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REPLANNING A FARM FOR PROFIT.

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF PLANT INDUSTRY,
OFFICE OF THE CHIEF,
Washington, D. C., July 7, 1909.

SIR: I have the honor to transmit herewith and to recommend for publication as a Farmers' Bulletin a manuscript entitled "Replanning a Farm for Profit," prepared jointly by Mr. C. Beaman Smith, Agriculturist, and Mr. J. W. Froley, Assistant Agriculturist, under the direction of the Agriculturist in Charge of the Office of Farm Management, of this Bureau.

Acknowledgments are due to the Bureau of Animal Industry of this Department for a critical reading of the manuscript and for helpful suggestions which have been embodied in the text.

Respectfully,

B. T. GALLOWAY,
Chief of Bureau.

Hon. JAMES WILSON,
Secretary of Agriculture.

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REPLANNING A FARM FOR PROFIT.

INTRODUCTION.

Habit frequently continues a type of farming in a community long after that type has become unprofitable. Wheat farming on fertile virgin soil is usually profitable, but there are many instances in the United States where farmers have continued to grow wheat for a number of years after it had ceased to be a profitable crop. The same is true of cotton. A two-year rotation of corn and oats has been continued in portions of the corn belt, notwithstanding the fact that it is often unprofitable, little or no money being made on either crop. Frequently these unprofitable types of farming continue through a series of years or until the property changes hands or new methods are introduced. The farmer finds it hard to change a lifelong habit.

DIFFICULTY OF TAKING UP A NEW LINE OF FARMING.

A man who has grown up with the agriculture of a community is slow to believe that the type of farming he has followed and which was at one time profitable has at last become unsuited to his conditions. It is no small task to think out and change his long-used type to some better kind of farming. There are several reasons why such a change is difficult. It may mean a new line of equipment. Buildings may need modification or fences must be rearranged. It may mean the introduction of commercial fertilizers or of more or different live stock on the farm. It may mean that money will have to be borrowed if the proposed changes are effected. Furthermore, the change may not succeed. At best the taking up of a new line of farming requires a readjustment of the usual ways of thinking and doing, a thing difficult in itself and requiring considerable time to accomplish.

HOW SHALL THE CHANGE BE MADE?

Notwithstanding habit may set the farmer in his ways, altered conditions and lessened yields and income may compel him to change his system or go out of business. To what shall he change? How shall be go about it? What type of farming is likely to prove more

profitable than the kind he is now following? What additional capital is necessary to institute a new and better system? These are the questions that confront him. They are difficult to answer. With pencil and paper in hand he may estimate the returns that may reasonably be expected by introducing more crops that build up the land, by growing more of the crop that is bringing him in the greatest amount of money, by giving more attention to the live stock that has been found to pay best, and the like.

If in these calculations he meets with difficulty because of a lack of definite information as to what may be reasonably expected when improved methods are applied in the culture of a crop or in the handling of stock, he may write to the agricultural college, or the board of agriculture, or the agricultural experiment station of his own State, or to the United States Department of Agriculture for help. It is the business of these institutions to discover and gather facts relative to the science, practice, and business of agriculture for the benefit of the farmer, and particularly for the farmer who wants to improve his methods of farming. The agricultural press also undertakes to aid the farmer in the solution of problems of this character.

In addition to these sources a few private firms have been established whose business it is to furnish expert advice on farm management for a consideration.

OBJECTIONS TO GIVING ADVICE ON THE MANAGEMENT OF ENTIRE FARMS.

Not always, however, are the institutions just mentioned prepared to give the farmer information on a plan covering his whole farm. The expert dairyman cares to give advice only on dairying, the entomologist only on insects and spraying, the agronomist only on field crops, the pathologist only on plant diseases, the shepherd only on sheep. Not many care to attempt to coordinate all the manifold interests of the farm into a single comprehensive farm plan, and yet this is exactly what the farmer must do every day of his life if he would get the most out of his farm and make farming pay.

The farmer is not simply a corn farmer, or a wheat grower, or a cattle breeder, or a sheep feeder, or a poultry raiser, but often all of these and more combined. His farm, therefore, must be planned with reference to all of these operations and the harmonious dovetailing together of the different parts. In replanning his farm for profit the farmer must see all these different problems in a comprehensive way at the outset, omit the features that do not pay, and strengthen those that do.

Fortunately, many of our agricultural colleges to-day are coordinating the work of their different departments and giving courses in farm management, and usually suggestions can be obtained from these sources relative to the general management of the farm—not necessarily detailed directions for farming, for it would be as difficult to tell a man how to farm as it is to tell him how to succeed in law, but rather to furnish him a comprehensive plan for managing his farm, corresponding in a way to the plan furnished by the architect to a builder.

FARM PLANS MUST BE BASED ON AVERAGE CONDITIONS.

It is often said that a farm can not be planned as other kinds of business are; that the vicissitudes of weather, the visitations of insect pests or plant diseases, the low prices that may prevail when the farmer has to sell, and other unforeseen circumstances may interfere to make all farm plans almost worthless from a practical standpoint.

This is often quite true with reference to plans made for a particular year. But when the plans are based on average conditions for a long series of years, then the objections do not hold. For while we can not tell what may happen during any particular season, we can foretell with considerable accuracy what the average conditions will be over a series, say, of ten years. The whole business of insurance is based on the reliability of averages. It can not be foretold just who out of a thousand persons will die next year, but it can be stated with much certainty about how many persons out of the thousand will die. Plans for the farm, likewise, must represent and be based on average conditions and not on single years. The farm plan must be made for a period of years and not for a single year.

HOW FARMS ARE REPLANNED BY THE OFFICE OF FARM MANAGEMENT.

The United States Department of Agriculture is in almost daily receipt of letters to the following effect: The writer owns a farm. The farm is not paying. Can the Department suggest a kind of farming that will pay?

This correspondence is usually referred to the Office of Farm Management of the Bureau of Plant Industry for reply. It is to show how the Office of Farm Management handles such problems as these, and thus to indicate to the farmer the capabilities of a farm when replanned for profit and how he may go about replanning his own farm, that this bulletin is written.

REPLANNING A FARM IN CENTRAL ILLINOIS.

For the purpose of illustration, the problem of an 80-acre farm reported to the Office of Farm Management from central Illinois may be taken. The owner stated that his farm was located on the black prairie corn land common to that section of the State, that it was valued at $150 to $175 an acre, would rent for $5 an acre cash, and that it had been cropped with corn and oats for many years until the average yields were about 35 bushels of corn per acre or 20 bushels of oats.

In 1908 the actual yields were 24 bushels of corn and 12 bushels of oats per acre. The total income of the whole farm, estimating crops at average prices, was less than $450 for the year, from which it will be readily seen that the labor and capital invested are not very handsomely rewarded. In fact, if the labor on the farm were hired the farm would be run at a considerable loss. Valuing the farm at $12,000, the interest alone at 5 per cent is $600.

This farm was chosen for illustration because it is typical of large farming areas in parts of the Middle States and because the price of the land has outgrown the system of farming in vogue.

In the future management of this farm three propositions are open to the owner: (1) Continue the old method of farming and lose money; (2) rent the land out at $5 per acre cash and permit the land to be further robbed of soil fertility and impoverished; and (3) change his plans to meet the new conditions and farm rationally and profitably.

In replanning this farm it was decided as a preliminary to make general estimates of the returns that might be expected if the farm were operated along any one of the following lines:

(1) A grain and hay farm, with a three-year rotation of corn, oats, and hay.
(2) A grain and clover-seed farm, with a three-year rotation of corn, oats, and clover for seed.
(3) A grain and clover farm, with a four-year rotation of corn, corn, oats, and clover.
(4) A sheep farm.
(5) A hog farm.
(6) A dairy farm.

GENERAL CONSIDERATIONS IN REPLANNING THE FARM.

Among the first things essential to know in replanning a farm is what can reasonably be expected from the farm if properly handled. Judgment on this point will be considerably influenced by what is being done by good farmers on similar land elsewhere under like conditions.

The usual crops grown in the vicinity and the usual rotation on most of the farms of the neighborhood are corn and oats. But very

little hay is raised, notwithstanding both clover and timothy do well, nor is much stock fed. Some colts are raised, but most of the grain is sold direct to the elevator.

