

than 100 crop acres. Farms of this size may be too small to provide an adequate living. FHA county supervisors are urged to use minimum resources guides as a precaution against making loans on farms that are too small.

The median initial loan was \$4,690. Approximately half of the borrowers also received supplemental loans. The median supplemental loan was \$830.

The largest share of initial loan funds were used for livestock purchases, 41 percent on the average. Machinery purchases and refinancing accounted for 26 and 22 percent, respectively, of the initial loan funds. Nearly one-half of the supplemental loan funds were used for machinery purchases and about one-quarter of the supplemental loan funds were used for operating expense.

More than half of the initial loans had terms of 6½ or 7 years. The loans were set up with installments geared to anticipated farm income over the life of the loan. The chattel mortgage that secures the promissory note was renewed periodically to keep it current.

The average borrower had been on the program for about 2½ years. He started with total assets that averaged \$10,339 and these had increased to \$15,328 on January 1, 1955. Average net worth increased from \$5,787 to \$7,561. Of the 162 borrowers, 120 showed increases in net worth while 40 showed decreases. The average borrower had an owner equity in his farm business of about 50 percent on January 1, 1955. However, there was considerable variation in owner equity of individual borrowers. Nearly 20 percent had equities of less than 35 percent. This points up the relatively high debt load that these borrowers are carrying.

Income and expense records of the borrowers in 1954 showed that net farm income over farm operating expenses ranged from \$2,240 in the southeast dairy and southwest livestock areas to \$260 in Itasca county. Income from sources other than farming was substantial in Itasca county and the northwest crop area where it averaged \$1,910 and \$1,350, respectively.

Net farm income and nonfarm income provide the means for family living, capital outlays, and debt repayment. The range in this amount was not wide between areas. It ranged from \$2,850 in the southeast dairy area to \$2,170 in Itasca county.

The average borrower in the southwest livestock and southeast dairy areas went further into debt by \$940 and \$220, respectively, during 1954. Capital expenditures averaged more than the amount available for this purpose in these areas. The average borrower in the northern areas applied about \$500 toward repayment of debts.

Approximately 60 percent of the borrowers who left the program during the five fiscal years 1950-54 repaid their loans in full and continued to farm. The remaining 40 percent did not become established in farming. This indicates the importance of utmost care in selection of applicants to hold losses and disappointments to a minimum.

Broadened lending authority was provided by Congress in 1956. The Farmers Home Administration can now make larger loans for longer terms, loans to part-time farmers, and loans where refinancing is the major purpose. This will enable the agency to be of greater assistance to young farmers, but successful operation will call for even more careful selection.

Planning Farms for Increased Profits

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Planning Farms for Increased Profits

Paul R. Hasbargen and George A. Pond¹

THERE IS A WIDE RANGE of earnings among farmers even though their farms are similar in size, type, and productivity. This is revealed in every study of the factors which affect farm income. Such studies also indicate that one factor is most important in determining a farmer's level of earnings—his skill in organizing and operating his farm business.

In organizing his business, each farmer is faced with two general problems. What and how much of each product should he produce? What production methods should he use?

With the economic forces that affect his farm business continually changing, continuous planning becomes necessary. He must adjust his farm organization from year to year to keep abreast of changes in methods, price relationships, and the resources available to him. He must constantly consider alternative courses of action, weigh any advantages each may offer.

There is a relatively simple process by which a farmer can compare probable results of his farm as now operated with what might be expected under alternative plans.² It employs what is termed the "substitution budget." It is the purpose of this study to illustrate that process, which is done in Part I.

Part II supplies basic information required in the process, since many farmers lack some of the types of data needed in applying such an analysis. The tables in Part II are based largely on carefully supervised records kept on farms in southern Minnesota. These have been supplemented by recommendations of members of the Minnesota Agricultural Experiment Station staff.

The value of the "substitution budget" process is made clearer if two matters are first briefly reviewed. One is the conditions that make continuous farm planning necessary today. The other is the proper approach to take to such planning.

CHANGE DOMINATES THE FARM PICTURE

Change that affects his plans faces the farmer constantly. The price of farm products is constantly changing, as well

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² There are two methods by which a farmer may increase returns from his operations: (1) choosing a combination of crops and livestock that will make the most effective use of his resources; (2) increasing the efficiency with which he handles those crops and livestock. Both should always be considered. In this study only the first is used, since the major purpose is to explain the method of "substitution" in planning a more profitable combination of crops and livestock. The importance of the second is fully realized; it is omitted from major consideration here only to make the substitution method stand out clearly, and to avoid confusion with the results of concurrent increases in efficiency due to improved practices.

as that of the goods and services used in farm production. Climate for a given area may be fairly constant, yet seasonal variations in weather will require adjustments in the farmer's plans.

Changes in farm techniques are constantly crowding their way into the farm picture. Hybrid corn plus large-scale corn machinery has greatly increased the comparative advantage of corn in competition with other crops. Mechanization has greatly reduced the cost of small grain and forage production. The use of commercial fertilizers, chemical weed control, or sprays and dusts for insect and disease control has changed the relative advantage of certain crops—or the methods used in their production.

Equally striking changes in animal feeding, breeding, and sanitation have come into the livestock picture. More and more mechanization has been introduced and building designs and equipment are being adjusted to these changes.

Then, too, the farmer's personal problems, resources, and needs change. As he accumulates more capital, changes in the farm business are needed to use it most effectively. His available family labor changes, as does his own ability, skills, and needs. Using his resources to best advantage requires careful planning, both on a longtime basis and in year-to-year adjustments.

Our discussion will deal primarily with planning the general organization of the farm business. But it should be stressed that any plan, however carefully conceived, will need adjustments from time to time.

PLANNING CHANGES IN THE FARM BUSINESS

Before setting up a plan for the future, the present operating plan should be appraised for possible weaknesses.

Is my farm business large enough to provide a satisfactory living? Is my cropping system such as to maximize the quantity and quality of feed pro-

duced or sale products available to market? Am I using the most economical practices in their production? Do my livestock fit my feed supply, my labor supply, and my buildings and equipment? Am I doing a good job of feeding and handling my livestock?

These are just a few of the considerations to be weighed in setting up a farm plan. A critical analysis of the past and present set-up is the logical place to start the planning process.

REVIEW OF FARM RECORDS AIDS PLANNING

To find the weakness in a farm business requires a careful analysis of current operations. A good set of farm accounts records is an invaluable source of information—especially if similar information from other farms in the same general area is available for comparison.

In the illustration used in this bulletin, the farmer was a member of a Farm Management Service for 16 years. He not only had useful records of his own business over this time but was able to compare his results with those of his neighbors in the same general area. He was not only able to spot the weakness in his own set-up but had much of the basic information he needed in planning adjustments. He could also draw on the records of other farms to supply the planning information needed in introducing crops or classes of livestock with which he had no experience.

As mentioned, the tables in Part II present the types of data on crop and livestock production needed in setting up a farm plan. It must be recognized, however, that some adjustments may be needed in applying these average data to a particular farm. This brings in the element of judgment in making the necessary adjustments. The final plan can be no better than the judgment used in selecting the basic information.

Nevertheless, the substitution budget method can be of real value to any farmer who applies it as explained in this bulletin.

Part I—The Substitution Budget

THE SUBSTITUTION BUDGET is a relatively simple farm planning process designed to compare the relative returns from two or more plans for operating a particular farm business. It differs from a complete budget in that it does not determine the net earnings to be expected under any particular plan of operation. Rather, it merely measures the approximate difference in earnings between two or more alternative plans of operation.

Only a fraction of the time required for a complete budget is needed. It is a simple, quick way by which farmers may compare possible alternative plans of operation. It is a "trial and error" method on paper that is much less costly than trying out new systems in practice. Basic weakness in the alternate plan can be brought out with a high degree of accuracy. The results, like those of a complete budget, are dependent on the accuracy and adequacy of the data used and the assumptions made.

