

Profitable Adjustments in Farming in East Central Minnesota

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Considering Changes in Farm Resources and in Milk and Hog Prices

L. M. Day, W. B. Sundquist, and H. R. Jensen

PROBLEM AND SCOPE

MANY MINNESOTA FARMERS CURRENTLY FACE problems of low income due to increasing costs, changing farm technology, changing market structures, and relatively low prices for farm products. As a result, they are involved in one of the biggest adjustments ever witnessed in our agricultural economy.

Adjustments are especially great in the dairy industry. In 1955, 116,230 Minnesota farmers kept milk cows. By 1959, only 4 years later, this number had declined to 90,171 or 77.6 percent of the 1955 total. In 1955 only 11 percent of these dairy enterprises reported more than 20 milk cows. By 1959 this number had grown to 19.5 percent. Thus, there was a large decrease in small dairy herds and a rapid increase in larger herds.

In 1954 about 97,530 Minnesota farmers produced hogs. By 1959 only 84,250, 86.4 percent of the 1954 number, reported hog enterprises. During this period the average size of the hog enter-

prise increased about 27 percent. This indicated a trend toward specialization in hog production as in dairy.

These sizable adjustments occurred over a short period and adjustments continue to be made. In order to make proper adjustments in their farm businesses, many farmers must consider the profitability of alternative changes in the organizations of crop and livestock enterprises.

The purpose of this study was to determine what profitable farm organizations might be developed in east central Minnesota with the use of resources typically available to farmers. In addition, we assumed that the quantities of

¹ L. M. Day and W. B. Sundquist are Agricultural Economists, Farm Economics Division, Economic Research Service, U. S. Department of Agriculture. H. R. Jensen is a Professor, Department of Agricultural Economics, Minnesota Agricultural Experiment Station.

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some resources could be expanded through the use of credit. The "most profitable" farm organizations presented are not established farm organizations but *estimates* of how farm resources could be used to maximize farm profits.

Income possibilities were determined by adjusting current farm organization in several ways. *Livestock enterprises* considered as possibilities were:

1. Stanchion dairy with milk production for manufacturing uses.
2. Production and feeding out of hogs including the possibility of purchasing and feeding out 35-pound feeder pigs.
3. Production of beef calves from a cow-calf enterprise.
4. Purchase and feeding out of yearling feeder steers.

Three different *crop rotations* and two levels of soil fertility and crop management were also considered as choices. Most crop and livestock alternatives considered here require improved management practices. These practices are explained later.

Future prices cannot be known with certainty. Prices of farm products vary with changes in supply and demand and government agricultural programs. In this study we estimated profitable farm organizations with prices varying at regular intervals between \$2.50 and \$4.50 per cwt. for milk and between \$11.00 and \$18.50 per cwt. for hogs. Prices for other farm products and expense items were projected at levels expected to hold through the mid-1960's.

Weather conditions for any particular year are also difficult to predict accurately. Therefore, crop yields and labor requirements are estimated for farm production with average weather conditions. Crop yields, feed conversion rates for livestock, and other productivity performances in this study are obtainable with *good* management practices.

Keep in mind that not all farm price and income problems are likely to be

solved by improving production efficiency or size of individual farms. Group action in the form of purchasing and marketing cooperatives and governmental action, for example, may be needed to provide adequate farm incomes. The analysis reported here, however, doesn't consider income improvements obtainable by group or governmental action.

AREA STUDIED

This study is part of a larger one that includes the major dairy areas of Minnesota and other states in the Lake States dairy region. Figure 1 shows the particular area to which this report applies—all or most of Morrison, Mille Lacs, Benton, Kanabec, and Pine Counties together with smaller portions of Todd and Stearns Counties.

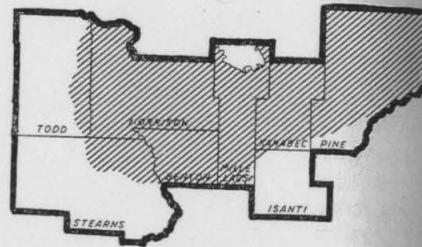


Fig. 1. The darkened section indicates the study area.

Most soils in this area are considerably less productive than those in farm areas to the west and south. This lower productivity is due not only to lack of natural fertility but also to the relatively short growing season. Primary soils are of the Milaca-Brainerd-Hibbing and Wadena-Hubbard series with a lesser though significant amount of sand. A large part of the land is best utilized as permanent pasture or hayland, although a great deal makes moderately good cropland, particularly when used for production of feed crops. Corn and soybean yields are substan-

tially lower than commercial production areas to the west and south.

PROCEDURES USED

Farm Survey

Before determining possible adjustment alternatives, a random sample of 36 farmers in the study area was interviewed in the summer of 1959. The purpose was to determine current farm practices and enterprises and to obtain an inventory of available farm resources. Farmers were asked questions relating to farm size, crop rotations, cropping practices, machinery, fertilizer use, livestock enterprises and practices, labor availability, and their capital position. This information then served as a benchmark of existing resources, technology, and farm organization from which adjustment alternatives were considered.