In the early days, when the land was new, corn yielded 75 to 80 bushels per acre and oats 40 bushels, and this type of farming—corn in rotation with oats—was very profitable. At the present time on similar land and within 10 miles of the farm in question one extensive farmer has been able to maintain the average yield of both corn and oats for a period of sixteen years at 40 bushels per acre. Even on this farm scarcely 15 per cent of the area is yearly planted to clover, and no commercial fertilizer and practically no stable manure is used.

With a proper system of rotation, the introduction of clover into the farming scheme, and the use of comparatively small quantities of commercial fertilizers where barnyard manure is not available, it should be easily possible to make the average yields of corn on this farm 60 to 75 bushels per acre and of oats 40 to 45 bushels.

This estimate is based on the fact that in a thirty-year rotation experiment at the University of Illinois the yield of corn in a rotation of corn, oats, and clover has averaged 58 bushels per acre, and when treated with lime and phosphorus in addition for thirteen years the average yield of corn per acre has been 90 bushels.[a] Our first thought, therefore, in replanning this farm is to introduce clover into the rotation and to use some form of commercial fertilizer that will maintain the fertility of the soil and increase the yield of money crops.

SOME FUNDAMENTAL POINTS TO BE KEPT IN MIND.

In replanning a farm it is essential that a few fundamental points in farming be kept constantly in mind:

(1) The plan should provide a reasonable reward for the labor and capital invested.

(2) The fertility of the farm should be maintained or increased.

(3) The plan must be suited to the capabilities of the owner for carrying it out.

It is assumed that in order to replan a farm for profit it is necessary to consider the capabilities of the farmer to put the new plan into effect. This, in general, will render it necessary to recombine the phases of farming with which he is already familiar or to bring in new features which are not very dissimilar to the ones he is already accustomed to. That is why in plan 1 the only change made is the addition of clover to the rotation, with a little bone meal to increase the corn crop.

[a] See Illinois Agricultural Experiment Station Bulletin 125, p. 324.

PLAN 1.—A GRAIN AND HAY FARM.

Live stock to be kept.

To successfully handle an 80-acre farm of heavy soil on which corn, oats, and hay are grown, about four work animals will be needed. These may well be draft brood mares, and it may safely be assumed that each mare will produce on an average a colt every other year. To supply the family with milk and butter, about two cows will be needed. The farmer will probably raise two or three hogs for pork and will keep a few chickens. It is assumed that the permanent pasture for two cows and two colts during the season, and possibly two or three hogs, depending on whether it may or may not be cheaper and less troublesome to buy pork than to put up hog fences and feed corn, together with the buildings, garden, and orchard, will require about 8 acres (ordinarily a cow requires 2 acres of pasture each season), thus leaving 72 acres of the farm which can be put into cultivated crops.

Rotation to be followed.

These 72 acres will be divided into three fields of 24 acres each without division fences, and a three-year rotation of crops will be observed as follows:

One 24-acre field will be planted with corn, using selected seed and fertilizing the field with all the barnyard manure available, and in addition applying about 400 pounds of steamed bone meal per acre. As this land still produces a luxuriant crop of clover no lime will be added at present other than that contained in the bone meal. The corn crop will be cultivated, not necessarily the regulation three times and then laid by, but as often as may be necessary to keep the upper 2 or 3 inches of soil loose, mellow, and free from weeds. The corn will be planted on a clover sod which has been plowed down in the fall and left rough through the winter.

The second 24-acre field will be planted to oats, or possibly winter wheat, as winter wheat is again coming into favor with farmers in the section. The oats will be put in on corn ground which has been thoroughly disked and put into fine condition for this crop. No fertilizer will be used on the oats. Selected seed of the Swedish Select variety or of some other variety that does well in the neighborhood will be sown. With the oats and ahead of the drill a mixture of about 10 pounds of common red clover and 12 pounds of timothy will be sown.

The third 24-acre field will be in hay, the timothy and clover mixture seeded with the oats the preceding year.

Yields to be expected.

In this first replanning of the farm, then, provision has been made for a three-year rotation of corn, oats, and clover, each to occupy the same field but one year before that field is refitted for another crop in the rotation. The total average yields that may be expected from this rotation after it is put into operation are about as follows:

Corn, 24 acres, at 60 bushels per acre	bushels	1,440
Oats, 24 acres, at 40 bushels per acre	do	960
Hay, 24 acres, at 2 tons per acre	tons	48

Feed required for stock.—All of this produce can not be sold, however. The stock must be fed, and for this purpose it is assumed that the following quantities will be required throughout the year for the different kinds of stock:

	Pounds.
4 mares, grain fed, 15 pounds each daily	21,900
2 colts, grain fed, 1 pound each, 300 days	600
2 cows, grain fed, 4 pounds each, 180 days	1,440
Total	23,940

The figures given are averages. It is expected that the grain fed the heavy type of draft horses kept on this farm will average nearer 20 pounds during the busiest part of the working season and considerably less than 15 pounds in winter. Usually in winter, when but little farm work is going on, only one team will be fed grain. In the above estimates no account is taken of the hay fed to stock, as it is the custom in the section to use oat straw and corn stover as the only roughage either winter or summer.

If this farm were being planned for the greatest profit instead of for the purpose of showing the various ways in which the problem may be attacked, less grain and more clover hay would be fed. In fact, all the hay produced on the place would be fed to stock of some kind bought or raised for the purpose.

Financial returns to be expected.

Since the roughage (oat straw and corn stover) fed both horses and cows is of a highly carbonaceous nature, the grain ration may well be straight oats, which is fairly rich in protein, instead of a mixture of oats and corn, which is commonly employed in the region. The 23,940 pounds of grain required to feed the stock represents about 750 bushels of oats. There will be required for seed each year also about 60 bushels of oats, making in all 810 bushels that will be consumed on the place. The remainder of the oats grown, together with all the corn, all the hay, 2 colts, and probably 2 veal calves, may

be sold each year and will constitute the gross income of the farm. The gross returns may be expected to be about as follows:

Corn, 1,440 bushels, at 50 cents a bushel	$720
Oats, 150 bushels, at 40 cents a bushel	60
Hay, 48 tons, at $8 a ton	384
Colts, 2, at $50 each	100
Calves, 2, at $5 each	10
Total gross income	1,274

From the $1,274 gross income should be deducted the cost of about 5 tons of steamed bone meal at $25 a ton, leaving a balance of $1,149 as the gross returns, out of which must come the expenses of labor, living, interest on investment, etc.

The effect of adopting plan 1.

In this first outline plan it is seen that by the introduction of hay, a large part of which is clover, into the rotation, thus augmenting the humus and nitrogen content of the soil, and by the addition of 400 pounds to the acre of steamed bone meal on each crop of corn, it may be expected that the yields will be doubled and the income raised from less than $450 to $1,149 a year, with all expense charges remaining practically the same as before, and in addition $125 paid out for steamed bone meal to help maintain the fertility of the farm. These results would not be secured the first year. The fertilized corn crop would first show the results of the system and not until the third year could the above results be expected.

The nearly 12 tons of grain fed, together with the 24 acres of oat straw and 24 acres of corn stover fed or used as bedding on the place, will make more than 100 tons of manurial material to be used on the corn. This, with the plowed-under clover stubble, will keep the farm fairly well supplied with humus. The 400 pounds of bone meal used on the corn, with that furnished by the manure, will more than supply the phosphoric acid removed by all the crops, and the only element of importance permanently decreased in the soil is potash. There is such an abundant supply of potash, however, in Illinois corn soils that this factor can probably be neglected for several generations yet.

In the above plan, should the farmer desire to feed about three hogs for pork, he should let them run on pasture, and can estimate that it will require about 15 bushels of corn each to bring them to a weight of 200 pounds at 10 months.

The income of $1,149 per annum by the system of farming outlined in plan 1 will pay only 5 per cent interest on a $15,000 investment and leave but $399 to pay taxes, running expenses, labor, etc., so further changes will be made as suggested in the following plan.

PLAN 2.—A GRAIN AND CLOVER-SEED FARM.