A 240-acre farm in southwestern Minnesota has been chosen as an example. The operator has been a member of the Southwest Minnesota Farm Management Service since 1940. A comparison of his own records with those of other members of the Association has convinced him that there are certain weaknesses in his general plan of operation.

His crop yields are about 10 percent below the average for the Association. This is due, in part, to the fact that the prevailing soil type on this farm is somewhat less productive than that of most of the farms in the group. Another factor accounting for lower yields is that his farm lies on the west edge of the area, where the annual precipitation is less than for the area as a whole. There is some fairly steep land that must be kept in sod to prevent erosion, and hence a smaller proportion of the farm is tillable. The return over feed to livestock other than hogs is not quite up to the average of the Association.

PERSONAL FACTORS THAT CONDITION THE FARM PLAN

Obviously a major objective in selecting an alternative set-up for this farm is a desire to increase earnings. Coupled with that is the desire to reduce labor requirements. This operator is 51 years of age. His available family labor is limited. He suggests that they are willing to put in up to 3,500 hours of work annually.

Not only does the family like to take some vacation each year but his physician has recommended that he take life a little easier. Up to now he has had a full-time hired man much of the time. He would like to eliminate hired labor insofar as possible. The plans suggested provide about one month of hired labor to look after the farm when the family is on vacation and perhaps to help out at peak-load periods.

The above considerations suggest an organization with minimum labor requirements. The major emphasis then should be on classes of livestock that not only have low labor requirements but provide a labor distribution that conflicts least with crops during the growing season. Feeder cattle, a breeding flock of sheep, and hogs seem to fit this requirement. At the same time they provide a profitable utilization of the crops which fit the farm and the labor supply.

INVENTORY OF AVAILABLE RESOURCES

The first step in a substitution budget analysis is a listing of the available resources. This 240-acre farm includes 192 acres of tillable land, 25 acres of permanent bluegrass pasture, 8 acres of farmstead, and 15 acres of roads and waste land. As already indicated, about 3,500 hours of labor by the proprietor and his family are available.

The operator is in a relatively sound financial position, with credit available

as necessary for any of the alternative plans considered. His farm buildings are adequate for present livestock needs.³ He has facilities for 20 spring litters of pigs and 13 fall litters. He has adequate machinery to work the farm effectively.

THE PRESENT ORGANIZATION

The next step in the process is to outline the present organization. Then it can be used as a bench mark or base with which to compare possible alternatives. This involves a statement of acreage and yield of crops and numbers and production of livestock, as the farm is

Table 1. Normal rates of fertilizer, seed, and twine used in crop production

Crop	Materials per acre	
	Kind	Quantity
Corn	Seed	0.16 bu.
	Fertilizer	75 lbs.
Barley	Seed	2.4 bu.
	Fertilizer	100 lbs.
Alfalfa-brome hay	Alfalfa seed	3 lbs.
	Brome seed	3 lbs.
	Timothy seed	1 lb.
	Baling twine	1/3 ball
Alfalfa-brome pasture	Alfalfa seed	3 lbs.
	Brome seed	3 lbs.
	Timothy seed	1 lb.

now being operated. Average yields of crops and average production rates for livestock are used, rather than the figures for any one year.

³ See table 4, page 7.

Table 2. Normal feed utilization by livestock

Class of livestock	Unit	Farm grains (pounds)	Hay equivalent (pounds)	Commercial feed (pounds)
Beef cows	1 cow	500	4,780	49
Feeders (Revised)*	cwt	775	600	64
	cwt	500	600	20
Hogs	cwt	460	3.7	50
Sheep (Revised)†	1 ewe	152	950	19
	1 ewe	205	1,000	20

* Feed requirements adjusted to expected efficiency in a pasture feeding program.

† Earlier lambing necessitated raising the feed requirements per ewe.

Prices likely to prevail in the future should be used in estimating the cost of goods and services purchased, also of products sold under this plan. In the sample budgets that follow, the average prices for the past 10 years have been used in determining the relationship between the prices of farm products sold and the prices of goods and services purchased. Since the past 10 years have been characterized by relatively high prices, the 10-year average prices have been scaled down to a more conservative level for use in these illustrations.

With the substitution budget, it is often wise to compute costs and returns on the basis of several possible price combinations. It is then possible to see how stable the differences in returns among various plans of operation may be under different price levels.

The present plan involves estimating the quantity of goods and services used in production—such as feed, seed, fertilizer, twine, and other items that must be purchased. Rates per acre for fertilizer, seed, and twine are shown in table 1. Normal feed utilization, based on feed records kept on this farm, is shown in table 2.

Table 3 presents a statement of crop acreages and production as the farm is now being operated. An estimate of the numbers and production of livestock is given in table 4. On the basis of feeding rates in the past, an estimate of the feed required for the amount of livestock listed in table 4 is shown immediately following in table 5.

Table 3. Distribution of acreage and the production and disposal of crops (present organization)

Crop	Acres	Yield per acre	Total production	Disposal		
				Seed	Feed	Sales
Tillable land						
Corn	70	42 bu.	2,940 bu.		2,940 bu.	
Barley	25	30 bu.	750 bu.	60 bu.	690 bu.	
Alfalfa-brome hay	53	2.2 tons	117 tons		117 tons	
Alfalfa-brome pasture	44					
Total tillable land	192					
Nontillable land						
Bluegrass pasture	25					
Roads and waste	15					
Farmstead	8					
Total acres	240					

From the data in these tables it is apparent that more feed is used than is produced on the farm. Both corn and hay must be purchased to meet feed requirements, as well as considerable quantities of commercial feed. The lat-

ter is largely high-protein concentrates. Some hay is bought and some of the deficit shown in table 5 was made up by hay cut in the pasture early in the season when there was an excess over livestock needs.

Table 4. Number, production, and disposal of livestock and livestock products (present organization)

Class of livestock	Size of enterprise	Production	
		Kind	Amount used and sold
Sheep	108 ewes	Culls	1,240 lbs.
		Lambs	7,290 lbs.
		Wool	1,220 lbs.
Hogs	28 litters	Marketable hogs	43,800 lbs.
Beef cattle	26 cows 1 bull 5 heifers 24 calves	4 culls	4,000 lbs.
		1/3 bull	400 lbs.
		1 yrly. heifer	900 lbs.
		19 calves	9,500 lbs.
Feeder cattle	19 head	Fat cattle	16,720 lbs.

Table 5. Utilization of feed (present organization)

Class of livestock	Unit	Farm grains (pounds)	Hay equivalent (pounds)	Commercial feed (pounds)
Beef cows and bull	27	13,500	129,060	1,323
Feeders	72 cwt	55,800	43,200	4,608
Hogs	438 cwt	201,480	1,620	21,900
Sheep	108 ewes	16,416	102,600	2,052
Total fed		287,196	276,480	
Total available		197,760	234,000	
Excess or deficit		-89,436*	-42,480*	

* Minus sign indicates a deficit. Sufficient grain and commercial feed was purchased to make up the deficit in grain. Approximately 11 tons of hay were purchased and the rest of the deficit was made up by hay cut on tillable pasture.