Typical Farms

The 36 farms were classified according to: (1) crop acres, (2) type of dairy facilities available (loose housing-parlor, stanchion, or none), and (3) type of milk market available (grade A or grade B). Of the 36 farms, 31 had *stanchion barn* facilities and were selling or were equipped to sell milk on a *grade B (manufacturing milk)* market. These 31 farms provided the information for constructing the typical farms in this study. They were divided into these three groups:

1. Farms with 0 to 79 acres of cropland and less than 20 stanchions.
2. Farms with 0 to 79 acres of cropland and 20 stanchions or more.
3. Farms with 80 or more acres of cropland.

Characteristics of farms falling within each group were tabulated in order to construct a typical farm for each group. When possible, resource items

(e.g., crop acres, cow stanchions, and available labor) found on the farms were totaled and a simple average obtained. When resource items occurred in "lumpy units," such as tractors and combines, the "most typical" combination of such resources was used.

These typical farm situations, therefore, are averages of several farm situations. They do not represent the resource base for any single farm exactly as some differences in soil, buildings, and equipment occur between farms. Moreover, farmers differ in experience, credit ratings, managerial skills, and enterprise preferences. However, investigating the organizational and income possibilities of several typical resource situations is a more helpful guide to individual farmers than investigating a single *average* resource situation. Few farms, if any, are ever exactly average.

The most profitable farm organizations were determined for the three typical farms. Nevertheless, organizations producing less profit may be preferable for individual farmers if, for example, they reduce credit or labor requirements, if they reduce risk, or if they better fit existing farm resources.

Linear Programming

The procedure used in determining the most profitable farm organizations is a system of budgeting called linear programming. This procedure consists of three major steps:

1. Budgeting resource requirements (such as land, labor, and miscellaneous cost items) and expected income for each crop and livestock enterprise considered.
2. Determining what resources are available for use, in what quantity, and at what cost.

3. Determining the combination of crop and livestock enterprises that can be managed with available resources and that will produce maximum profits from the farm business.

Limits were placed on the availability of such resources as land, capital (including credit), and hired and family labor. Except for the credit restriction, these limits were based on information obtained from the survey of farmers. Credit limits were estimated on the basis of what might be loaned by commercial banks, Production Credit Associations, Federal Land Banks, or other lending agencies.

The Typical Farm Situations

The resources available for the three typical farm situations are summarized in table 1. Because one can often buy land only in whole farm tracts or hire labor only on a year-round basis, quantities of land and labor available were considered fixed at their *current levels*. Because purchase of additional land was not considered, the current inventory of tractors and machinery was thought ample for farming the available land. More details on machinery use are included in table 7.

The cash and inventories item in table 1 equals the value of cash or bonds on hand plus feed and livestock inventories less any non-real-estate liabilities. Although these resource items are not all ready cash, it was assumed that they could be converted to cash or to other resources. For example, dairy cows could be sold and the money used to buy sows if hogs were more profitable. The amount of real estate credit available was estimated by taking 50 percent of the value of real estate and subtracting current mortgages on real estate. Non-real-estate, or chattel, credit equals 50 percent of the value of machinery and equipment. *In addition*, money could be borrowed to purchase feeder cattle, cows, or hogs if either the necessary feed supplies or cash or

Other resource items such as concentrate feeds, fertilizer, and livestock were purchased at market prices until (1) it was not profitable to purchase more or (2) capital and credit became limiting.

The most profitable farm organizations determined here are limited to the crop and livestock enterprises considered. They reflect price levels and resource productivities used in the study.

credit to purchase the feed were available. Interest of 7 percent per annum was charged for all short-term credit.

In determining the resources available for typical farms, the feed, labor, and capital actually used for farm flocks of chickens, turkeys, and sheep were left committed to these enterprises. This was done because the enterprises were small in size and, in most instances, the labor used in the poultry enterprise was largely that of the housewife. Resource requirements for these enterprises were subtracted from the resource availabilities shown in table 1.

LIVESTOCK ENTERPRISE ALTERNATIVES

Several livestock enterprise alternatives were considered for all three typical farms.

Dairy

The dairy enterprise alternative had stanchion barn housing since such housing was available on all farms. A two-unit milker was used and neither bulk tank nor pipelines were installed. Cows were fed baled hay and/or silage

Table 1. Resources available for typical farms

Resources	Unit	Farm 1	Farm 2	Farm 3
		0 to 79 acres with less than 20 stanchions	0 to 79 acres with 20 stanchions or more	80 acres or more
Cropland	Acres	50	53	98
Open pasture	Acres	60	54	42
Wooded pasture	Acres	45	27	27
Family labor*				
January-March	Hours	713	748	1,187
April-May	Hours	666	993	818
June-July	Hours	721	818	809
August	Hours	360	405	409
September-October	Hours	630	783	800
November-December	Hours	516	670	748
Hired labor				
January-March	Hours	.....	.....	.....
April-May	Hours	4	.....	68
June-July	Hours	19	52	171
August	Hours	13	34	50
September-October	Hours	.....	.....	25
November-December	Hours	.....	.....	.....
Cash and inventories†	Dollars	\$4,740	\$5,980	\$5,580
Real estate credit	Dollars	\$3,460	\$5,590	\$4,680
Chattel credit	Dollars	\$2,240	\$3,060	\$6,330
Dairy stanchions	Cows	12	23	27
Farrowing capacity	Sows	3	6	5
Silo capacity	Tons	60	90	130

* An overhead labor requirement (time necessary for building and equipment repair, upkeep, etc.) of 4 hours per crop acre was subtracted from available family labor. Consequently, the quantities of labor shown here are available for direct use in crop and livestock production.