In plan 1, just described, the usual system of operating the 80-acre farm was modified in only one important particular. The rotation of corn and oats was changed to a three-year rotation of corn, oats, and clover and timothy hay, and the hay was sold for $8 a ton. Instead of selling the hay, suppose only clover seed is sown—either mammoth, common red, or alsike—and the whole crop saved for seed. How would this change affect the income and fertility of the farm?

The live stock kept on the farm would be 4 brood mares, 2 cows, and 2 colts, as before. The method of feeding them would be the same. One man could do practically all the work on the farm, as before. The 400 pounds of bone meal per acre would be applied on the corn crop each year, but instead of attempting to put up or market hay, only clover seed would be sown and attention centered on the production of a heavy clover-seed crop. The rotation would be (1) corn, (2) oats, (3) clover for seed.

Possibilities of clover-seed farming.

What are the possibilities of clover seed as a standard farm crop? As commonly handled—the first crop cut for hay and the second crop taken for seed—the average yields vary from a peck to occasionally 2 bushels per acre. Thus handled, clover seed is a precarious crop and there is practically no money in it. But farmers are known in Ohio and Illinois who make a business of growing clover for seed each year and who count with as much certainty on getting yields of 4 bushels of seed per acre as they do on getting 50 bushels of corn per acre each year on good corn land.

To secure seed the clover-seed farmer aims to make his clover bloom in dry weather. He reduces the quantity of stem, and instead of a rank-growing plant that lodges badly he will have a short, stocky, upright clover plant. Likewise he aims to have only a medium thick stand of clover on the field when he grows it for seed, and so will use much less seed at planting time than when the crop is grown for hay. And probably most important of all, the successful clover-seed farmer will make his clover bloom at a time when the insects [a] which injure the seed most are for the most part undergoing their transformations in the ground.

Usually all of the results referred to are accomplished by pasturing the clover back in northern Illinois to about June 1 to 10, or clip-

[a] What these insects are, their nature, and how to avoid them may be learned in detail by a study of Circular No. 69 of the Bureau of Entomology, United States Department of Agriculture, entitled "Some Insects Affecting the Production of Red Clover Seed."

ping the clover with the mower at about the same time and letting the clippings lie on the ground. It is not usually possible to get both a good hay crop and a good clover-seed crop the same season. Generally the hay crop must be sacrificed or cut considerably earlier than usual.

An instance is known of a 50-acre field of clover in Illinois, not far from the 80-acre farm here being considered, where haying was begun one season about ten days earlier than usual and finished about the usual time. The whole of the second crop was then saved for seed. On the part cut earliest for hay the seed obtained at the second cutting averaged close to 5 bushels per acre for common red clover. On that portion of the field cut last for hay the seed yield of the second crop was scarcely 1 bushel per acre. By cutting hay early the ravages of the clover-flower midge, which prevents clover-seed formation, were largely avoided and a good seed crop obtained.

Financial returns to be expected.

In the second plan it is assumed that if a farmer understands his business he can get average yields of at least 3 bushels of clover seed per acre. Assuming yields of 60 bushels of corn per acre and 40 bushels of oats, as before, that the stock will require the same quantity of feed as in plan 1, and that prices will be 50 cents per bushel for corn, 40 cents for oats, and $6 for clover seed, there will be for gross income the following:

Corn, 24 acres, 1,440 bushels, at 50 cents	$720
Oats (feed and seed, 810 bushels), 150 bushels, at 40 cents	60
Clover seed, 24 acres, 72 bushels, at $6	432
2 colts at $50 each	100
2 calves at $5 each	10
Total income	1,322

From this gross income of $1,322 will be deducted $125 for 5 tons of bone meal, leaving $1,197 to pay for labor, interest on investment, and other charges against the farm.

The growing of the clover for seed instead of for hay is thus seen to be even more profitable than the hay proposition. The labor of harvesting the seed is much less exacting than handling the crop for hay, and if a rain or two should come after the seed crop is cut the damage is far less than in the case of the hay crop.

Besides, instead of the hay being sold, resulting in considerable loss of soil fertility to the farm, all the clover straw and chaff would be returned to the fields and the fertility of the soil maintained much more surely than by plan 1.

It is thus seen that by simply modifying the present system of corn and oat growing on this farm by the addition of clover grown

for either hay or seed the gross income is more than doubled and the land greatly improved at the same time. The returns from this system of farming will just about pay 5 per cent interest on a $15,000 investment and moderate wages to one man for the year. It would not satisfy the man who had bought a farm and was trying to pay for it out of the proceeds of the farm.

PLAN 3.—A GRAIN AND CLOVER FARM.

If the crops grown on this farm and the prices received for them are examined critically, attention is attracted at once to the fact that the largest return per acre, $30, is secured from the corn crop. From the standpoint, therefore, of profit and the use of the crops here under consideration it is desirable to grow as large an acreage of corn each year as is consistent with good farming.

Some of the important factors that must be kept in mind in increasing the acreage of corn are the insects that affect the crop injuriously when grown too many seasons on the same field in succession, the necessity of maintaining the nitrogen and humus supply in the soil by the culture of some leguminous crop, and the supplying of adequate amounts of certain mineral fertilizers, like the phosphates, to secure maximum corn crops and insure the continued productiveness of the farm.

Rotation to be adopted.

A rotation which has been found satisfactory and effective in parts of the corn belt and which puts half the farm in corn each year is as follows: (1) Corn, (2) corn, (3) oats, (4) clover. This is a four-year rotation in which half the fields are in corn each year. It is true that in this rotation corn follows corn for two years, but this is not particularly objectionable on good corn ground, especially when, following corn, the field is given two years' rest from this crop and opportunity is thus afforded to free the land from the more serious pests of the corn. This is also a type of farming differing but little from that already in operation on the farm under consideration, and hence easy to adopt.

If it be assumed, as in previous plans, that 8 acres of the farm are devoted to buildings, yards, garden, orchard, and permanent pasture for the cows, colts, and calves, there will remain 72 acres to fit into this four-year rotation. These 72 acres, therefore, may be divided into four 18-acre fields and each year there will be grown (1) 18 acres of corn, (2) 18 acres of corn, (3) 18 acres of oats, and (4) 18 acres of clover. The corn will be fertilized each year with about 400 pounds of steamed bone meal per acre.

Live stock to be kept and yields to be expected.

As in previous plans, it is assumed that the stock kept on the farm will be 4 brood mares, 2 colts, and 2 cows. It has already been shown that to feed the fixed stock on the farm about 23,940 pounds of grain will be needed. In feeding the grain and for seed all the oats grown on the farm, about 720 bushels, will be needed, and about 45 bushels of corn in addition. The roughage and bedding for stock will consist of corn stover and oat straw. The clover may be handled either for seed or hay.

As the hay crop in the hands of the ordinary farmer is a little more certain than the seed crop, this phase will be considered in making the final calculations.

The average yield expected will be as follows:

Corn, 36 acres, at 60 bushels per acre	bushels	2,160
Oats, 18 acres, at 40 bushels per acre	do	720
Clover hay, 18 acres, at 2 tons per acre	tons	36

Financial returns to be expected.

Of the oats, 40 bushels will be used for seed and all the remainder fed.

Of the 2,160 bushels of corn, all but 45 bushels will be sold. All the clover hay will be sold. The average gross returns of the farm from all sources should be about as follows for the four-year rotation:

Corn, 2,115 bushels, at 50 cents	$1,057.50
Clover hay, 36 tons, at $8	288.00
2 colts, at $50 each	100.00
2 calves, at $5 each	10.00
Total	1,455.50

The amount of bone meal bought for the corn will be increased from 5 to 7 tons, which will cost about $175, leaving $1,280.50 as a return for the year's expenses, interest, and labor.

If the clover were harvested for seed instead of hay the returns for the clover crop would be $324 instead of $288, and in addition all the clover straw, which is worth as a fertilizer practically $8 a ton, would be left on the land as a permanent improvement instead of being sold off for hay.

The gross returns secured by thus adopting a four-year rotation instead of a three-year rotation and by increasing the acreage in corn have been increased from $130 to $160 over plan 1 and from $80 to $116 over plan 2, while as compared with the farm as at present planned the returns are 2.8 times as great. This plan yields a return of about 5 per cent on a $15,000 investment, and leaves from $530 to $566 to pay expenses, wages, etc.