Table 6. Normal returns (present organization)

	Amount	Price	Value
Sales:			
Cull ewes	1,240 lbs.	\$.085	\$ 105
Lambs	7,290 lbs.	.195	1,422
Wool	1,220 lbs.	.60	732
Market hogs	377 cwt	16.50	6,220
Sows	61 cwt	14.50	885
Cull cattle	4,400 lbs.	.125	550
Cattle	16,720 lbs.	.205	3,428
Milk used in house	1,300 qts.	.10	130
Total sales			\$13,472
Expenses:			
Alfalfa hay	10.8 ton	18.00	194
Corn for feed	1,597 bu.	1.20	1,916
Corn seed	11.2 bu.	12.00	134
Alfalfa seed	294 lbs.	.40	118
Brome seed	294 lbs.	.20	59
Timothy seed	98 lbs.	.20	20
Baling twine	18 balls	3.70	67
Commercial feed for:			
Beef cows	13 cwt	4.10	53
Feeders	46 cwt	4.70	216
Hogs	219 cwt	5.50	1,204
Sheep	21 cwt	4.75	100
Bull	1/3	150.00	50
Rams	1 1/2	65.00	98
Sheep shearing	1,220 lbs.	.055	67
Hired labor	10 months	175.00	1,750
Total expenses			\$ 6,046
Return over listed expenses			\$ 7,426

The final step in setting up the present organization of this farm is the computation of normal returns, as shown in table 6. The total value of the products sold or used in the house are first computed to get the gross sales. From these total sales are deducted those cost items that vary directly with the crops grown and the livestock maintained.

These costs include purchases of feed, seed, twine, and fertilizer, purchased livestock, custom services, hired labor, and items of this type. Items like taxes, building upkeep, insurance on buildings, and general overhead—items that remain fairly constant regardless of the crops grown or livestock produced—are omitted. Many of the items omitted would involve time-consuming computations and yet would add little if anything to the value of the comparisons made.

AN ANALYSIS OF THE PRESENT ORGANIZATION

The present organization provides a large proportion of forage-consuming livestock. This in turn necessitates a large acreage in hay and pasture, and limits corn production. Some of the permanent pasture is of rather low productivity. Corn yields, though low compared with other farms in the Association, are high compared with other crops on this farm. It would appear desirable to increase the corn acreage to the limit consistent with sound soil conservation.

Rates of feed consumption by sheep, feeder cattle, and the beef breeding herd are somewhat higher than the average rates for the Association. Feeding efficiency in hogs, however, compares very favorably with the Associa-

tion average. This suggests that hogs should be given a major place in the livestock system as a market for corn.

Some forage-consuming livestock are needed to utilize the steep land that must be kept in grass, as well as the legume crops needed to maintain soil productivity and provide a balanced cropping system. There is considerable opportunity to increase the productivity of pasture by renovation. At least half of the permanent pasture could be plowed up and seeded to alfalfa and brome grass—but the steeper slopes would have to remain in bluegrass.

BUDGETING ALTERNATIVE PLANS

The next step after outlining the pattern of the present organization is to select possible alternatives that might increase the earnings, utilize advantageously the operator's resources, and reduce the labor requirements. Decreasing the number of classes of livestock, limiting numbers to what can be produced with the feeds grown on the farm, and

increasing the productivity of the pasture would be important possibilities to explore.

Three alternatives have been worked out for comparison with the present plan of operation:

Alternative Plan A—Hogs and sheep

Alternative Plan B—Hogs, sheep, and feeder cattle

Alternative Plan C—Hogs and feeder cattle

Each of these is described in the following sections.

Alternative Plan A—Hogs and Sheep

The first alternative plan provides for utilizing all the feed produced with hogs and sheep. The cropping plan and the utilization of crops is shown in table 7 and the livestock organization in table 8. The utilization of the feed is given in table 9 and an estimate of normal return from the plan in table 10.



Raise more Sheep? More hogs? Drop all cattle? Budgeting as if such shifts were already in effect (Plan A) gives the operator a sounder basis for deciding if the change would aid his farm business.

Table 7. Distribution of acreage and the production and disposal of crops
(Alternative Plan A)

Crop	Acres	Yield per acre	Total production	Disposal		
				Seed	Feed	Sales
Tillable land						
Corn	91	42 bu.	3,822 bu.		3,822 bu.	
Barley	42	30 bu.	1,260 bu.	100 bu.	1,160 bu.	
Alfalfa-brome hay	39	2.2 ton	85.8 ton		76 ton	20.8 ton
Alfalfa-brome pasture	13		11.0 ton			
Hog pasture	6					
Total tillable land*	191					
Nontillable land						
Roads and waste	16					
Farmstead	8					
Renovated pasture	13					
Bluegrass pasture	12					
Total acres	240					

* A loss of 1 acre is allowed in field reorganization.

Since hogs have proven the most profitable class of livestock on this farm in the past, they are included in Alternative Plan A up to the capacity of the present housing facilities. There is sufficient concentrate feed for 150 ewes and their lambs. The pasture available under the new cropping plan is adequate for a flock of this size, if a portion of the permanent pasture is

lambs available for the more favorable market earlier in the season. This earlier lambing reduces the length of the pasture season and necessitates using more dry feed. A small quantity of hay above the needs of the sheep would be available in years of average or higher-than-average yields. This would be available for sale. In years of low hay yields, it may prove a valuable reserve.

Table 8. Number, production, and disposal of livestock and livestock products
(Alternative Plan A)

Class of livestock	Size of enterprise	Production	
		Kind	Amount used and sold
Sheep	150 ewes	Culls	1,720 lbs.
		Lambs	10,125 lbs.
		Wool	1,695 lbs.
Hogs	33 litters	Marketable hogs	52,000 lbs.

seeded to a brome-alfalfa mixture as previously suggested.⁴

The feed for the sheep has been increased slightly, because this plan calls for earlier lambing in order to have the

The normal returns that might be expected from Alternative Plan A show a substantial increase in returns over the present. Total sales are less but expenses have been reduced even more.

⁴ The pasture carrying capacities used in these budgets are as follows:
SHEEP—5 ewes per acre on alfalfa-brome pasture (including renovated acres) 3¼ ewes per acre on fertilized bluegrass.
FEEDER CATTLE—2 head of feeders per acre on all alfalfa-brome pasture and 1½ head per acre on fertilized bluegrass.
HOGS—3 to 4 litters per acre on alfalfa-brome pasture.

Table 9. Utilization of feed (Alternative Plan A)

Class of livestock	Unit	Farm grains (pounds)	Hay equivalent (pounds)	Commercial feed (pounds)
Hogs	52,000 lbs.	239,200	2,000	26,000
Sheep	150 ewes	30,750	150,000	3,000
Total fed		269,950	152,000	
Total available		269,712	193,600	
Excess or Deficit		-238	+41,600	

Feed purchases have been eliminated and there is a small surplus of hay for sale. With less total livestock and a shift to kinds with lower labor requirements—as well as some larger scale machinery for the increased acreage of corn—hired labor is largely eliminated. There is a small additional charge for

combining the increased acreage of barley. Only the annual costs of the additional corn machinery are included.

Heavy purchases of feed made it possible to carry more livestock under the present normal. To offset the loss of manure resulting from the reduction in livestock numbers, more commercial

Table 10. Normal returns (Alternative Plan A)

	Amount	Price	Value
Sales:			
Cull ewes	1,720 lbs.	\$.085	\$ 146
Lambs	10,125 lbs.	.215*	2,177
Wool	1,695 lbs.	.60	1,017
Market hogs	447 cwt.	16.50	7,376
Sows	73 cwt.	14.50	1,559
Hay	80.8 ton	18.00	374
Total sales			\$12,149
Expenses:			
Seed corn	14.5 bu.	12.00	174
Alfalfa seed	272 lbs.	.40	109
Brome seed	90 lbs.	.20	18
Timothy seed	108 lbs.	.20	22
Baling twine	13 balls	3.70	48
Commercial feed for:			
Sheep	30 cwt.	4.75	143
Hogs	260 cwt.	5.50	1,430
Rams	2	65.00	130
Sheep shearing	1,695 lbs.	.055	93
Hired labor	1 month	175.00	175
Pasture renovation	13 acres	5.00†	65
Annual cost of extra corn equipment	\$1,131	10%	113
Additional fertilizer for:			
Corn	0.90 ton	90.00	81
Barley	0.85 ton	95.00	81
Permanent pasture	0.67 ton	94.00	63
Additional combining charges	17 acres	4.00	68
Total expenses			\$ 2,813
Return over listed expenses			\$ 9,336
PROBABLE DIFFERENCE IN RETURNS OVER THE PRESENT			\$ 1,910

* Price is expected to be \$2.00 per 100 lbs. higher than in the present since the early lambs can be sold on a better market.