† Includes cash and bonds on hand beside the market value of livestock and feed inventories. Over 90 percent of these assets were noncash items, primarily livestock.

Table 2. Dairy enterprise budgets (per cow including replacements with varied feeding rate)

Item	Unit	Grain: milk feeding ratio		
		1:2.5	1:4.0	1:6.0
Gross income (except milk)*	Dollars	\$ 78.60	\$ 78.60	\$ 78.60
Milk production	Pounds			
	3.5 f.c.m.	10,900	10,000	9,210
Miscellaneous cash costs†	Dollars	\$ 61.60	\$ 61.60	\$ 61.60
Corn equivalent	Bushels	88.07	54.50	37.36
Forage equivalent	Tons	4.32	4.74	4.90
Livestock pasture	Tons hay equivalent	2.16	2.37	2.45
Investment in cow and replacement	Dollars	\$371.25	\$371.25	\$371.25
Labor, stanchion barn				
First five cows‡	Hours	211.6	211.6	211.6
Each added cow	Hours	52.5	52.5	52.5
Expanding buildings (annual cost)§	Dollars	\$ 52.73	\$ 52.73	\$ 52.73

* Includes sale of cull cows, all bull calves, and excess heifers.

† Includes protein feeds, breeding fees, annual costs of machinery and equipment, barn repairs and upkeep, electricity, and veterinary expenses.

‡ Labor requirements for the first five cows include all fixed labor requirements associated with a dairy herd housed and milked in a stanchion barn since these fixed labor requirements are incurred whether 5, 10, or 30 cows are milked. No dairy enterprise smaller than five cows was allowed as an alternative in any farm organization.

§ Cost incurred only when the size of enterprise exceeds available stanchion barn facilities.

twice daily. The roughage ration depended upon whether it was more profitable to put up silage or hay. The silage was unloaded by hand from a tower silo. Heifer replacements were raised, cows were bred artificially, and bull calves were sold at 90-pound weights. The dairy practices listed here were those reported by farmers; these practices determined the labor and cost requirements of the dairy enterprise shown in table 2.

Dairy cows were assumed capable of producing 10,000 pounds of 3.5 percent fat corrected milk when fed a concentrate ration of 1 pound grain to 4 pounds milk. Although this is a better quality cow than is kept on many farms, some farmers have cows producing 11,000 or 12,000 pounds of milk. The average is constantly increasing. Two other concentrate rations—1 pound grain to 6 pounds milk, and 1 pound

Table 3. Beef cow-calf enterprise budget (per cow basis)

Item	Unit	Amount
Income		
Sale of calf (net of replacement)	Dollars	\$ 72.56
Sale of cull cow	Dollars	21.85
Total	Dollars	\$ 94.41
Cash expenses		
Miscellaneous cash costs*	Dollars	\$ 10.03
Protein feeds	Dollars	2.84
Total	Dollars	\$ 12.87
Other requirements		
Corn equivalent	Bushels	.34
Forage equivalent	Tons	2.10
Pasture equivalent	Tons	1.50
Livestock investment†	Dollars	\$183.50
Labor	Hours	6.46
Expanding buildings (annual cost)‡	Dollars	\$ 9.12

* Includes charges for the annual costs of machinery and buildings as well as veterinary expenses.

† Includes prorated portion of a herd sire and replacement heifer.

‡ Cost incurred only when the size of enterprise cannot be housed in available space.

Table 4. Feeder cattle budget (per steer basis)

Item	Unit	Amount
Sale value of steer at \$21.50 cwt.	Dollars	\$233.71
Cash expenses		
Purchase cost	Dollars	-\$128.21
Protein feed	Dollars	-\$ 7.44
Miscellaneous cash costs*	Dollars	-\$ 5.56
Net cash income	Dollars	\$ 92.50
Other requirements		
Corn equivalent	Bushels	43.6
Forage	Tons hay equivalent	.23
Labor	Hours per steer	6.19
Expanding facilities (annual cost)†	Dollars	\$ 5.21

* Includes charges for the annual costs of machinery and buildings as well as veterinary expenses.

† Costs incurred only when the size of enterprise exceeds available space and feeding facilities.

grain to 2.5 pounds milk—were also considered.

Expanding stanchion facilities beyond those currently available cost about \$530 per cow including space for replacement heifers and calves. This cost was prorated (amortized) over a 15-year period at 5½ percent interest, as was the cost of adding additional space for silage storage. Most buildings would probably last longer than 15 years. However, if the revenue from additional milk sales would not pay the additional costs over this period, it would be difficult to justify the expenditures. Obsolescence was also a consideration in selecting a 15-year amortization period for buildings.

Beef Cow-Calf Herd

A beef cow-calf enterprise was one of the livestock alternatives. A 90-percent calf crop was raised. Calves weighing about 430 pounds were marketed by mid-October. Fifteen percent of the cows were replaced annual-

ly from home-raised heifer replacements. Up to 10 beef cows could be housed in existing buildings. Expansion that required additional building and feeding facilities cost about \$91.00 per cow. This cost was also amortized over a 15-year period. Resource requirements for this enterprise are summarized in table 3.