To show the effect of making live stock the leading feature of the farm, plans showing the returns that may be expected by certain methods of handling different classes of stock will now be taken up.

PLAN 4.—A SHEEP FARM.

Of all the different types of agriculture, live-stock farming is the surest way known to increase yields and keep up permanently the fertility of the farm or to build up the farm after it has once been run down by years of grain, cotton, or tobacco farming. The owner of the 80-acre farm here under consideration was conscious of this fact and thought possibly he might go into some kind of stock farming. Would it pay? He liked sheep; people said there was "money in sheep." He desired that in replanning the farm its possible conversion into a sheep farm be considered. To meet this request, therefore, the farm has been planned along one of the more usual lines of sheep farming common to Illinois to see about what returns might be expected.

Live-stock farming a complex problem.

The introduction of stock on the farm complicates matters considerably in planning a cropping system which shall fit the needs of the stock kept and in estimating expenses and returns. First of all, in the present instance, it is necessary to know how many sheep an 80-acre farm will carry. Before this question can be answered it must be known roughly how much "fixed stock," like horses and cows, will be kept on the place, since it will require a certain amount of land to grow crops for this "fixed stock," and it is only the area that is left that can be counted on for pasture and crops for the sheep. In the previous plans, where an excess of grain and roughage was grown, the acreage of crops required for the fixed stock did not necessarily enter into the problem except as regards final returns. Now, however, the number of fixed stock kept and what they eat will be a limiting factor on the number of sheep that can be kept, and must be known at the outset.

In order that the plan for the farm may be in a measure comparable with the plans previously outlined it will be assumed at the outset that 4 brood mares will be kept for farm work, 2 colts raised yearly, 2 cows kept for family use, and 2 calves sold for veal.

Good sheep farming presupposes the growing of considerable clover or other leguminous hay. With clover hay for feed, an efficient ration for practically all this stock can be made, with corn as the principal grain ration. Some oats, perhaps, should be grown for the colts and cows, and some will be needed in starting lambs on

grain rations, but as corn weighs more per bushel and yields more bushels per acre than oats, it is desirable to use corn instead of oats whenever possible.

Feeding system for fixed stock.

The fixed stock or permanent stock on the place will be fed about as follows:

Horses.—An average each of 15 pounds of corn, 10 pounds of clover hay, and 5 to 10 pounds of cornstalks daily throughout the year.

Colts.—Run in permanent pasture; for about 300 days they will be fed an average of 1 pound of oats daily, and for 120 days of this time they will each be fed an average of 1½ pounds of clover hay a day. They will be sold before they are a year old.

Cows.—Run on permanent pasture from May 1 to October 31. From November 1 to April 30, or about 180 days, each will be fed an average of 4 pounds of corn and oats, half and half, with 5 pounds of clover hay and cornstalks or oat straw in addition.

The grain and hay required for this stock during the year will be about as shown below:

	Pounds.
Corn:	
4 horses, 15 pounds each, 365 days	21,900
2 cows, 2 pounds each, 180 days	720
Total corn	22,620
Oats:	
2 cows, 2 pounds each, 180 days	720
2 colts, 1 pound each, 300 days	600
Total oats	1,320
Hay:	
4 horses, 10 pounds each, 365 days	14,600
2 cows, 5 pounds each, 180 days	1,800
2 colts, 1½ pounds each, 120 days	360
Total hay	16,760

The above data indicate that for the fixed stock there will be required yearly 22,620 pounds of corn, 1,320 pounds of oats, and 16,760 pounds of hay.

With this type of farming, in which all of the crops grown on the farm are consumed on the farm and where clover will constitute the principal hay and pasture crop, it is assumed, as in previous plans, that the yields will be 60 bushels, or 3,360 pounds, of corn; 40 bushels, or 1,280 pounds, of oats; and 2 tons of clover hay per acre on the average each year.

Acreage required to support fixed stock.

With the above data in hand it is possible to determine the amount of land that will be required to support the fixed stock on the farm. This is shown in the table below.

TABLE 1.—*Acreage of corn, oats, and hay required by fixed stock.*

Kind of feed required.	Total quantity required.	Yield of 1 acre.	Total area of each crop required.
	Pounds.	*Pounds.*	*Acres.*
Corn	22,620	3,360 (60 bushels)	6.73
Oats	1,320	1,280 (40 bushels)	1.03
Hay	16,760	4,000 (2 tons)	4.19
Total acreage required			11.95

This table shows that about 12 acres of the farm must be devoted to growing hay and grain for the fixed stock. If to the 12 acres of corn, oats, and hay required for the fixed stock 8 acres more are added for the buildings, orchard, garden, and permanent pasture for the cows, colts, and pigs, there will be left for sheep only 60 acres of the farm. The problem now is, How many sheep will this area support? What is the maximum number of ewes that can be maintained on this area and what are the average returns that may be expected per annum?

To answer these questions it is first necessary to find out how much land will be required to support one sheep. This, in turn, depends on what the sheep eats, and so at the outset it is found necessary to adopt a feeding system and plan of management for the flock.

Flock management and feeding system.

Good grade Merino-Shropshire ewes will be used and pure-bred bucks of either the Shropshire, Oxford, Hampshire, or Southdown breeds. It is assumed that on the average each ewe in the flock will drop one lamb. It is planned to have the lambs dropped in February and sold the last of June or first of July, at a weight of from 40 to 50 pounds. This will avoid carrying the lambs through the hot summer months, when pastures are short, gains slow, and danger from infestation by stomach worms great. Besides, the ewes will be relieved by weaning the lambs at this season of the year and more pasture will be available for grazing; hence, more ewes can be kept and the ewes will be in better condition for September and October breeding.

The general scheme of feeding ewes and lambs will be about as follows:

Ewes.—The ewes will run at pasture from May 1 to November 30, and it is assumed that an acre of good clover pasture will support

about 4 ewes with their lambs. From December 1 to April 30 the ewes will receive about 3 pounds of clover hay daily, and in addition during the month of February, when the lambs are coming, each ewe will be fed about 1 pound of oats daily, while during March and April the same quantity of grain will be fed the ewes with the idea of thus increasing the growth of the lambs, but half the grain will be oats and the other half corn.

Lambs.—The lambs will run with the ewes up to the time they are sold, and from March 15 to June 30 will each receive daily on the average about three-eighths of a pound of corn until sold the latter part of June or early in July.

The total quantity of grain and hay that will be required for each ewe and her lamb during the year will be about as follows:

Ewes:	Pounds.
Hay, December 1–April 30, 151 days, fed 3 pounds daily	453
Oats, February 1–28, 28 days, fed 1 pound daily	28
Oats, March 1–April 30, 61 days, fed ½ pound daily	30.5
	58.5
Corn, March 1–April 30, 61 days, fed ½ pound daily	30.5
Lambs: Corn, March 15–June 30, 107 days, fed ⅜ pound daily	40.1
	70.6

Acreage required to support each ewe and her lamb.

As shown, each ewe and her lamb will require during the year a total of 453 pounds of hay, 58.5 pounds of oats, and 70.6 pounds of corn. In addition it has been assumed that they will also require one-fourth acre of pasture. The total area of land, then, required for each ewe and lamb for grain, hay, and pasture will be as shown in the following table:

TABLE 2.—*Acreage of corn, oats, hay, and pasture required by each ewe and her lamb during a season.*

Kind of feed required.	Total quantity required.	Yield of 1 acre.	Total area of each crop required.
	Pounds.	*Pounds.*	*Acres.*
Corn	70.6	3,360 (60 bushels)	0.021
Oats	58.5	1,280 (40 bushels)	.046
Hay	453.0	4,000 (2 tons)	.113
Pasture			.250
Total acreage for each ewe and her lamb			.430

In the above table the figures showing acreages in the last column are obtained by dividing the amount of feed required for each head by the quantity that can be produced on an acre. They show that there must be grown for each ewe and her lamb 0.021 of an acre of

corn, 0.046 of an acre of oats, 0.113 of an acre of hay, and 0.25 of an acre of pasture, or a total of 0.43 of an acre for a ewe and her lamb.

Number of ewes the farm will carry.