† Total yearly cost is \$5.00 an acre. At present, ACP repayment rates cover half of this cost.

fertilizer is purchased. The cost of pasture renovation is spread over a five-year period.

The reader should note that the return over expenses that vary directly with the organization is not a net income figure. The operator would not have this much available for family living or savings. However, the last figure in table 10 gives the information the farmer wants. A shift to Alternative A will increase his spendable income \$1,910 above the returns from his present organization.

Alternate Plan B—Hogs, Sheep, and Feeder Cattle

The crop acreages and utilization under Alternative Plan B are shown in table 11, the numbers and production of livestock in table 12, the utilization of feed in table 13, and the income and

costs that vary with the organization in table 14.

Alternative Plan B calls for the addition of a feeder cattle enterprise based on a pasture feeding program. Twenty-six head of feeder calves averaging about 460 pounds in weight would be purchased in the fall, grazed on corn-stalk pasture, and wintered on legume silage and hay. The next season they would be grazed on alfalfa-brome pasture and gradually brought onto a full feed of corn for finishing.

The rates of feeding for this operation are taken from the records of other cattle feeders following this system as reported in table 2. There would be enough additional pasture for a 100-ewe flock and enough grain to feed out 26 litters of hogs. A small amount of hay would have to be purchased to provide an ample supply for the cattle and sheep.

Table 11. Distribution of acreage and the production and disposal of crops (Alternative Plan B)

Crop	Acres	Yield per acre	Total production	Disposal		
				Seed	Feed	Sales
Tillable land						
Corn	93	42 bu.	3,906 bu.		3,906 bu.	
Barley	42	30 bu.	1,260 bu.	100 bu.	1,160 bu.	
Alfalfa-brome hay	39	2.2 ton	85.8 ton		85.8 ton	
Alfalfa-brome pasture	13					
Hog pasture	4					
Total tillable land	191					
Nontillable land						
Roads and waste	16					
Farmstead	8					
Renovated pasture	13					
Bluegrass pasture	12					
Total acres	240					

Table 12. Number, production and disposal of livestock and livestock products (Alternative Plan B)

Class of livestock	Size of enterprise	Production	
		Kind	Amount used and sold
Sheep	100 ewes	Culls	1,148 lbs.
		Lambs	6,750 lbs.
		Wool	1,130 lbs.
Hogs	26 litters	Marketable hogs	41,300 lbs.
Feeders	26 head	Fat cattle	24,700 lbs.

Table 13. Utilization of feed (Alternative Plan B)

Class of livestock	Unit	Farm grains (pounds)	Hay equivalent (pounds)	Commercial feed (pounds)
Sheep	100 ewes	20,500	100,000	2,000
Feeders	127.5 cwt.	63,750	76,500	2,550
Hogs	413 cwt.	189,980	1,500	20,650
Total fed		274,230	178,000	
Total available		274,416	171,600	
Excess or Deficit		186	-6,400	

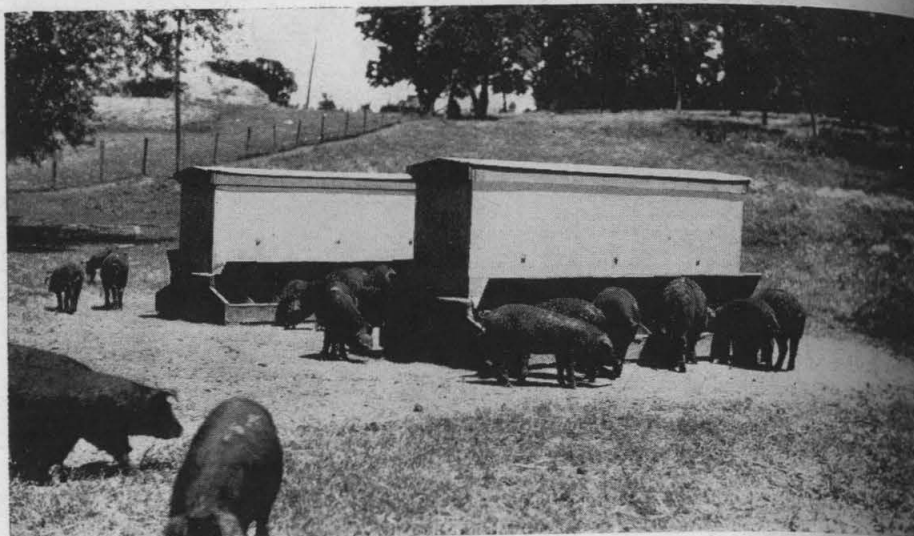
The cropping system would be identical with that of Alternate Plan A, except that the hog pasture would be reduced by 2 acres and the corn increased by that amount. Gross income would be increased by approximately

\$1,900. Feed purchases would be less, but the cost of purchased feeders would bring the return over expenses that vary directly with the organization down to slightly below that of Alternative Plan A.

Table 14. Normal returns (Alternative Plan B)

	Amount	Price	Value
Sales:			
Cull ewes	1,148 lbs.	\$.085	\$ 98
Lambs	6,750 lbs.	.215	1,451
Wool	1,130 lbs.	.60	678
Market hogs	355 cwt.	16.50	5,858
Sows	58 cwt.	14.50	841
Fat cattle	247 cwt.	20.50	5,064
Total sales			\$13,990
Expenses:			
Seed corn	15 bu.	12.00	180
Alfalfa seed	272 lbs.	.40	109
Brome seed	90 lbs.	.20	18
Timothy seed	108 lbs.	.20	22
Baling twine	13 balls	3.70	48
Hay	3.2 ton	18.00	58
Commercial feed for:			
Sheep	20 cwt.	4.75	95
Hogs	206.5 cwt.	5.50	1,136
Feeders	25.5 cwt.	4.70	120
Rams	1.5	65.00	98
Feeder calves	119.5 cwt.	18.50	2,211
Sheep shearing	1,130 lbs.	.055	62
Hired labor	1 month	175.00	175
Annual cost of extra corn equipment	\$1,131	10%	113
Additional fertilizer for:			
Corn	0.90 ton	90.00	81
Barley	0.85 ton	95.00	81
Permanent pasture	0.67 ton	94.00	63
Additional combining charges	17 acres	4.00	68
Pasture renovation	13 acres	5.00*	65
Total expenses			\$ 4,803
Return over listed expenses			\$ 9,187
PROBABLE DIFFERENCE IN RETURNS OVER THE PRESENT			\$ 1,761

* Total yearly cost is \$5.00 per acre. At present, ACP repayment rates cover one-half of this cost.



Grow more hogs? Balance hogs and sheep with feeder cattle? Or concentrate on hogs and feeder cattle? Comparing his budgets for Plans A, B, and C helps the operator judge which is the best alternative.

Alternative Plan C—Hogs and Feeder Cattle

The crop acreages and utilization are shown in table 15, the numbers and production of livestock in table 16, the utilization of feed in table 17, and the income and the costs that vary directly with changes in the organization in Table 18.

Table 15. Distribution of acreage and the production and disposal of crops (Alternative Plan C)

Crop	Acres	Yield per acre	Total production	Disposal		
				Seed	Feed	Sales
Tillable land						
Corn	93	42 bu.	3906 bu.		3906 bu.	
Barley	42	30 bu.	1260 bu.	100 bu.	1160 bu.	
Alfalfa-brome hay	49	2.2 ton	107.8 ton		71.15 ton	36.65 ton
Alfalfa-brome pasture	3					
Hog pasture	4					
Total tillable land	191					
Nontillable land						
Roads and waste	16					
Farmstead	8					
Renovated pasture	13					
Bluegrass pasture	12					
Total acres	240					

The cropping system is identical with that used in Alternative Plan B. There is sufficient forage to permit expanding the feeder cattle to 62 head. This would increase the labor load and would reduce hog production unless additional corn was purchased. The number of feeders was therefore set at 48. These would be of the same weight and qual-

Table 16. Number, production and disposal of livestock and livestock products (Alternative Plan C)

Class of livestock	Size of enterprise	Production	
		Kind	Amount used and sold
Feeders	48 head	Fat cattle	456 cwt.
Hogs	22 litters	Marketable hogs	341 cwt.