Cattle Feeding

A cattle feeding enterprise included the purchase and feeding out of yearling steers. Steers were bought in October at about 690 pounds, roughed with limited grain for 10½ weeks, put on full feed in drylot for about 18 weeks, and sold with a gain of about 400 pounds per head. Expansion of building and feeding facilities cost about \$52.00 per head. Labor and feed requirements were based on information obtained from Minnesota and Illinois cattle-feeding operations (see table 4).

Hogs

Several hog enterprise alternatives were considered. These included one-litter and two-litter farrowing and feeding systems and the purchase and fattening of feeder pigs. Thirty-five-pound feeder pigs were priced at \$8.00 when the price of market hogs was \$14.00 per cwt. or less, and at \$11.00 per head if the price of market hogs was over \$14.00 per cwt. Litters averaging eight pigs were raised. Gilts were kept for replacements from the spring litter. Spring litters were fed out on pasture, but fall litters were fed out in confinement. Spring litters financed the out-of-pocket (commercial feed and incidental) costs of the fall litters when a two-litter system was used.

Expanding hog enterprises to a size exceeding available building and feeding facilities required adding central farrowing house type facilities. These cost \$157.40 per sow, and feeding facilities (self feeders, waterers, concrete feeding lot, and shelter) cost

Table 5. Budgets for alternative pig production systems

Item	Unit	Per sow	
		One-litter system	Two-litter system
Sale of sow*	Pounds	320	320
Sale of boar†	Pounds	10	10
35-pound feeder pigs transferred to feed lot	Number	7	15
Cash expenditures			
Protein and mineral feeds	Dollars	\$16.50	\$28.08
Vaccination, power, and miscellaneous costs	Dollars	\$17.79	\$34.22
Investment in gilt and boar‡	Dollars	\$27.73	\$27.73
	Dollars	\$38.13	\$38.13
Corn equivalent	Bushels	38.91	64.14
Forage equivalent	Tons	.18	.18
Expanding farrowing facilities§ (annual cost)	Dollars	\$16.42	\$16.42
Labor	Hours per sow	16.00	22.90

* Based on historical prices, sale of a 350-pound sow equals sale of 320 pounds of market hog.

† This assumes one boar per 15 sows. Based on historical prices, this equals sale of 10 pounds of market hog.

‡ When hogs were priced from \$11.00 to \$14.00 per cwt. the investment figure of \$27.73 was used. For the price range of \$15.50 to \$18.50 per cwt., the amount of livestock investment was \$38.13.

§ This cost incurred only when the size of enterprise exceeds available space.

Table 6. Budgets for market hogs after weaning

Item	Unit	Per hog	
		Spring farrowed	Fall farrowed
Weight at sale	Pounds	225	225
Cash expenditures			
Protein and mineral feeds	Dollars	\$3.59	\$2.93
Power and miscellaneous costs	Dollars	\$4.05	\$4.26
Corn equivalent	Bushels	9.77	11.07
Forage equivalent	Tons	.18	
Expanding feeding facilities (annual cost)*	Dollars	\$2.00	
Labor used	Hours	1.32	1.32

* Cost incurred only when the size of enterprise exceeds available space.

\$19.09 per hog fattened. The cost of buildings was amortized over a 15-year period and the cost of equipment over a 10-year period. Labor requirements and other costs for the hog enterprises are shown in tables 5 and 6.

CROP PRODUCTION ALTERNATIVES AND CROP YIELDS

The resources required for crop production and the expected crop yields

Table 7. Resources used for crop production and crop yields per acre

Item	Crop and fertility level							
	Corn grain		Corn silage		Oats		Hay	
	Current	Improved	Current	Improved	Current	Improved	Current	Improved
	dollars							
Fertilizer	3.60	8.10*	3.60	8.10*	0.80	11.30†		4.85
Spray		5.00		5.00				
Seed	3.00	3.00	3.00	3.00	1.90	1.90	5.70‡	5.70‡
Fuel and repairs§								
Farm 1	3.69	2.94	4.08	3.33	1.35	1.35	2.82	3.07
Farm 2	3.69	2.94	4.08	3.33	1.35	1.35	2.82	3.07
Farm 3	3.69	2.94	4.08	3.33	1.35	1.35	2.82	3.07
Custom hire								
Farm 1	4.00	4.00	10.00	10.00	5.50	5.50	5.60	8.80
Farm 2	4.00	4.00	10.00	10.00	5.50	5.50	5.60	8.80
Farm 3	4.00	4.00	10.00	10.00	5.50	5.50	5.60	8.80
	hours							
Labor required¶								
Farm 1	4.50	3.40	6.29	5.74	1.67	1.67	5.59	7.66
Farm 2	4.50	3.40	6.29	5.74	1.67	1.67	5.59	7.66
Farm 3	4.13	3.03	5.93	5.37	1.67	1.67	5.59	7.66
	bushels		tons		bushels		tons	
Crop yields	45	55	8.10	9.90	38	54	1.75	2.75

* Fertilizer cost for first year corn. If corn yields are to be sustained for a second consecutive year of corn, an additional 50 pounds of nitrogen per acre is recommended.

† A major part of this fertilizer application is used for fertilizing the legume seeding.

‡ Total cost of seed used in establishing the legume seeding.

§ Based on the use of two-plow tractors for typical farms 1 and 2 and three-plow tractors for typical farm 3 and with equivalent sizes for other machinery. This was the size of machinery typical on survey farms.

