000. This is a rather large investment for a landlord to make, probably in a 3-year period, and many landlords would hesitate to make it.

If, after the soil has been built up, the landlord pays one-third of the cost of superphosphate, potash, and nitrate, his cost for fertilizers will be about $450 per year. With this system, the landlord's net returns will be higher from the grain-farm plan with a catch-crop rotation than from the grain-and-livestock plan (Table 8). But the operator's earnings will be higher with a grain-and-livestock farm and a standover legume rotation.

The provisions of a lease may be changed in a number of ways to adjust the landlord's receipts to the cost of fertilizers and to make the grain-and-livestock plan more attractive to him. Cash rent could be increased to compensate him for the more fertile pastureland and greater use of buildings. Or the landlord's share of one or more grain crops could be increased, for instance, to two-fifths, or his share of harvesting expenses could be decreased. Still another possibility would be the use of a livestock-share lease. Such a lease might be attractive to both landlord and tenant.

Some adjustments are already being made on many rented farms in the area. It is highly unlikely that all the provisions in an individual lease will be identical with the most common provisions in leases in the area (see footnote 1, page 32). For example, the survey showed that 32 percent of the landlords reporting paid none of the cost of combining soybeans and 37 percent paid none of the cost of combining wheat. Under a lease by which the tenant pays all the cost of combining soybeans and wheat, just how far he could afford to go in making adjustments in the lease would depend considerably on his prospects for good returns from the larger cattle program he could carry with a grain and livestock farm.

With the grain-and-livestock plan the tenant will have either to buy the landlord's share of hay and most of the landlord's corn, or to buy similar quantities of these feeds elsewhere. At 1948 prices, these pur-

Table 8.—FLAT UPLAND FARM: Total Farm Receipts, Expenses, Returns, and Operator's and Landlord's Shares Under Operator's Actual Plan of Operation and Estimated Total Farm Receipts, Expenses, Returns, and Operator's and Landlord's Shares Under Two Improved Plans of Operation

(Based on most common leasing practices)

Item	Plan used			Improved plans for—					
				Grain farm			Livestock farm		
	Total	Operator	Landlord	Total	Operator	Landlord	Total	Operator	Landlord
Receipts									
Corn	$2,316	$1,377	$ 939	$4,050	$2,109	$2,031	$1,516	$ 0	$1,516
Soybeans	1,015	646	369	3,536	2,272	1,264	2,706	1,749	957
Wheat	149	83	66	2,846	1,828	1,018	2,178	1,407	771
Hay	252	212	40	0	0	0	604	0	604
Milk and veal calves	0	0	0	492	492	0	492	492	0
Steers	1,432	1,432	0	4,400	4,400	0	11,088	11,088	0
Hogs	557	557	0	557	557	0	3,713	3,713	0
Poultry and eggs	842	842	0	1,282	1,282	0	1,282	1,282	0
Total	6,563	5,149	1,414	17,163	12,850	4,313	23,579	19,713	3,848
Expenses									
Fertilizers	202	142	60	1,142	678	464	1,036	609	427
Buildings	286	143	143	435	292	143	605	385	220
Machinery	1,751	1,676	75	3,504	3,307	197	3,504	3,183	321
Feed	226	226	0	1,019	1,019	0	3,267	3,267	0
Seed	70	70	0	405	106	299	399	130	269
Livestock bought	34	34	0	1,856	1,856	0	4,376	4,367	0
Hired labor	0	0	0	450	450	0	1,500	1,500	0
Taxes and miscellaneous	375	150	225	475	250	225	475	250	225
Total	2,944	2,441	503	9,286	7,958	1,328	15,162	13,700	1,462
Receipts less expenses	3,619	2,708	911	7,877	4,892	2,985	8,417	6,031	2,386
Operator and family labor	1,760	1,760	0	1,760	1,760	0	1,760	1,760	0
Returns to capital and management	1,859	948	911	6,117	3,132	2,985	6,657	4,271	2,386

chases would come to $1,812. In most cases, these purchases should present no particular problems. It is significant, however, that the tenant's capital requirements for feed (Table 8) are considerably higher than might be concluded from the analysis of the farm as a unit.