Table 17. Utilization of feed (Alternative Plan C)

Class of livestock	Unit	Farm grains (pounds)	Hay equivalent (pounds)	Commercial feed (pounds)
Hogs	341 cwt.	156,860	1,300	17,050
Feeders	235 cwt.	117,500	141,000	4,700
Total fed		274,360	142,300	
Total available		274,416	215,600	
Excess or Deficit		56	73,300	

ity and handled in the same way as the feeders in Alternative Plan B. There would then be sufficient corn available to feed out 22 litters of pigs. The surplus hay would be sold.

BALANCING ALTERNATIVE PLANS AGAINST PRESENT PLAN

The three alternative budgets suggested for the farm used as an example

Table 18. Normal returns (Alternative Plan C)

	Amount	Price	Value
Sales:			
Fat cattle	456 cwt.	\$20.50	\$9,348
Sows	48 cwt.	14.50	696
Market hogs	293 cwt.	16.50	4,835
Hay	36.65 ton	18.00	660
Total sales			\$15,539
Expenses:			
Seed corn	15 bu.	12.00	180
Alfalfa seed	272 lbs.	.40	109
Brome seed	90 lbs.	.20	18
Timothy seed	108 lbs.	.20	22
Baling twine	13 balls	3.70	48
Commercial feed for:			
Feeder cattle	47 cwt.	4.70	221
Hogs	170.5 cwt.	5.50	938
Feeder calves	221 cwt.	18.50	4,089
Hired labor	1 month	175.00	175
Annual cost of extra corn equipment	\$1,131	10%	113
Additional fertilizer for:			
Corn	0.90 ton	90.00	81
Barley	0.85 ton	95.00	81
Permanent pasture	0.67 ton	94.00	63
Additional combining charges	17 acres	4.00	68
Pasture renovation	13 acres	5.00*	65
Total expenses			\$ 6,271
Return over listed expenses			\$ 9,268
PROBABLE DIFFERENCE IN RETURNS OVER PRESENT			\$ 1,842

* Total yearly cost is \$5.00 per acre. At present, ACP repayment rates cover one-half of this cost.

should be sufficient to illustrate the use of this substitution budgeting technique. The substantial increase in income over expenses that vary with the organization, as shown in table 19, indicates that the alternative plans meet one of the primary objectives of the process—namely providing a substantial increase in net income over the present.

Table 19. Comparisons of cost and income between present organization and suggested alternative plans

	Present organization	Alternative Plans		
		A	B	C
Gross income	\$13,472	\$12,149	\$13,990	\$15,539
Expenses that vary indirectly with the organization	6,046	2,813	4,803	6,271
Net return over variable expense	7,426	9,336	9,187	9,268
Excess over present		1,910	1,761	1,842

The differences in net income among the three alternatives chosen are not large. The income from Alternative Plan B would probably be more stable over the years because of the larger number of sources of livestock income. The differences in returns among the three alternatives are too small to be highly significant.

These alternative plans also meet the other objectives, namely keeping the labor requirements within the limits suggested by the farm family. Estimates shown in table 20 indicate that all three

alternative plans come within the 3,500 hour limit set. Alternative Plans A and C promise slightly larger reductions in labor requirements than does Alternative Plan B which would use three different classes of livestock. The larger the size of the livestock enterprise, other things being equal, the less the labor per animal unit.

A breakdown of these labor hours by months shows relatively little variation in distribution by months. Hiring extra help in August would permit some vacation for the family at that time.

Another factor in determining the choice among these alternatives is the ease with which the farmer can adopt them and get them under way. The farmer's personal preference is also an important determinant. These are actual plans worked out with an individual farmer who is now adjusting his operations to fit the plan of his choice.

Table 20. Estimated hours of man labor for the present organization and for suggested alternative plans

	Present organization	Alternative Plans		
		A	B	C
Corn	448	410*	418*	418*
Barley	113	189	189	189
Hay (meadow)	323	238	238	238
Hay (pasture)	16	16	16	31
Hogs†	700	803	704	614
Feeder Cattle†	216	332	332	541
Sheep†	324	420	300	—
Beef cows	594	—	—	—
Manure Hauling	213	133	181	185
Miscellaneous	1297	972	1039	975
Total	4244	3181	3401	3191

* Hours of labor per acre of corn reduced 30% from present plan to alternative plans because of use of large scale corn machinery.

† Labor per unit of livestock adjusted to size of enterprise on the basis of data in table 26.



Drop all beef cattle and more than double the number of feeders (Plan C)? Again, a substitution budget can give the operator a sounder estimate of how such a step is likely to work out for him.

USING THE SUBSTITUTION BUDGET IN FARM PLANNING

The substitution budget has a wide variety of uses in farm planning. It can be used in replanning the whole farm business, as has been illustrated in the previous pages. It gives a quick answer to the question of what combination of crops and livestock promises the largest financial return under specified price assumptions.

It is equally well adapted to comparing the costs and returns over cost for two competing crops or classes of livestock. It can also be used to determine the relative economy of different methods of production and different types of machines and power for a given farm.

⁵ This should not be construed as a criticism of the complete budget. The latter is a very useful device in setting up a new farm business to determine the potential income that might be expected. It is also very useful in appraising the potential income that might safely be capitalized into the value of a farm or in determining the price a farmer could afford to pay for a farm. It has a wide variety of important uses but for balancing the type of alternative plans such as are considered here the substitution budget will give the information desired with the least expenditure of time and effort and with a degree of accuracy equal to that of the complete budget.

With the substitution budget one can determine the relative returns from two or more plans of operation with practically the same precision as a complete budget, and with only a minor fraction of the time and effort involved.⁵ Furthermore it is simple and flexible. Different price combinations as well as different enterprise combinations can be tried out very quickly once the basic factors of yield, cost and the like are set up in the present organization.

It should be fully recognized that the "return over costs that vary with the organization" is not a net earnings figure. It cannot be capitalized into the value of a farm for appraisal purposes. It is purely a method of comparison—but for that purpose it has wide usefulness. The method is relatively simple

and can be adapted to numerous uses in farm planning.

It is a simple way to "make your mistakes on paper" rather than in practice. To use the method freely and consistently will save a lot of costly "trial and error" experience. It is true that the answer may not be accurate to the last dollar but neither is any other method of advance planning—since all future plans must be based on estimates of future prices, weather, and other elements that can never be forecast precisely.

The substitution method has the advantage of using only simple mathematics and, to a large extent, facts that the farmer has available or can obtain easily with a fair degree of precision. The process is simple and follows the farmer's usual line of reasoning. The mechanics are simple.

However, no plans for the future are any better than the basic price and production data used. As previously stated, the results, like those of a complete budget, are dependent on the accuracy and adequacy of the data used and the assumptions made. By way of summary, the general steps involved in the substitution method of planning are presented. Not all of these are involved in every case, but they suggest the nature and sequence of the steps involved.

1. Determine the goals and objectives of the farmer and his family, and their likes, dislikes, and experience with the farm enterprises adapted to their farm.

2. Make an inventory of the resources at the farmer's disposal—amount and kind of land and improvements, labor, machinery, capital resources and credit.

3. Determine the normal cropping system, the normal livestock organiza-

tion, the normal rates of crop and livestock production, and the normal amounts of goods and services used in production.

4. Analyze the present organization carefully and compare with other farms in the area to determine the strong and weak points.