¶ These labor requirements do not include labor for custom work which is included in the cost of custom hire. Custom hiring was done for corn picking, field chopping, combining, and hay baling. All other operations were accomplished with owned machinery.

Table 8. Prices used in the study

Item	Unit	Price
		dollars
Nitrogen fertilizer	Pounds	0.15
Phosphate fertilizer	Pounds	0.10
Potash fertilizer	Pounds	0.05
Corn	Bushels	1.10
Oats	Bushels	.57*
Milk cows	Head	300.00
Fat steers, good	cwt.	21.50
Feeder calves, good-choice	cwt.	22.50
Feeder steers, good yearlings	cwt.	18.50
Milk, grade B	cwt.	2.50-4.50†
Market hogs	cwt.	11.00-18.50‡
Hired labor	Hour	1.00
Commercial feeds and supplies		1959 prices
Building materials		1959 prices + 12%
Motor supplies		1959 prices + 10%

* Oats were priced in terms of their equivalent feed value in corn.

† Projected prices were about \$2.90 per cwt. for grade B milk, Minnesota average.

‡ Projected prices were about \$14.00 per cwt. for market hogs, Minnesota average.

are shown in table 7. Three crop rotations were chosen as alternatives: (1) a 4-year rotation of corn—oats—alfalfa hay—alfalfa hay, (2) 5-year rotations of corn—corn—oats—alfalfa hay—alfalfa hay, and (3) corn—oats—3 years of alfalfa hay.

For each rotation, a choice of two soil fertility and crop management levels was considered. The first included the practices currently used by farmers, while the second was that recommended by the Minnesota Agricultural Experiment Station.² The recommended practices included both higher fertilizer rates than those currently used by farmers and a system of cultivation using "minimum tillage." Minimum tillage here essentially means only less tillage with conventional equipment. Differences between recommended tillage practices and those currently used explain some of the differences in labor requirements between the "current" and the "recommended" systems. Higher crop yields, particularly for hay and silage, are associated with the recommended practices. These higher yields increase labor requirements to handle the larger crops.

Open permanent pasture could be left unfertilized or it could be fertilized according to recommendations of the Minnesota Agricultural Experiment Station. If fertilized according to recommendations, pasture yields were increased about 1¼ tons per acre.

PRICE ASSUMPTIONS OF THE STUDY

Prices used in this study were projected to 1965. The projected level and relationships among products sold were

forward estimates for the research analysis. They are not forecasts of future prices. Prices paid were usually projected to be about the same as the 1959 levels. However, prices of building materials were projected to increase by 12 percent and motor supplies by 10 percent over 1959 levels.

Prices for hogs were varied from \$11.00 to \$18.50 per cwt. at \$1.50 intervals and milk prices from \$2.50 to \$4.50 per cwt. at \$0.40 intervals in order to show the effects of price changes on the most profitable farm organizations.³ A list of the prices used in this study are shown in table 8.

² For additional detail on recommended fertility practices, see Extension Pamphlet 194, 1961 *Crop Production Guide for Minnesota*, Agricultural Extension Service, Institute of Agriculture, University of Minnesota.

³ Later study and analysis will show the supply response of pork and milk associated with changes in hog and milk prices.

Profitable Adjustments on Small Farms

With less than 80 acres of cropland available, individual farmers should, when possible, seriously consider acquiring more cropland in order to (1) better utilize machinery and equipment, and (2) produce a larger portion of the feed supplies necessary for any sizable livestock enterprise. In the following discussion of "profitable adjustments" on small farms, it is well to remember that these are adjustments suggested as being profitable on farms that are already established with small acreages and on which many other resources are also severely restricted.

It will be recalled that these smaller farms (0 to 79 crop acres) were divided into two groups, those with less than 20 stanchions and those with 20 or more stanchions available for use in grade B milk production.

TYPICAL FARM 1—LESS THAN 20 STANCHIONS

This typical farm has 50 acres of cropland, 60 acres of open pasture, and 45 acres of wooded pasture. In addition to credit used for purchasing livestock, it has \$2,240 chattel credit; \$3,460 real estate credit; and cash, livestock, and feed inventories worth \$4,740 after deducting the total of outstanding notes and chattel mortgages. A 50-ton capacity tower silo is available for use but must be unloaded by hand.

Space is available without additional investment to milk 12 cows in a stanchion barn, to farrow 3 sows both spring and fall, and to house 10 beef cows or their equivalent (18 head) of feeder cattle. Expansion of livestock in numbers beyond these requires building additional space at the costs shown in tables 2 to 6. The labor available is essentially that of the farm operator.

The dairy equipment includes a two-unit milker but no bulk tank. In 1959 this typical farm was organized with a nine-cow dairy herd and with three sows farrowed once a year. Thus, facilities are available for expanding the dairy herd by three cows before adding more stanchions.

For this typical farm, it is *most profitable* at the prices considered (including *all specified levels* of hog and milk prices) to keep a dairy enterprise. Consequently, the type of adjustments that are profitable with changes in milk and hog prices are changes in: (1) size of the dairy operation, (2) rate of feeding grain to dairy cows, (3) cropping program, and (4) type and size of other livestock enterprises.