It has already been shown that the area required for the fixed stock, buildings, permanent pasture, etc., was 20 acres, thus leaving 60 acres of the farm for sheep, and since one ewe requires but 0.43 of an acre for her support, 60 acres will carry as many ewes as 0.43 is contained in 60, or 139, leaving off the fraction. It is assumed that three bucks will be needed for a flock of ewes of this size and that the bucks will require about the same feed as the ewes. It will therefore be safe to figure on a permanent flock of about 136 ewes and 3 bucks.

Acreage of crops to be grown for feed.

In replanning this farm as a sheep farm only such crops will be grown as the sheep and other live stock require. The acreages devoted to each of the crops of hay, pasture, oats, and corn are easily determined by multiplying the amount of each crop required for one ewe and her lamb, as shown in Table 2, by the total number of mature sheep kept on the place, or 139, and adding these results to the acreages required by the fixed stock as shown in Table 1. In the following table these calculations are made:

TABLE 3.—*Acreage required for the maintenance of 139 sheep and for the fixed stock.*

Kind of feed required.	Area required for 1 sheep	Area required for whole flock.	Area required for fixed stock.	Total area of each crop grown.
	Acres.	*Acres.*	*Acres.*	*Acres.*
Corn	0.021	2.919	6.730	9.65
Oats	.046	6.394	1.030	7.42
Hay	.113	15.707	4.190	19.90
Pasture	.250	34.750	.....	34.75
Total acreage required	.....	.....	.....	71.72

The last column of the above table shows that to meet the requirements of the sheep and fixed stock on the farm there should be grown each year about 9½ acres of corn, 7½ acres of oats, 20 acres of hay, and 35 acres of pasture, or 72 acres in all, in addition to the 8 acres of land devoted to buildings, orchard, garden, and permanent pasture for cows and colts.

Rotation to be followed.

For all practical purposes, these 72 acres might be divided into four 18-acre fields and a four-year rotation adopted as follows: (1) Corn and oats (10 acres of corn, 8 acres of oats, and the whole field seeded

to clover and timothy), (2) hay, (3) pasture, and (4) pasture. This rotation would supply each year 10 acres of corn, 8 acres of oats, 18 acres of hay, and 36 acres of pasture, which is practically what is needed by the stock kept.

This rotation calls for the seeding of clover in the corn at the last cultivation. Should the catch fail, a mixture of oats and field peas will be sown on the corn land the following spring and cut for hay. A mixture of clover and grasses should be seeded with the peas and oats to furnish pasture the following season.

Another rotation and arrangement of fields which would meet the needs of the sheep as regards crops and pasture would be as follows: (1) Nine acres of corn, (2) 9 acres of oats, (3) 9 acres of mixed clover hay, (4) 9 acres of mixed clover hay, and (5) four 9-acre fields of permanent or semipermanent pasture. The objection to this plan is the increased liability to stomach-worm diseases resulting from too long continued pasturing on the same fields.

Financial returns to be expected.

Having planned this farm as a sheep farm and having arranged to handle the flock by a method common on Illinois farms, the returns that may be expected from this type of farming may be considered. The sources of income and the gross returns that may be expected are about as follows:

136 lambs, at $4 each	$544.00
139 fleeces, at $1.50 each	208.50
2 colts, at $50 each	100.00
2 calves, at $5 each	10.00
Total returns	862.50

These returns are not particularly attractive, though nearly double what the farm is now paying. They hardly pay wages and interest on the investment. Had the owner not done some such preliminary figuring as here recorded, he might have gone into the sheep business somewhat along the usual lines, as outlined above, to his considerable disappointment.

Pasturage responsible for low returns.

An examination of the crop acreages required to support this flock of 139 sheep indicates the reasons for the comparatively low returns from this type of farming. Comparatively low-priced crops are grown. More than half the farm is in pasture. One-fourth of it is in hay. This is too large a proportion of high-priced land in cheap crops for profit.

There are other types of sheep farming much better adapted to this high-priced land. If a four-year rotation of corn, oats, hay, and

pasture were adopted, only half the number of sheep kept, and the surplus grain and hay sold, the income would be increased from $862.50 to $1,045.

Again, if a four-year rotation of (1) corn, (2) corn, (3) oats, and (4) clover for hay were adopted, cowpeas sown in one cornfield at the time of planting, rape sown in the other at the time of laying by the corn, the first crop of clover cut for hay and the second used for pasture, and a good quality of western lambs bought in September at the average Chicago price for the past five years ($5.87) and pastured on the clover, cowpeas, rape, and standing corn, then fed clover hay and corn until February and sold at the average Chicago price for the past five years ($7.44), the income from the farm after deducting the usual expenses for freight, commission, etc., would be about $2,065. This increased return is due primarily to the fact that three-fourths of the farm each year is in grain, while during the latter part of the season practically the whole farm is used for pasture. This system of sheep farming, besides taking more than $2,500 extra capital for purchase of lambs, requires executive ability of a high order. It serves, however, to bring out the value of studying carefully the type of farming one is following for profit.

PLAN 5.—A HOG FARM.

The returns that may be expected on this 80-acre farm from making hogs the main source of income and by following one of the better plans of hog raising will now be considered.

Pasture crops desirable for hogs.

A bushel of corn fed to hogs on a dry lot or in a pen will produce on an average 10 pounds of pork. The same corn fed in connection with bluegrass, clover, or other suitable pasture will produce 30 per cent more pork; besides the hogs will be healthier, and there will be much less danger from disease in the pastured hogs.

In replanning the 80-acre farm here under consideration as a hog farm, therefore, suitable pasture crops will be provided throughout the season. An acre of clover pasture or its equivalent should carry, when at its best, 12 to 20 hogs. In the present plan it is assumed that each brood sow on the farm will have one litter of 6 pigs a season, probably in April, and that 15 bushels of corn will carry a sow a year or produce a pig weighing 200 pounds by December.

Cropping plan.

While a ewe and her lamb in the farm system presented in plan 4 will scarcely eat 130 pounds of grain a season, two pigs will eat 1,680 pounds of grain, or more than twelve times as much as the sheep. Sheep are primarily grass eaters. Hogs economically consume large

quantities of grain. At the outset, then, it is seen that a hog farm must provide an abundance of grain, and in central Illinois that grain is corn.

In order, therefore, to grow as large an area of corn as possible and still follow a rotation of crops that will not permit of corn being planted on the same field oftener than two years in succession, with two years intervening before another corn crop is planted on the same field (for reasons that have been explained in plan 3), only one-half of the farm at most can be put into corn in a four-year rotation.

If there is set aside, therefore, as in all the plans heretofore considered, about 8 acres for the house, barn, orchard, garden, and permanent pasture for the cows, calves, and colts, there will remain 72 acres on which to grow crops for the fixed stock and the hogs.

This area may be divided into four fields of 18 acres each and a rotation followed of (1) corn, (2) corn, (3) oats, and (4) clover, exactly as discussed in plan 3. The important difference in the two plans is that instead of selling off the corn, as in plan 3, it will be fed on the place. The grain will be made into pork and the farm built up in productiveness considerably more rapidly than where all the corn is sold.

In the management of the fields the following general plan will be followed: One field of corn will be drilled in rows instead of check-rowed and with the corn will be planted about a peck of cowpeas. At the last cultivation of the corn a mixture of rye and rape will be sown in the corn to furnish additional green feed for the hogs in the fall. With the aid of movable fences this field of corn, cowpeas, rye, and rape will be harvested by the hogs themselves, the hogs being turned into the field early in September of each year.

The following year this field of corn, enriched by the planting of cowpeas, the pasturing off of the whole field with hogs, and the plowing under of the excess stubble and straw, will again be planted to corn. The third year the field will be seeded to oats and clover and the oats cut for grain. The fourth year the field will be in clover. A part of the clover will be pastured by hogs, part will be cut for seed, and a portion of the field plowed and seeded to a mixture of sorghum and rape for midsummer pasture, as outlined in detail farther along in this bulletin.

Conditions assumed.

In this plan, as in the others, it is assumed, in accordance with reasons previously stated, that by the use of 400 pounds of bone meal or its equivalent per acre on the corn and the growing of clover or an equivalent legume crop on the land once every three or four years

in systematic rotation, the corn yield can be made to average on the farm in question 60 bushels and oats 40 bushels per acre.