5. On the basis of the above information, draw up several alternative crop and livestock combinations that emphasize the strong points and minimize the weak points in the business as now conducted. Keep in mind the preferences and capabilities of the farm family and the resources they have available.

6. Make the best estimate you can of prices that you think most likely to prevail in the years ahead.

7. Calculate on the basis of prices in table 6, the value of all sales in the normal and proposed organizations and the cost of all items of expense that vary with the organization.

8. Compare the returns over cost that vary with the organization and select the one that promises the largest and most stable return, and that best fits the personal skills and preferences of the farm family.

9. Do not assume that the plan selected should necessarily be followed unchanged through the years. From time to time, as conditions change, try out additional alternatives by the substitution method covering either the whole farm business or certain crops or livestock. No one plan is likely to prove best over the years without occasional adjustments as farm techniques, prices, family labor, and other factors change.

Part II—Basic Data Needed in Substitution Budgets

TYPES OF DATA NEEDED IN FARM PLANNING

SOME DEFINITE basic data are needed for all types of farm planning whether the substitution budget, the complete budget, or some other type of procedure is used. These include facts about labor, power, machinery, custom services, materials, and practices used in crop production, and also the seasonal sequence or distribution of the various operations through the year.

Likewise one needs to know the quantity of labor, feed, and other essentials in livestock production and the seasonal distribution of the demand for these factors. The quantities needed per acre, per head, or per 100 pounds vary with the size of the farm, the acreage of crops and numbers of livestock, the practices followed in production, the size and type of equipment used, and many other factors of this kind.

SOURCES OF DATA

The best source of data for farm planning is accounting records kept on the farm to be planned, covering the items listed in the previous paragraph. Seldom, however, are sufficient data kept by any farmer in adequate detail over a sufficient period of time to supply all the planner's needs.

The records may be quite complete for the particular crops and livestock that have been maintained on the farm for which plans are to be made and for the practices followed. However, the planning process usually involves consideration of kinds of crops, classes of livestock, and systems of management not found or practiced previously on the farm in question. This is especially likely to be the case at the present time,

because of the new techniques that are crowding their way into the picture and virtually revolutionizing practices in both crop and livestock production.

It becomes necessary, therefore, for the farm planner to draw on other sources for at least some of the data needed. Records kept on other farms operating under comparable conditions are an important source. Another is the results of controlled experiments conducted by agricultural research institutions.

The tables that follow (tables 21-32) supply such information. Most of them are based on farm records kept on farms in southern Minnesota supervised and analyzed by the Department of Agricultural Economics of the Institute of Agriculture, University of Minnesota.

Some of these data apply only to southern Minnesota conditions but most of them—especially such things as feed and labor for livestock production, rates of machine operation, machine and power costs—have a much wider application. Much of this information can be used in other states in this general region with little, if any, adjustment.

On the other hand, the data in some tables—such as tables 24 and 28—will need some adjusting if used in areas where the seasons vary materially from southern Minnesota. In fact, many of the facts presented may need some adjustment to fit individual cases. With careful judgment and a knowledge of the area from which these data were obtained and that to which they are to be applied, these adjustments should not greatly impair their usefulness in farm budgeting. Individual judgment is always a factor of major importance in determining the validity of the data and methods used by the farm planner.

Table 21. Labor and power used per acre for crop production in southern Minnesota

Crop	Labor			Tractor Power		
	Average hour*	1/5 Low* hours	1/5 High† hours	Average hours	1/5 Low* hours	1/5 High† hours
Oats	5.0	2.8	9.6	3.5	2.1	6.1
Barley	5.5	3.1	10.5	3.6	2.1	6.1
Flax	4.7	2.9	8.4	3.4	2.0	4.2
Soybeans	4.5	3.3	7.5	3.8	2.8	4.8
Corn (husked)	6.4	4.4	10.0	5.5	3.6	6.2
Corn (silage)	10.5	6.9	15.9	8.2	5.3	8.2
Alfalfa	6.1	3.3	10.3	4.1	2.0	12.7

* Average of the low 20% according to records.

† Average of the high 20% according to records.

Table 22. Recommended seeding Rates*

Crop or Mixture	Seeding rate per acre	Comments
Grain Crops		
Corn	0.14 bu.	For a 10,000 stalk population.
Corn	0.20 bu.	For a 16,000 stalk population.
Oats	2 to 3 bu.	If broadcast, use 3.5 bu./acre.
Barley	2.0 bu.	
Durum wheat	7 or 8 pecks	
Bread wheat	5 or 6 pecks	
Rye	1.5 to 2 bu.	2 to 2.5 bu. for pasture.
Flax	1.0 bu.	
Soybeans	1.0 bu.	Higher rate for narrow rows (24").
Hay, Pasture and Silage Crops		
1. Alfalfa	6 to 8 lbs.	Brome is the recommended grass for sods left 2 years or longer.
Brome	6 to 8 lbs.	
2. Clover	6 to 8 lbs.	Use for silage or hay in a short rotation.
Timothy	4 lbs.	
3. Mixture:		Recommended for flexible use as pasture, grass silage, or hay. Alsike and ladino withstand excessive moisture.
Alfalfa	5 lbs.	
Red clover	2 lbs.	
Alsike clover	1/2 lb.	
Ladino	1/2 lb.	
Brome	8 lbs.	
4. Sweetclover	10 to 12 lbs.	Suited to high lime areas.
5. Reed canarygrass	6 to 8 lbs.	For poorly drained soils.
6. Oats	1 to 2 bu.	For silage.
Peas	1/2 to 1 bu.	
7. Oats	1 to 2 bu.	For hog or poultry pasture.
Rape	6 lbs.	
8. Sudangrass—pasture	25 to 30 lbs.	For midsummer pasture.
9. Sudangrass	10 to 15 lbs.	For silage or hay.
Soybeans	1 bu.	

* Note: These recommendations are from the Agronomy Department of the University of Minnesota. Forage mixtures listed are from Minnesota Extension Folder 182.

Table 23. A guide to fertilizer use*

Crop	Soil texture† group	Present‡ soil productivity	Nitrogen		Phosphate	Potash
			First year after legume or manure	More than one year from legume		
Corn§	Group 1	High	10	40	20	.....
		Medium	10	55	40	40
		Low	30	70	60	60
	Group 2	High	10	40	20	10
		Medium	15	50	30	40
		Low	20	60	40	60
Small grains and flax	Group 1	High	.....	10	20	.....
		Medium	.....	40	40	.....
		Low	.....	60	40	20
without legume seedings	Group 2	High	.....	20	20	.....
		Medium	.....	30	40	.....
		Low	.....	40	40	20
Small grains and flax with legume seedings	Group 1	High	.....	10	20	.....
		Medium	.....	20	40	40
		Low	.....	40	80	80
Group 2	High	.....	10	20	.....
	Medium	.....	20	40	40	
	Low	.....	40	80	80	
			Nitrogen	Phosphate	Potash	
Legumes and mixtures seeded	Group 1	High	10	20	.....	.....
		Medium	20	40	40	40
		Low	30	80	80	80
without a companion crop	Group 2	High	10	40	.....	.....
		Medium	20	60	40	40
		Low	30	80	80	80
Topdressing for established	Group 1	High	.....	.....	.....	.....
		Medium	.....	40	40	40
		Low	.....	60	60	60
legumes or mixtures	Group 2	High	.....	.....	.....	.....
		Medium	.....	30	30	30
		Low	.....	50	50	50
Permanent grass pastures	Group 1	High	30	20	.....	.....
		Medium	60	40	20	20
		Low	100	60	30	30
	Group 2	High	30	20	.....	.....
		Medium	50	40	20	20
		Low	80	60	30	30
Soybeans	Group 1	High	.....	.....	.....	.....
		Medium	10	20	20	20
		Low	40	40	60	60
	Group 2	High	.....	.....	.....	.....
		Medium	20	20	20	20
		Low	40	40	60	60

* Note: These data are from Minnesota Extension Bulletin 277.