A summary of the most profitable organizations with varying prices for milk and hogs is shown in table 9. Profitability is measured by income net of variable costs. Income net of variable costs is gross income less cash operating expenses and less the annual cost of amortizing new livestock facilities. Fixed costs such as real estate taxes and depreciation on current buildings and machinery were *not* deducted. Neither was a charge made for owned capital. Income net of variable cost is the amount left as payment for the labor of the farmer and his family and for use of land, buildings, and owned capital.

Profitable Farm Organizations With Low Hog-Low Milk Prices

With hog prices at \$11.00 per cwt., milk prices at \$2.50 per cwt. (the lowest prices considered for hogs and milk), and good grade fat cattle at \$21.50 per cwt., maximum profits are obtained with the following plan: 12 cows

milking and fed a medium grain ration—1 pound grain to 4 pounds milk (see table 9). Even with this low price for milk, it is profitable to milk cows as long as space is available. However, it is not profitable to enlarge the barn in order to keep more cows. Moreover, with these low hog prices it is not profitable to produce hogs. It is, however, profitable to fatten cattle. In fact, since labor and credit are available, it is profitable to buy corn in order to expand cattle feeding. With the labor and credit available, it is profitable to feed out 84 steers. This requires the purchase of almost 3,400 bushels of corn and the use of \$16,440 of chattel credit.

Of the 50 acres of cropland available, 38 acres are used for a corn-oats-3-years alfalfa hay rotation and 12 acres for corn-corn-oats-2-years alfalfa hay rotation. In other words, hay production is emphasized. The heavier rate of fertilization is used. These rotations provide adequate supplies of hay and pasture for the dairy and feeder cattle. It is more profitable to harvest all of the corn for grain than to reduce the acreage of hay and replace it with corn silage. The income net of variable costs for this farm plan is about \$4,630 for typical farm 1.

Changes With Higher Dairy Prices

If milk prices increased with no change in hog and cattle prices, the farm plan outlined above would still be the most profitable plan; that is, until milk prices rose above \$3.70 per cwt. If milk prices rose to the high level of \$4.50, these changes from the preceding plan should be made:

1. Shift entirely to the corn-oats-3-years alfalfa hay rotation (for maximum hay and pasture production).
2. Shift to heavy grain feeding for dairy cows (1 pound grain for every 2.5 pounds milk).
3. Enlarge the barn and add dairy cows to a total of 19.

4. Reduce the number of cattle fed to 18 head.

5. Reduce the purchase of corn to 1,620 bushels.

These changes would also result in a reduction of chattel credit to \$7,420.

Changes With High Hog Prices

It is not profitable to add hogs unless the price rises to \$14.00 per cwt.; only four litters (two sows farrowed both spring and fall) are profitable at that price level. If hog prices rose to \$17.00, it would be profitable to go into commercial production (14 sows farrowed both spring and fall) and reduce the number of steers fed. Again, the decrease in feeder cattle numbers would also reduce substantially the amount of credit needed.

If hog prices rose to \$18.50, hog production would practically replace cattle feeding. It would also be unprofitable to increase the dairy enterprise materially, even with milk prices as high as \$4.50 per cwt.

The Most Profitable Farm Organization With Intermediate Prices

Intermediate livestock prices more in line with recent and current prices range from \$14.00 to \$15.50 per cwt. for hogs, from \$2.90 to \$3.30 per cwt. for manufacturing milk, and at \$21.50 per cwt. for finished, good cattle. If these intermediate prices prevail, the most profitable farm organization would be:

1. Fill existing stanchions with 12 cows and feed them the medium grain ration of 1 pound grain to 4 pounds milk.
2. Use the existing hog facilities to farrow two or three sows in both spring and fall.
3. Purchase about 4,000 bushels of corn and use about \$17,000 of chattel credit mainly to purchase and feed out 80 to 85 head of yearling steers.