In the claypan area, the tenant's purchase of the landlord's share of the feed crops is not so common as it is in some areas where crop-share leases predominate. If the tenant on this farm, operating it as a grain-and-livestock farm, were to limit his livestock operation so as to use only his share of the feed crops, he would have about 1,000 fewer bushels of corn to feed and less hay. He could adjust his livestock program to use his share of the crops by cutting the number of steers from 48 to 43, the litters of hogs from 16 to 8, and by cutting hay from a part of the 50 acres that he owns. This adjustment would reduce the tenant's net income by roughly $500.

SOME QUESTIONS AND ANSWERS

How good a manager must you be to get returns as high as those given here? At least average. The crop yields given for these various plans are entirely reasonable. If you spread fertilizers in the amounts needed, choose adapted varieties, perform critical operations at the right time, and keep weeds and insects under control, you should be able to get these yields. If your ability as a manager is better than average or if you put on higher (but still profitable) applications of fertilizers, you can get still greater yields. If you choose one of the livestock plans, you should also have average ability as a livestock man.

Whatever your plan, it is essential to realize that managing a successful farm business means more than knowing how to put in and harvest a crop or how to raise and feed livestock. Good management demands good judgment — especially good judgment concerning markets and how they are likely to change, and concerning keeping expenses in line with income.

What effect will prices and costs have on these plans? Prices vary from year to year and over a period of years, as do the relationships of prices to costs. The prices and costs on which these plans were made, however, are conservative enough to make the plans profitable, even though the price level, or the relationship between prices received and prices paid were to change considerably.

The prices used are considerably lower than prices have been in recent years. The relationship of feed prices to livestock prices is in line with what can be expected over a period of years and is profitable. Most farmers should be able to convert feed into livestock and livestock products at these rates. The price spread between feeder cattle and fat cattle is favorable, but lower than it has been in many recent years.

Expenses have been greater in the last few years than they were in 1948 when the plans were made. And the prices farmers have had to pay in relation to those they have received have gone up.

How can you put a plan in operation? There is no answer to this question that will apply in all respects to every farmer, since no two farms or farmers are just alike. In general, however, you will need to take these steps.

1. Decide to which of these 4 types your farm belongs.
2. Study the various plans suggested here for that type and decide what features of the various plans seem best adapted to your farm and to your abilities and interests. At this point a realistic appraisal of your

experience and abilities is highly important. Such an appraisal should take into account your age and physical capacity, as well as your ability to manage a larger business successfully. It should also take your interests into account. If you like and have handled livestock successfully, you may do well to consider a livestock plan. But if you don't like livestock, you may do better as a grain farmer if your farm is suited to grain production.

3. Decide what cropping system is best adapted to your farm and what the rotation is to be. You may need expert help with this and some of the following problems. Go to your farm adviser for advice, or write to the Department of Agricultural Economics, University of Illinois, Urbana.

4. Take stock of your fertilizer needs. How much limestone and phosphate have already been spread? How much more does the soil need? To find out, get the soil tested. (Soil samples for tests should be taken in the right way and in the right order. If you don't know how to take samples, ask your farm adviser.) Don't ignore the need for potash. Many claypan soils need and must have potash to produce good yields.

5. Make a list of the buildings, livestock, fences, equipment, etc. on your farm. How much of it will need to be repaired, remodeled, or replaced to make it fit the demands of your new plan?

6. Estimate your costs and returns. How much will fertilizers, repairs, equipment, feed, livestock, etc. cost the first year, the second year? How much income can you expect from the new plan? How many years will it take to put the plan in operation? How much will you need to borrow for a short term, for a long term? Plan so that you use limited capital for investments that pay off in a short time or that carry a low risk.

7. Consider the provisions of your lease if you rent land. Will your plan be profitable under its terms? What adjustments can you and your landlord work out?