† Group 1 includes medium to heavy textured soils; group 2 included sandy soils with moisture limitations.

‡ The low and medium rated soils in group 1 will yield up to 75 or 80 bushel of corn per acre. The high will yield 90 bushels per acre. For group 2, the recommendations are based on expected yields of 60 to 65 bushels per acre.

§ Recommended stand of corn is 16,000 plants per acre for the soils of group 1 and 12,000 for the soils of group 2.

Table 24. Calendar of field operations, Winona county, 1935-40

Crop	Operation	Average time period	Average of Earliest dates	Average of Latest dates
Oats and Barley	Spring tooth	April 20-April 29	April 12	May 9
	Harrow before	April 20-April 26	April 12	May 6
	Seed	April 21-April 30	April 13	May 14
	Harrow after	April 25-May 1	April 13	May 16
	Cut	July 20-July 28	July 12	Aug. 8
	Combine*	July 21-Aug. 2	July 13	Aug. 10
Flax	Spring tooth	April 30-May 8		
	Seed	April 30-May 8		
	Harrow after	May 5-May 11		
	Cut	Aug. 4-Aug. 10		
	Combine*	Aug. 7-Aug. 14		
Corn	Plow	May 9-May 23	April 17	June 10
	Spring tooth	May 11-May 22	April 22	June 3
	Harrow before	May 11-May 23	April 22	June 5
	Plant	May 16-May 26	May 8	June 10
	Harrow after	May 22-May 31	May 11	June 13
	Cultivate	June 2-July 14	May 22	July 26
	Harvest as silage	Sept. 12-Sept. 18	Aug. 29	Oct. 2
	Harvest as grain	Oct. 10-Oct. 27	Sept. 21	Nov. 18
Alfalfa	First cutting	June 18-June 28	June 9	July 5
	Second cutting	Aug. 10-Aug. 16	July 15	Aug. 30
Winter wheat	Spring tooth	Sept. 8-Sept. 12	Aug. 29	Sept. 24
	Harrow before	Sept. 9-Sept. 13	Sept. 1	Sept. 25
	Seed	Sept. 13-Sept. 15	Sept. 6	Sept. 27
	Harrow after	Sept. 14-Sept. 16	Sept. 7	Sept. 24
	Cut	July 16-July 20	July 13	July 30
	Combine*	July 18-July 22	July 16	July 30

* Estimated.

Table 25. Feed used in livestock production*

	Farm grains lbs.	Hay equivalent† lbs.	Commercial feeds lbs.	Pasture (days)	Whole milk	Skim milk
ENTERPRISE						
DAIRY COW						
Less than 275# BF	1185	6165	200	148		
275-349# BF	2425	6850	435	144		
More than 349#	3025	7610	530	141		
OTHER DAIRY CATTLE						
In low producing herds, per head	510	2510		108	310	475
In medium producing herds	665	2565		104	350	335
In high producing herds	880	2665		100	360	170
HOGS, per 100# gain						
Less than 6 pigs weaned/litter	455		48	38		
6.0-7.9 pigs weaned/litter	420		47	38		
8 or more pigs weaned/litter	390		55	38		
FEEDER CATTLE, per 100# of gain‡						
Long-fed calves	555	460	42	14		
Long-fed yearlings	570	460	49	14		
Short-fed yearlings and 2-year-olds	770	525	63	6		
BEEF COW and replacement§	175	5085	20	150		
CHICKENS						
Hen producing 190 eggs¶	75		35			
Rearing flock per 100 chicks bought**						
Pullet flock	1350		1235			
Straight run	1355		1010			
EWE and lamb††	145	585		116		
FEEDER LAMBS per 100# net gain‡‡	775	515	70			
TURKEYS per 100# net gain §§	300		235			

* Note: These data were obtained from 1,498 records kept on southern Minnesota farms over the 5 year period, 1950 through 1954.

† Silage is included in this rate with 3 lbs. of silage considered equal to 1 lb. of hay.

‡ Average death loss was 2.2% for long-fed calves, 0.9% for long-fed yearlings, and 1.1% for the short-fed animals.

§ Average ratio of cows to young stock was 1:0.9.

¶ Average death loss in laying flock was 23% of the pullets housed in the fall. Average proportion of pullets in the laying flock was 86%.

** Average death loss was 14%, thus 86 chickens were raised to an average weight of 4.1 lbs.

†† Average output was 81 lbs. of mutton and 13 lbs. of wool per ewe. Average death loss was

3%. Average lamb crop was 103%.

‡‡ Average death loss was 3.2%.

§§ Average death loss was 17.6%.

Table 26. Labor used for livestock by size of enterprise

Enterprise	Units	Labor Requirements by Size of Enterprise				Average number of hrs.
		No. of head	Hrs. per head	Total cost	Average cost per unit	
Milk cows*	No. of head	6-13.9	14-21.9	22 and over	101	
	Hrs. per head	114	98	95		
Other dairy cattle	No. of head	7-15.9	16-24.9	25 and over	18	
	Hrs. per head	20	19	17		
Hogs	No. of litters	1-1.4	15-29	30 and over	32	
	Hrs. per litter	41	33	22		
Chickens	No. of hens	50-149	150-299	300 and over	2.1	
	Hrs. per hen	2.6	2.0	1.6		
Feeder cattle	No. of head	less than 50	50 and over			
	Hrs. per cwt.	3.0	2.1			
Beef breeding†	No. of cows	less than 16	16-30	31 and over	2.6	
	Hrs. per cow	33	22	17		
Sheep‡	No. of ewes	less than 25	25-49	50-120	2.4	
	Hrs. per ewe	6.2	4.5	3.2	4.6	

* Labor requirements are about 15% lower with loose housing.
 † Labor inputs for Livestock Enterprises, South Dakota State College Agricultural Economics Pamphlet 40, Sept. 1952.

Table 27. Power, equipment, shelter, interest, and miscellaneous cash costs in livestock production*

Enterprise	Power Total Tractor cost	Auto hours	Truck miles	Equipment Total cost	Cash cost	Shelter		Miscel. interest charges†	Miscel. interest charges‡
						Total cost	Average cost		
CHICKENS per 100 hens	\$8.00	2.6	28.5	\$35	\$21.00	\$6.70	\$30.00	\$6.00	\$17.00
FEEDER CATTLE per cwt. produced	.40	0.3	0.9	0.7	.30	.15	.65	.13	1.80
HOGS per cwt. produced	.20	0.1	0.3	0.7	.28	.08	.30	.06	.30
MILK COWS per cow									
Small herd, 6-13.9 cows	3.00	1.8	4.5	13.3	10.00	4.50	18.00	3.60	10.00
Average herd, 14-21.9 cows	3.00	1.8	4.5	13.3	10.00	4.50	15.00	3.00	10.00
Large herd, 22 or more cows	3.00	1.8	4.5	13.3	10.00	4.50	11.00	2.20	10.00
OTHER DAIRY CATTLE per head									
Small herd, 7-15.9	1.00	0.6	1.2	3.1	.....	.....	12.00	2.40	5.00
Average herd, 16-24.9	1.00	0.6	1.2	3.1	.....	.....	7.00	1.40	5.00
Large herd, 25 or more	1.00	0.6	1.2	3.1	.....	.....	6.00	1.20	5.00

* If cash costs alone are being deducted in an effort to determine the cash returns from an enterprise that will be available for reinvestment, it must be borne in mind that additional cash expenditures are made each year to replace equipment at an average rate of 25% of the inventory value of said equipment and to replace and add new buildings at the rate of 9% of their average inventory value.
 † Individual interest charges can be calculated by multiplying the average annual investment in livestock by the interest rate.
 ‡ It was found that in the dairy enterprise miscellaneous cash costs varied with level of production rather than with size of herd. Average cash outlays were: low producing herds—\$14.91 per cow, and \$1.32 per head for other dairy cattle; medium producing herds—\$24.68 per cow and \$2.14 per head for other dairy cattle; high producing herds—\$30.96 per cow and \$3.06 per head for other dairy cattle.