Table 9. Most profitable farm organizations for typical farm 1

Organization	Price of milk (cwt.)					
	\$2.50	\$2.90	\$3.30	\$3.70	\$4.10	\$4.50
Price of hogs (cwt.)	\$11.00	\$11.00	\$11.00	\$11.00	\$11.00	\$11.00
Income (net of variable costs)	\$4,630	\$5,110	\$5,590	\$6,070	\$6,590	\$7,400
Number of cows milked	12	12	12	12	12	19
Dairy grain ration	1:4	1:4	1:4	1:4	1:2.5	1:2.5
Number of steers fed	84	84	84	84	84	18
Number of sows farrowed	0	0	0	0	0	0
Number of feeder pigs purchased	0	0	0	0	0	0
Acres of COHHH rotation	38	38	38	38	30	50
Acres of CCOHH rotation	12	12	12	12	20	0
Corn purchased (bushels)	3,390	3,390	3,390	3,390	3,690	1,620
Real estate credit	\$3,460	\$3,460	\$3,460	\$3,460	\$3,460	\$3,460
Chattel credit	\$16,440	\$16,440	\$16,440	\$16,440	\$16,820	\$7,420
Labor limiting periods*	None	None	None	None	None	None
Price of hogs (cwt.)	\$12.50	\$12.50	\$12.50	\$12.50	\$12.50	\$12.50
Income (net of variable costs)	\$4,630	\$5,110	\$5,590	\$6,070	\$6,590	\$7,400
Number of cows milked	12	12	12	12	12	19
Dairy grain ration	1:4	1:4	1:4	1:4	1:2.5	1:2.5
Number of steers fed	84	84	84	84	84	18
Number of sows farrowed	0	0	0	0	0	0
Number of feeder pigs purchased	0	0	0	0	0	0
Acres of COHHH rotation	38	38	38	38	30	50
Acres of CCOHH rotation	12	12	12	12	20	0
Corn purchased (bushels)	3,390	3,390	3,390	3,390	3,690	1,620
Real estate credit	\$3,460	\$3,460	\$3,460	\$3,460	\$3,460	\$3,460
Chattel credit	\$16,440	\$16,440	\$16,440	\$16,440	\$16,820	\$7,420
Labor limiting periods*	None	None	None	None	None	None
Price of hogs (cwt.)	\$14.00	\$14.00	\$14.00	\$14.00	\$14.00	\$14.00
Income (net of variable costs)	\$4,730	\$5,210	\$5,690	\$6,170	\$6,690	\$7,490
Number of cows milked	12	12	12	12	12	19
Dairy grain ration	1:4	1:4	1:4	1:4	1:2.5	1:2.5
Number of steers fed	84	84	84	84	80	18
Number of sows farrowed (two-litter system)	2	2	2	2	2	2
Number of feeder pigs purchased	0	0	0	0	0	0
Acres of COHHH rotation	45	45	45	45	37	50
Acres of CCOHH rotation	5	5	5	5	13	0
Corn purchased (bushels)	3,980	3,980	3,980	3,980	4,150	2,200
Real estate credit	\$3,460	\$3,460	\$3,460	\$3,460	\$3,460	\$3,460
Chattel credit	\$17,390	\$17,390	\$17,390	\$17,390	\$17,150	\$8,380
Labor limiting periods*	None	None	None	None	None	None
Price of hogs (cwt.)	\$15.50	\$15.50	\$15.50	\$15.50	\$15.50	\$15.50
Income (net of variable costs)	\$4,870	\$5,350	\$5,830	\$6,310	\$6,840	\$7,620
Number of cows milked	12	12	12	12	13	18
Dairy grain ration	1:4	1:4	1:4	1:4	1:2.5	1:2.5
Number of steers fed	82	82	82	82	75	18
Number of sows farrowed (two-litter system)	3	3	3	3	3	3
Number of feeder pigs purchased	0	0	0	0	0	0
Acres of COHHH rotation	46	46	46	46	39	50
Acres of CCOHH rotation	4	4	4	4	11	0
Corn purchased (bushels)	4,070	4,070	4,070	4,070	4,150	2,350
Real estate credit	\$3,460	\$3,460	\$3,460	\$3,460	\$3,460	\$3,460
Chattel credit	\$17,310	\$17,310	\$17,310	\$17,310	\$16,680	\$8,610
Labor limiting periods*	None	None	None	None	None	None

Table 9. (Continued) Most profitable farm organizations for typical farm 1

Organization	Price of milk (cwt.)					
	\$2.50	\$2.90	\$3.30	\$3.70	\$4.10	\$4.50
Price of hogs (cwt.)	\$17.00	\$17.00	\$17.00	\$17.00	\$17.00	\$17.00
Income (net of variable costs)	\$5,170	\$5,650	\$6,130	\$6,610	\$7,120	\$7,790
Number of cows milked	12	12	12	12	12	18
Dairy grain ration	1:4	1:4	1:4	1:4	1:2.5	1:2.5
Number of steers fed	18	18	18	18	18	18
Number of sows farrowed (two-litter system)	14	14	14	14	13	3
Number of feeder pigs purchased	14	14	14	14	13	0
Acres of COHHH rotation	50	50	50	50	41	50
Acres of CCOHH rotation	0	0	0	0	9	0
Corn purchased (bushels)	3,790	3,790	3,790	3,790	4,010	2,350
Real estate credit	\$3,460	\$3,460	\$3,460	\$3,460	\$3,460	\$3,460
Chattel credit	\$9,420	\$9,420	\$9,420	\$9,420	\$9,730	\$8,610
Labor limiting periods*	None	None	None	None	None	None
Price of hogs (cwt.)	\$18.50	\$18.50	\$18.50	\$18.50	\$18.50	\$18.50
Income (net of variable costs)	\$6,000	\$6,450	\$6,930	\$7,410	\$7,890	\$8,460
Number of cows milked	12	12	12	12	12	14
Dairy grain ration	1:6	1:4	1:4	1:4	1:4	1:2.5
Number of steers fed	5	2	2	2	2	4
Number of sows farrowed (two-litter system)	9	9	9	9	9	3
Number of feeder pigs purchased	169	152	152	152	152	241
Number of beef cows	7	9	9	9	9	7
Acres of COHHH rotation	50	50	50	50	50	50
Acres of CCOHH rotation	0	0	0	0	0	0
Corn purchased (bushels)	3,920	3,940	3,940	3,940	3,940	4,140
Real estate credit	\$3,460	\$3,460	\$3,460	\$3,460	\$3,460	\$3,460
Chattel credit	\$10,860	\$10,630	\$10,630	\$10,630	\$10,630	\$12,160
Labor limiting periods*	None	None	None	None	None	None

* Months included in labor periods are: (1) January, February, March; (2) April, May; (3) June, July; (4) August; (5) September, October; and (6) November, December.