For this type of farm also, as in previous plans, about 4 work mares, 2 cows, 2 colts, 2 calves, and in addition 1 boar will be kept. The grain required for this stock will be, as shown on page 11, 23,940 pounds. In order to reserve as much corn as possible for the hogs, this stock will be fed 680 bushels of oats—reserving 40 bushels for seed—which falls short 2,180 pounds of the required quantity. It will take 40 bushels of corn to make up this deficiency. In addition, 15 bushels of corn for the boar should be added.

Number of brood sows that can be kept.

Thirty-six acres of corn are grown in all and only 1 acre of it is required for seed and for extra feed for the fixed stock. It will therefore be safe to calculate roughly on about 35 acres of corn that may be fed to hogs. But it has been assumed that each brood sow and each of her 6 pigs will consume on the average 15 bushels of corn; therefore the total quantity consumed by 1 brood sow and litter—7 pigs in all—will be 105 bushels. At 60 bushels of corn per acre 105 bushels represents 1.75 acres of corn required for each brood sow and litter; 35 acres of corn land, then, will support 20 brood sows and their litters.

Pasture for hogs.

From the time clover pasture is ready in the spring until about June 1 the hogs will be pastured on 5 acres of an 18-acre field of clover fenced off with a temporary hog fence. Up to about June 1 the suckling pigs running with the sows do not need much pasture, and this 5 acres of young clover will furnish them and the sows all they will need. After removing the hogs from this 5 acres the clover will come on and later be cut for seed. About June 1 the hogs will all be transferred to 7 acres of clover adjacent, now in prime condition for pasture, and kept on it until about July 15.

To furnish fresh prime pasture for the hogs from about July 15, when the clover is past its prime, up to the time when the corn is ready to be hogged off, 6 acres of the 18-acre clover field will be plowed up about May 1 and planted in sorghum and rape. About July 15 the temporary fence next to this sorghum and rape pasture will be removed and the hogs given the run of the pasture they are already on and in addition the 6 acres of sorghum and rape. This will furnish ample green feed for the hogs until September 15, when all but the sows will be turned in on a portion of the 18-acre cornfield planted with peas and later sown to rye and rape.

The corn plant will have considerable feeding value for the hogs in September, but as the stalks become more woody the cowpeas,

rye, and rape will furnish the necessary green feed and the corn and cowpeas will furnish the grain. As the hogs clean up one portion of the cornfield the portable fence will be moved and another portion added, and by the time the entire field is cleaned up the hogs will be ready for market.

In handling the clover crop for seed it is quite desirable that the clover be pastured off until about June 1 in central Illinois. The 5-acre field of clover that the hogs were pastured on earliest in the season has been handled so as to fulfill this condition, as shown in plan 2; therefore it may be cut for seed in late August. After the clover field has been cleared of the hogs which were turned into the cornfield and after the clover for seed has been harvested, the sows and boars may be given the run of the entire 18-acre field until cold weather or until the field is plowed in the fall for the next year's crop.

Financial returns to be expected.

The gross returns that may be expected from the 80-acre farm as here planned are about as follows:

120 hogs, 200 pounds each, at 5½ cents	$1,320
5 acres of clover seed, 15 bushels, at $6	90
2 colts, at $50 each	100
2 calves, at $5 each	10
Total gross returns	1,520

From this total must be deducted for the first few years about $175 each year for bone meal for the corn, leaving $1,340 to pay interest on the investment, wages, and expenses.

One of the interesting features of these results is that they are about $478, or 55 per cent, better than when the farm is handled in the ordinary way as a sheep farm. Another fact worth noticing is that while the returns for hogs are not much greater than where the farm is run in a similar way without hogs, all the corn is fed on the place. This practice, together with the practice of sowing cowpeas, rape, and rye in the corn and pasturing it off, will tend rapidly to build up the farm, so that in time even larger yields of crops than here assumed would be easily possible.

It will also be noticed that each field has a leguminous crop on it three out of the four years over which the rotation runs and that the field of corn that was hogged off has practically everything that was grown on the land left on it. The fertilizer bill may be reduced materially and at the same time the yields largely increased. The labor of gathering the corn is saved, and the experience of some of the most successful hog raisers demonstrates that there is not enough waste of grain in this method of harvesting to offset the wages for the

necessary labor to gather the corn. Most of the labor on this farm can be performed by one man. The necessary extra equipment for hog raising on the farm is comparatively inexpensive. This type of farming is very attractive to a great many farmers because usually the hog requires less attention than most other farm animals.

For a detailed account of a successful 80-acre hog farm in Illinois on which the annual income available for general expenses, family income. etc., was $2,284, see Farmers' Bulletin 272.

PLAN 6.—A DAIRY FARM.

General considerations on dairy farming.

With good cows and good management dairy farming is one of the most profitable types of stock farming; but with poor cows and ordinary management there is no money in dairying.

It is not profitable to pasture cows on high-priced land and sell butter for 25 cents a pound; it requires too much land for pasture, about 2 acres for each cow kept.

Feeding silage to dairy cows the year around has been found to be as satisfactory as regards milk yield and butter production as soiling in summer and silage in winter, and more convenient. By either of these methods many more cows can be kept on a farm of given size and more profit made than by the pasture system.

The most frequent sources of loss in the dairy business are poor cows, low crop yield, and inadequate rations. Home-grown feeds usually need to be supplemented with such feeds as cotton-seed meal, gluten feed, or oil meal in compounding rations for dairy cows which shall result in maximum milk and butter production.

With purchased feeds and the manure handled properly and put back on the land, dairy farming is one of the most certain methods known for building up a farm to a high state of productivity.

Conditions assumed.

It is assumed that if a man is going into dairying he will read up the business and make a thorough study of all the details of good cows, effective rations, proper herd management, suitable cropping systems, efficient methods of caring for and applying manure, and other like factors of importance. It is assumed that he will keep a herd of well-bred grade dairy cows, each of which will produce 6,000 pounds of milk or make 280 pounds of butter a year.

Since it is difficult to buy cows of this type whenever wanted, it is assumed that heifers will be raised for the purpose and that on the average there will be about one-fourth as many heifer yearlings and one-fourth as many heifer calves as there are milch cows, or in all one-half as many young stock as there are cows in the herd.

The problem is, How many cows with corresponding young stock will this farm of 80 acres support? To answer this it is first necessary to know how much fixed stock, like horses, colts, bulls, etc., will be kept and what this fixed stock, the young stock, and the dairy herd will be fed.

Fixed stock on dairy farm.

As in previous plans, it will be assumed that four brood mares will be kept on the place and two colts raised each season, and one bull kept for herd use.

Feeding system for stock.

Horses and colts.—The horses, as heretofore, will be fed an average of 15 pounds of corn and 10 pounds of clover hay daily, with all the cornstalks they will eat throughout the year. The colts will be fed 1½ pounds of clover hay for 120 days of the year and 1 pound of oats for about 300 days.

Cows.—The daily ration for the cows will average for the year as follows: 35 pounds of corn silage, 7 pounds of clover hay, 3 pounds of corn-and-cob meal, 2 pounds of oats, and 1 pound of cotton-seed meal. Corn stover in small amounts will be fed in addition.

The above combination of feeds will afford a well-balanced ration for cows giving 6,000 pounds of milk a year. All the grain will be grown on the place except the cotton-seed meal, or its equivalent, which will be bought. The grain will be mixed in about the proportions above indicated.

The quantity fed to one cow at any particular time will depend on the amount of milk the cow is giving. Roughly speaking, a pound of mixed grain will be fed for every 3 or 3½ pounds of milk given. Thus, if the cow is giving 30 pounds of milk a day 10 pounds of grain will be fed; if she gives only 15 pounds a day then only 5 pounds will be fed. The average for the whole year for one cow will be about as shown above.

Yearlings.—The yearlings from about May 1 to October 31, 184 days, will run at pasture and will receive on the average about 4½ pounds of hay daily in addition. It is estimated that each yearling will require on the average 1 acre of pasture for its support. From November 1 to April 30, 181 days, the yearlings will be fed 12 pounds of silage, 10 pounds of hay, and 2 pounds of corn-and-cob meal daily.