Why not start making these farms earn more now? As has been said before, the production and earning levels established in these plans, though higher than many farmers in the area now attain, are reasonable and practicable. Some farmers will be able to reach these levels in less time than the plans call for. And some may need more time.

Some farmers will need expert help and advice from time to time. Many will no doubt need the cooperation of their landlords and some will need borrowed capital. But the figures for these farms show that the added capital needed to put the plans in operation pays big dividends. The time to start earning those dividends is now.

SOME STANDARDS USED IN FARM PLANS AND BUDGETS

Seeding Mixtures for Pastures and Catch Crops, Pounds per Acre

Pasture Mixtures

Flat upland soils

Timothy, 4
Ladino, 1
Red clover, 4
Lespedeza, 5

Rolling upland soils[a]

Timothy, 4
Ladino, 1
Red clover, 5
Lespedeza, 6

[a] Alfalfa could be used in this mixture.

Bottomland soils

Timothy, 3
Ladino, 1
Alsike clover, 2
Lespedeza, 6

Catch-Crop Mixtures

Upland soils

Sweet clover, 8
Red clover, 6
Lespedeza, 8

Bottomland Soils

Rye, 60
Vetch, 12

Prices Received by Farmers[b]

Grain, per bushel	
Corn	$ 1.25
Oats	.60
Wheat	1.65
Soybeans	2.05
Hay, per ton	
Soybean	14.50
Redtop	14.00
Lespedeza	13.50
Redtop and lespedeza	13.75
Mixed clover	17.50
Mixed alfalfa	20.50
Cattle and hogs, per 100 pounds	
Fat hogs	$ 16.50
Fat steers	22.00
Grass steers	18.00
Cows and calves, per head	
Cull beef cows	140.00
Cull dairy cows	125.00
Veal calves	38.00
Milk, per 100 pounds	3.20
Butterfat, per pound	.52
Eggs, per dozen	.35
Poultry, per bird	.90

[b] Prices are based on 1.9 times the 1935-1939 average except where adjustments were necessary because of changes in price relationships. Adjustments were made on prices of soybeans, beef cattle, and eggs. The 1935-1939 average was based on data from Illinois Crop Reporting Service and *Drovers' Journal*.

Prices Paid by Farmers

Seed, per bushel	
Corn	$10.00
Alsike clover	20.00
Red clover	25.00
Alfalfa	35.00
Timothy	7.00
Rye	1.50
Seed, per pound	
Redtop	.40
Ladino	1.50
Sweet clover	.10
Fescue	.90
Lespedeza	.22
Bromegrass	.25
Vetch seed, per 100 pounds	6.50
Fertilizers, per ton	
Limestone	$ 3.00
Rock phosphate	22.50
Superphosphate	35.00
Muriate of potash	52.00
Ammonium nitrate	67.00
Feeds, per 100 pounds	
Dairy	3.40
Soybean meal	3.60
Tankage	5.50
Linseed oil meal	4.50
Cottonseed oil meal	3.70
Chick mash	5.00
Laying mash	4.50
Feeder steers, per 100 pounds	18.00
Baby chicks, per 100	14.00

Machinery and Building Costs[a]

	Farms of 140 to 219 acres			Farms of 220 to 299 acres			Farms of 300 acres or more		
	Grain	Live-stock	Dairy	Grain	Live-stock	Dairy	Grain	Live-stock	Dairy
Machinery costs, per acre	$11.89	$14.87	$15.00	$11.25	$14.36	$14.56	$9.62	$13.23	$13.44
Building costs, per acre	1.88	2.24	2.80	1.58	2.20	2.40	1.33	1.90	2.10

[a] Annual charges for building and machinery expenses for farms of various sizes and types are based on data from Illinois Detailed Cost Accounting Record and adjusted to fit Wayne county conditions. These charges are on a 1948 level.

Results of a study of farms in the claypan area of southern Illinois were reported in Illinois Bulletin 579, Organization and Operation of Farms in the Claypan Area of Southern Illinois. This circular, an outgrowth of the study, applies the findings to typical claypan farms and shows how production and earnings can be increased.

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