Table 28. Percentage distribution of man labor by months

Month	Spring grains	Flax	Corn for grain	Soy-beans	Alfalfa	Manure* hauling	Dairy	Hogs		Chickens	Feeder cattle	Beef breeding herd‡	Sheep‡ (farm flock)	Miscellaneous labor§
								Spring only	Spring and fall pigs†					
Jan.						9.5	10.4	8.2	8.1	8.0	12.2	16	13	5.6
Feb.						10.5	9.5	9.8	10.6	7.8	10.6	14	12	5.3
Mar.	0.8		0.2		0.1	10.0	10.3	12.4	13.3	9.1	12.3	14	15	5.9
Apr.	16.8	6.0	1.6	2.0	0.2	11.5	9.3	15.2	11.0	10.0	10.2	14	13	6.6
May	10.0	16.2	25.3	24.2	0.5	13.8	8.1	9.2	7.7	9.5	7.2	5	6	7.8
June	0.6	8.1	15.5	20.9	36.4	4.5	6.7	7.5	6.4	8.4	5.8	2	3	11.4
July	16.4	5.1	7.8	12.4	30.8	4.8	6.8	7.0	6.1	8.4	5.2	1	2	10.3
Aug.	41.6	28.7	3.1	2.0	14.4	7.8	6.6	5.7	7.8	8.3	5.8	2	4	11.2
Sept.	6.2	26.1	12.7	9.1	16.9	8.3	6.6	5.5	7.6	8.2	5.4	3	4	12.3
Oct.	3.2	6.2	27.3	23.6	0.7	4.8	7.3	5.4	6.9	7.6	5.3	4	7	10.0
Nov.	4.4	3.6	6.4	5.8		6.0	8.3	6.5	7.0	7.3	8.4	10	9	7.3
Dec.			0.1			8.5	10.1	7.6	7.5	7.4	11.6	15	12	6.3

* Total hours of manure hauling can be obtained by figuring 4 hours per dairy cow, 2 hours per head of other dairy stock, 2 hours per litter of pigs, 3 hours per beef cow or feeder, 4 hours per 100 hens, and 0.4 hours per ewe.

† The ratio of spring to fall litters was 1.4 to 1.

‡ Labor inputs for Livestock Enterprises, South Dakota College of Agricultural Economics Pamphlet 40, Sept. 1952.

§ Miscellaneous labor includes labor on farmstead upkeep, new building construction, building repair, machinery and equipment repair, tractor repair, truck and auto repair, wood cutting, garden work, exchange work, and other miscellaneous jobs. Total labor required for these tasks amounted to 44% of the combined crop and livestock labor on farms with emphasis on beef and hogs. For dairy farms it amounted to 29% on the combined crop and livestock labor. (This does not include time spent at farm meetings, work for pay, or public service work.)

Table 29. Machine capacity and power and labor requirements per acre

Machine		Hours per acre		Total hours, including hauling		Machine capacity, acres per hour*
Kind	Size	Man	Tractor	Man	Tractor	
Tandem Disk	7'-10'	0.35	0.35			2.9
Single Disk	10'-18'	0.20	0.20			5.0
Plow	2	1.15	1.14			0.9
Plow	3	1.00	0.99			1.0
Plow	4	0.71	0.70			1.4
Spring tooth	7'-12'	0.30	0.30			3.3
Spring tooth	15'-20'	0.27	0.23			3.7
Spike tooth	16'-21'	0.14	0.14			7.1
Grain Drill	75-8	0.50	0.46			2.0
Grain Drill	9'-12'	0.35	0.32			2.9
Corn Planter	2-row drop	0.50	0.50			2.0
Corn Planter	4-row drop	0.44	0.43			2.3
Corn Planter	2-row check	0.77	0.63			1.3
Corn Planter	4-row check	0.65	0.54			1.5
Corn Cultivator	2-row	0.47	0.46			2.1
Corn Cultivator	4-row	0.32	0.32			3.1
Corn Picker	1-row	1.40	1.40	3.48	2.32	0.7
Corn Picker	2-row	0.70	0.70	1.68	1.38	1.4
Field Chopper	(corn)	1.50	1.50	5.99	4.21	0.7
Swather	7'-12'	0.52	0.39			2.0
Binder	7'-10'	1.23	0.66			1.5
Combine	5'-6'	0.60	0.50	1.38	0.98	1.7
Combine	12'	0.40	0.40	1.38	0.82	2.5
Thresher		2.28	1.07	3.29	1.30	0.9
Mower		0.50	0.48			2.0
S.D. Rake		0.35	0.35			2.9
Dump Rake		0.31	0.31			3.2
Baler		0.70	0.60	2.25	1.02	1.4
Field chopper (hay)		1.00	1.00	3.32	1.65	1.0
Hay chopper (dry)				2.84	2.35	

* Capacity of machines is based on man hour requirements excluding labor required for hauling.

Table 30. Annual variable machine costs*

Machine	Repair and upkeep as a percent of original cost	Machine	Repair and upkeep as a percent of original cost	Fuel and oil per acre
Hauling Equipment	4.8	Corn Cultivator	3.9	
Tillage Machinery	5.2	Corn Picker, 1 row	1.5	
Fertilizer Equipment	1.9	Corn Picker, 2 row	4.3	
Seeding Equipment	0.6	Mower and Rake	3.9	
Crop Sprayer	6.0	Combine 4'-6'	2.3	\$.23
Grain Binder	6.9	Combine 12'	2.4	.19
Thresher	0.8	Swather	2.3	
Manure loader	3.4	Baler	2.1	
Manure spreader	2.8	Elevator	1.4	
Corn Planter	2.0	Field chopper	2.6	.30

* Total annual cost is obtained by adding the calculated variable cost to the fixed cost. Annual fixed costs can be calculated for each machine by adding depreciation, shelter, and interest charges. The annual depreciation is based on the machine's life expectancy. Shelter charges should be calculated for those machines to which it is applicable. Interest can be computed at 2½% of the original cost.

Table 31. Variable tractor costs

Tractor size (drawbar horsepower)	Variable cost* (dollars per hour)
7-1	\$.45
15-20	.55
20-27	.69
30 and over	.84

* Includes cost of fuel, oil, grease, repairs, maintenance and servicing.

Table 32. Sources and uses of labor on 89 southern Minnesota farms, 1951 through 1953

SOURCES	Percentage of total labor	
	62 farm with emphasis on dairy	27 farms with emphasis on feeder cattle or hogs
Operator	57.6	60.5
Family	15.8	11.2
Hired	23.9	25.1
Exchange	2.7	3.2
USES		
Grain	4.2	5.2
Corn	6.2	11.6
Soybeans	0.6	1.1
Hay	4.2	4.5
Other crops	1.2	2.0
Hauling manure	2.4	2.4
Fall work	1.3	3.1
Total Crops	20.1	29.9
Dairy cattle	40.4	5.0
Feeder cattle	0.6	9.8
Hogs	6.7	13.6
Chickens	6.9	5.7
Other	0.8	2.7
Horses	0.5	0.2
Total Livestock	55.9	37.0
Farmstead	1.6	3.6
New buildings	2.8	2.4
Building and repair	2.8	3.8
Fences	1.4	2.3
Machinery and equipment	3.2	6.6
Tractor repair	0.4	0.9
Truck and auto repair	0.2	0.4
Wood for fuel	0.7	0.5
Garden work	0.6	0.5
Farm business	2.7	4.6
Farm meetings	1.2	2.0
Exchange work	2.6	2.9
Work for pay	1.7	0.5
Public service work	1.5	1.2
Other	0.6	0.9
Total Miscellaneous	24.0	33.1
Hours of labor per year	5,717	4,935