Calves.—The heifer calves that are kept will be allowed to run at pasture for about six months, or 180 days, of the year, and one-half acre of pasture will be allowed for each calf. They will be fed in addition about 5 pounds of hay daily throughout the year. Supplementing the hay for about three months they will receive 6 pounds of corn silage. One pound of corn-and-cob meal per head will be

fed for about six months of each year, with a little oil meal in addition. About 2,000 pounds of skim milk will be fed each calf raised.

Bull.—The bull will be fed about 2 pounds of corn, 2 pounds of oats, a half pound of oil meal, 6 pounds of hay, and 25 pounds of silage a day.

Yields to be expected.

As in previous plans, average yields of 60 bushels of corn or 12 tons of silage, 40 bushels of oats, and 2 tons of hay per acre, when fairly started as a dairy farm, are assumed.

Acreage required for fixed stock and for buildings.

The grain and hay required for the horses, colts, and one bull, and the land required to grow these crops on, calculated from the feeding data and assumed yields per acre previously given, are as follows:

	Pounds.	Acres.
Corn:		
4 horses, 15 pounds, 365 days	21,900	
1 bull, 2 pounds, 365 days	730	
Total corn	22,630	or 6.735
Corn silage:		
1 bull, 25 pounds, 365 days	9,125	or .380
Oats:		
2 colts, 1 pound, 300 days	600	
1 bull, 2 pounds, 365 days	730	
Total oats	1,330	or 1.039
Hay:		
4 horses, 10 pounds, 365 days	14,600	
2 colts, 1½ pounds, 120 days	360	
1 bull, 6 pounds, 365 days	2,190	
Total hay	17,150	or 4.287
Total area required for fixed stock		12.441

From the above table it is seen that about 7.115 acres of corn, 1.039 acres of oats, and 4.287 acres of hay, or a total of 12.441 acres of land, will be required to grow crops for the fixed stock on the farm. To this must be added the land devoted to orchard, garden, buildings, and exercise lot for the cattle, or about 4 acres, making in all practically 17 acres. This subtracted from 80 acres leaves 63 acres on which to support the cows and young stock of the farm.

The number of stock that this area will support may next be determined.

Number of cows and young stock that can be kept.

To determine how many cows and young stock can be kept on this 63 acres it is first necessary to determine how much land is required to keep one cow and one-half as much young stock.

Feed consumed by one cow and corresponding young yearly.

Based on the rations already assumed, the quantity of feed required by one cow and corresponding young and the acreage required to grow the same on the farm are shown in the following table:

TABLE 4.—*Feed and acreage required for each cow and corresponding young.*

Kind of feed required.	Cow.[a]	Yearlings.[b]	Calves.[b]	Total feed required.	Area corresponding to total feed required.[c]
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Acres.*
Corn silage	12,775	543.0	135.0	13,453.0	0.561
Corn-and-cob meal	1,095	90.5	45.0	1,230.5	.293
Oats	730	.....	.....	730.0	.570
Clover hay	2,555	659.5	456.3	3,670.8	.918
Cotton-seed meal	365	.....	.....	.....	.....
		Acre.	*Acre.*		
Pasturage	.....	0.25	0.125	.....	.375
					2.717

[a] The amount of each feed required for a cow per year is obtained by multiplying by 365 the average quantity of feed consumed daily, as shown on p. 28.

[b] The quantity of feed required by the yearlings and calves corresponding to one cow will be the quantity fed, as shown in the rations assumed, p. 28, multiplied by the number of days each feed is given, and the sum divided by 4, since there are only one-fourth as many yearlings and one-fourth as many calves as there are cows in the herd.

[c] The acreage of each crop required for one cow and corresponding young is determined by dividing the amount of feed required, as shown in column 4, by the yield per acre (as assumed on p. 28). It is estimated, also, that 1 bushel of corn will produce 70 pounds of corn-and-cob meal, or 4,200 pounds per acre.

The last column of the above table shows that the area of land required to grow the crops for the maintenance of one cow and corresponding young is 2.717 acres. On page 29 it was shown that 63 acres of the farm are available for cows and young stock. This area will therefore support 23.2 cows.

Omitting the fraction for the sake of convenience, it may be assumed that the farm will support about 23 cows and 12 head of young stock and that it will produce all the grain and hay required for them except about 4.25 tons of cotton-seed meal or oil meal, which must be purchased at a cost of about $32 per ton, or $136.

Acreage of crops required for feed.

With the data given in the last column of Table 4, which shows the acreage of each crop grown for feed required for the support of one cow and corresponding young, it will be easy to calculate the acreage required for the whole herd. Thus, in the case of corn silage, if 0.561 acre is required for 1 cow and young, 23 cows will require 12.9 acres.

The acreage thus obtained for all the crops grown for the herd of 23 cows, as well as the acreages of the different crops required for the fixed stock on the place, as shown on page 29, are given in the following table:

TABLE 5.—*Acreage of crops required to be grown on the farm.*

Kind of feed required.	Acreage required for each cow and corresponding young.	Acreage required for herd.	Acreage required for fixed stock.	Total acreage to be grown.
	Acres.	*Acres.*	*Acres.*	*Acres.*
Corn silage	0.561	12.90	0.38	13.28
Corn for grain	.293	6.74	6.74	13.48
Oats	.570	13.11	1.04	14.15
Clover hay	.918	21.11	4.29	25.40
Pasture	.375	8.63	.....	8.63
Total acreage	.....	62.49	.....	74.94

From the last column in the above table it will be seen that it will be necessary to grow on the farm each year for the herd and fixed stock 13.28 acres of corn for silage and 13.48 acres of corn for grain, or 26.76 acres of corn in all, 14.15 acres of oats, 25.4 acres of clover hay, and 8.63 acres of pasture.

Rotation to be followed.

For practical purposes of rotation it may be assumed that the acreages required for the different crops in round numbers are as follows: Corn, 27 acres; oats, 15 acres; hay, 25 acres; pasture, 9 acres; total, 76 acres. While on a dairy farm, where an abundance of stable manure is available, systematic rotation is not so essential as on a grain farm, yet rotation is always good farm practice. In the present instance it will be easy to fit the crops required to a four-year rotation. For this purpose the 76 acres may be divided into 4 fields of 19 acres each and the following cropping plan adopted on each field:

First year, 19 acres of corn, well manured.
Second year, 19 acres of oats, 4 acres cut for hay, whole field seeded down.
Third year, 19 acres of hay.
Fourth year, 19 acres—9 of pasture, 2 of hay, and 8 of corn.

This scheme would require movable fencing for the 9-acre pasture. The crops in all the fields for the entire period of the rotation would be as shown in the following diagram:

Year	Field A (19 acres).	Field B (19 acres).	Field C (19 acres).	Field D (19 acres).
First	Corn.	Oats (4 acres cut for hay).	Hay.	9 acres of pasture. 2 acres of hay. 8 acres of corn.
Second	Oats (4 acres cut for hay).	Hay.	9 acres of pasture. 2 acres of hay. 8 acres of corn.	Corn.
Third	Hay.	9 acres of pasture. 2 acres of hay. 8 acres of corn.	Corn.	Oats (4 acres cut for hay).
Fourth	9 acres of pasture. 2 acres of hay. 8 acres of corn.	Corn.	Oats (4 acres cut for hay).	Hay.

Financial returns to be expected.

The gross returns that may be expected from a dairy farm on which 23 good cows are kept may now be estimated about as follows:

280 pounds of butter from each of 23 cows, at 25 cents	$1,610
100,000 pounds of skim milk, at 20 cents per hundredweight	200
16 calves, at $5 each	80
2 colts, at $50 each	100
Total gross income	1,990

From this gross income must be deducted $136 for cotton-seed meal or oil meal, leaving $1,854 as a gross return for the 80-acre dairy farm.

If milk were sold instead of butter and 4 cents a quart received, the returns would be about as follows:

61,000 quarts of milk, at 4 cents	$2,440
16 calves, at $5 each	80
2 colts, at $50 each	100
Total gross income	2,620

Deducting from this gross income $136 for concentrated feed, as before, leaves $2,484 to pay the expenses, interest, and labor of the farm. The calves that are kept will about offset the decreased value of the herd from year to year.

Labor item on a dairy farm.

While these returns for the dairy farm appear larger than for any other type of farming they are not so in reality, because it requires more labor on this type of farm than on any of the types previously considered. It will require the labor of the owner and one other man the year around, and during the growing season at least, or about seven months of the year, a second man will have to be employed. The cost of this extra labor to the owner will be at least $40 a month, including board, for each hired man, or about $760. This would reduce the gross income from the farm when butter is made from $1,854 to $1,094, and when milk is sold, from $2,484 to $1,724. At 5 cents a quart the gross income after deducting these same items would be $2,334.

Increased investment necessary in dairy farming.

A further item necessary to take into consideration in the dairy type of farming is the considerable increase in investment necessary. Each cow in the herd of the character here planned for costs at least $75. The cows, with the bull and young stock, represent an investment of at least $2,000. To this must be added a suitable stable and about two 90-ton silos, which would represent an investment of at

least $1,500. In addition, a silage cutter, a milk separator, and other equipment would make in all an extra investment for dairy farming over the ordinary grain type of nearly $4,000. It is a system, however, in which the returns begin to come in at once and furnishes a cash income uniformly throughout the year.

Increased productiveness of a dairy farm.

While the labor bill and the investment are necessarily considerably increased in dairy farming, there is also a compensating feature. As all the crops grown on the farm are fed on the farm and additional grain bought and fed besides, the productiveness of the farm after the system has once fairly been put in operation will tend gradually to increase. In time every acre of land on the farm ought to be capable of producing an average of 90 bushels of corn or 3 tons of hay to the acre. This would permit an increase in the size of the herd, so that the profits would increase as the plan was continued.[a]

SUMMARY OF RETURNS FROM DIFFERENT TYPES OF FARMING.

A brief survey may now be taken of the differences in income which may be obtained from the same farm from the six different types of farming herein outlined. In all the types considered one man would be able to do practically all the work of the farm, except in rush seasons and in the case of dairy farming, and in one phase of sheep farming where two and sometimes three men would be required. Had the owner of the farm two or three sons to help him, more intensive types of farming than here outlined would have been planned.

The gross income from each of the different types of farming, after deducting the cost of fertilizers or feeding stuffs, is assembled below for comparison.

Farm as managed at present	$450
(1) Farm planned as a grain and hay farm, three-year rotation	1,149
(2) Farm planned as a grain and clover-seed farm	1,197
(3) Farm planned as a grain and hay farm, four-year rotation	1,280
(4) Farm planned as a sheep farm:	
(a) Pasture system	862
(b) Small flock	1,045
(c) Lamb feeding	2,065
(5) Farm planned as a hog and clover-seed farm	1,340
(6) Farm planned as a dairy farm:	
(a) Butter, sold at 25 cents (less extra labor)	1,094
(b) Milk, sold at 4 cents a quart (less extra labor)	1,724
(c) Milk, sold at 5 cents a quart (less extra labor)	2,334

[a] For a detailed account of a 15-acre dairy farm in Pennsylvania which supported 17 dairy cows and returned a gross profit of $1,775, see Farmers' Bulletin 242.

An examination of the figures shows the returns for the different types to vary from $450 as now managed to $2,334 per annum in the case of dairy farming, indicating a wide variation in the returns possible from the same farm by different systems of farming. These data emphasize the importance of studying closely the organization of a farm and the plan on which it is operated. If a corn-and-oat rotation of crops brings in but $450 a year and by the use of clover and a little fertilizer the returns can be increased by $600 or $800 without additional machinery or hired help, then a revision of the system of farming would seem worth while. By combining some of the types here considered and by introducing other modifications the returns might be still further increased.

Generally speaking, grain farming with a rotation of crops and the intelligent use of fertilizers is about as profitable a type of farming as any of the ordinary forms of stock raising. The following facts, however, should be considered in this connection. The fertilizer bills in the grain and hay types of farming must be indefinitely continued, and as the years go by will probably have to be revised. Quite certainly lime will be needed in addition to the phosphates applied if the yields assumed are maintained. On the other hand, in the live-stock types of farming, particularly dairy farming, the fertilizer bills will grow less instead of increasing, while at the same time the land will be growing more productive, and instead of average yields of 60 bushels of corn and 2 tons of hay per acre considerably larger yields than these may be confidently expected.

PLANS GIVEN NOT MODEL PLANS.

The plans suggested in this bulletin are neither complete nor are they models to follow. Their purpose is to show primarily that the income from the same farm can be doubled, trebled, or often quadrupled by simply changing the system of farming and dropping the crops or practices that do not pay and substituting for them something that does pay.

The real purpose of the plans here made in some detail is to illustrate various ways of thinking about the farm when the time comes for replanning it for profit and of ways of going at the problem of estimating the stock that can be kept and the returns that may be expected to result from the adoption of a given type of farming.

It would be easy to modify in a hundred different ways each plan given by the introduction of other crops, by varying the combinations of crops, by emphasizing the poultry industry or the orchard, by combining hogs with dairy cows, and so on. The plans given in this bulletin, however, will serve their purpose if they suggest ways of looking at the problem and estimating returns.

THE PROBLEM OF REPLANNING A FARM.

The reader who may be led by the preceding pages to replan his own farm will quickly learn how limited is the reliable available information on any given phase of farming and how necessary is a broad fund of agricultural knowledge in successfully replanning a farm.

If he relies for the purpose on what data he has accumulated on his own farm, he may be surprised to find out how limited such data are and that he may not even know how much grain and hay it takes to keep a horse or a cow a year, although he may have fed both all his life. He may not know just when or just how long a field of peas and oats planted together would be available for sheep or hog pasture. He may not know the average yields of different crops that he can grow on different fields, or how those yields might be increased by the use of a little commercial fertilizer of the right kind properly applied or by rotation of crops. He may even have to go outside of himself to establish a standard as to what good farming really is and what results ought to be obtained from good farming.

If these gaps in his knowledge be made apparent through his undertaking to replan his farm and he be led thereby to observe more closely his farm operations, as well as those of his neighbors, and to read more extensively agricultural papers, bulletins, books, and reports, one of the first aims of this paper will have been accomplished.

WHY LOW RETURNS ARE REALIZED FROM SOME FARMS.

Many a farmer fails to get adequate returns from his farm because he stays at home too closely, puts in too many hours a day following the plow, and does not often enough visit good farmers in his neighborhood or other sections of the country where good farming is done. Furthermore, a man physically exhausted from a long, hard day's work is in no condition to follow and get much out of the literature of his business as reported in farm papers, agricultural bulletins, reports, and books, and without the advantage of all the information available from every possible source he will find awkward situations when he comes to replan his farm for profit.

Success in farming calls for the very best effort in a man along all lines. That best effort is called for in replanning a farm for profit. The farmer who is dissatisfied with his income from the farm needs to think seriously as to whether or not his farm is planned right for the largest returns, remembering that good farming calls for keeping up the productiveness of the farm while getting maximum crops economically from the soil.

SUMMARY.

(1) Habit frequently continues a type of farming in a community long after that type has become unprofitable.

(2) Changes in the farm system are often deferred (1) because of lack of knowledge of how to replan the farm, (2) because of lack of funds in carrying out new plans, (3) because new fences, buildings, or equipment are called for in the new plan, and (4) because a change frequently requires a readjustment of many of the usual ways of thinking and doing.

(3) In replanning the farm, help may be obtained from visits to successful farms, from farm literature, agricultural papers, the State experiment stations, the agricultural colleges, the United States Department of Agriculture, and from agricultural experts.

(4) The farm can be as successfully planned as other businesses are, provided the plans are made to cover average conditions over a period of years.

(5) Profitable farming results from good farm plans comprehending every feature of the farm carefully coordinated and effectually carried out.

(6) A good farm plan provides for (1) a reasonable reward for the capital and labor invested and (2) the maintenance or increase of soil fertility, and (3) it must be within the comprehension and ability of the owner to carry out.

(7) The income from the same farm can often be doubled or trebled without increased expense by adopting a system of farming suited to the land, the locality, and the owner.

(8) The successful replanning of a farm rests on a comprehensive knowledge of agriculture gained by experience and by familiarity with what is being accomplished by others along agricultural lines, either as observed by personal visits or as recorded in the literature of agriculture.

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