4. Use a corn-oats-3-years alfalfa hay (high forage) rotation primarily and fertilize at the higher recommended rate.

With \$15.50 hogs and \$3.30 milk, this farm organization produces an income, net of operating expenses, of up to \$5,830 (see table 9).

Alternative Farm Organizations With Intermediate Prices

The dairy enterprise is essential to the most profitable use of resources on this typical farm. Substituting any other livestock enterprises for dairy reduces net income by about \$3,000 on this farm.

Many farmers lack experience in feeding cattle, are unable to undertake the price and income risks, or cannot raise the capital required for purchasing and feeding large numbers of cattle. Consequently, it may be best to consider farm organizations that include few feeder cattle.

With hog prices at \$17.00, milk prices at \$3.30, and fat good grade cattle prices at \$21.50 per cwt., the most profitable farm organization shifts heavily to hogs (see table 9). By using this dairy-hog organization (which is most profitable with \$17.00 hogs) in place of the dairy-feeder cattle organization (which is most profitable with \$15.50 hogs) and recomputing the income with the lower

\$15.50 hog price, we can estimate the reduction in income due to going heavily into hogs instead of feeder cattle. The substitution can be made by using the enterprise budgets in tables 4, 5, and 6 and the respective farm organizations in table 9. Because the number of dairy cows and the feeding rate remain the same for both farm organizations, only the substitution of hogs for feeder cattle needs to be made. This substitution is shown as follows:

1. Increase income by saving \$7,890 of chattel credit at 7 percent	+\$ 552.30
2. Reduce income from sale of 64 head less of finished steers (at \$92.50 per head)	-\$5,920.00
3. Increase income by saving 2,790.4 bushels of corn fed to steers (43.6 bushels per head for 64 head of steers at \$1.15 per bushel)	+\$3,208.96
4. Increase income by saving the annual expenses of adding building and feeding facilities for steers (\$5.21 per head for 64 head)	+\$ 333.44
5. Increase income by the sale of hogs as follows:	
a. 14 purchased feeder pigs sold (at 225 pounds at \$15.50/cwt.)	+\$ 488.25
b. 165 market hogs raised from the 11 additional sows (includes spring and fall farrowings less the 11 gilts saved for herd replacements)	+\$5,754.38
c. 11 sows (at 320 pounds each of market hog equivalent)	+\$ 545.60
d. 110 pounds of market hog equivalent of boar	+\$ 17.05
6. Reduce income by additional expenses of:	
a. Cash expenditures for pig production of \$62.30 per sow for 11 sows	-\$ 685.30
b. Annual cost of expanding farrowing facilities for 11 sows (at \$16.42 per sow)	-\$ 180.62
c. Purchase of corn for producing pigs from 11 sows (at 64.14 bushels per sow)	-\$ 811.37
d. Purchase of 14 feeder pigs (at \$11.00 per head)	-\$ 154.00
e. Cash expenditures for fattening 91 spring hogs (including 14 purchased feeder pigs at \$7.64 per hog)	-\$ 695.24
f. Cash expenditures for fattening 88 fall hogs (at \$7.19 per hog)	-\$ 632.72
g. Purchase of corn for fattening hogs (includes 91 spring hogs at 9.77 bushels per hog and 88 fall hogs at 11.07 bushels per hog)	-\$2,142.71
h. Annual cost of expanding feeding facilities for 88 hogs (spring and fall hogs use the same facilities and there were facilities available for 3 additional spring hogs, at \$2.00 per hog)	-\$ 176.00
Total change in net income	-\$ 497.98

This computation indicates that the income net of operating expenses for the most profitable organization with 82 head of feeder cattle is reduced about \$500, from \$5,830 to \$5,330, by eliminating 64 steers, adding 11 sows, farrowing two litters annually, and purchasing 14 feeder pigs. At the same time, the amount of credit required is reduced by almost \$7,900.

Similar substitutions can be made in any farm organization shown in tables 9, 10, and 11 in order to determine the reduction in income and the changes in resource requirements that result from alternative farm organizations.

In general, profitable organization of typical farm 1 relies heavily on a dairy enterprise. The most profitable accompanying livestock enterprises depend on the relative prices of hogs and beef. Further expansion of this farm business in every case is limited by depletion of the \$3,460 of real estate credit available for expanding livestock facilities (see table 9). In addition, the small acreage of cropland limits crop production to a rather small scale operation. In no case is labor the limiting resource on this typical farm.

TYPICAL FARM 2—WITH 20 OR MORE STANCHIONS

Typical farm 2 has essentially the same acreage of crop and pastureland as typical farm 1. About 20 percent more labor is available, largely summer-family labor. This farm has \$1,240 more of cash, livestock, and feed inventories; \$2,130 more available real estate credit; and \$820 more available chattel credit than farm 1. With 23 stanchions, farrowing facilities for six sows, and a 90-ton silo, available livestock facilities are almost double those of typical farm 1. Dairy facilities include a two-unit milker but no bulk tank. A more detailed listing of available resources is shown in table 1. In 1959, survey farms, of which typical farm 2 is representative, had dairy

herds averaging 16 cows and farrowed four litters of spring pigs.

As with typical farm 1, over the whole range of prices considered, a dairy enterprise is always more profitable than a farm organization without dairy. In general, farm organization adjustments that are profitable with price changes are similar to those for typical farm 1 but on a larger scale. This reflects the additional dairy facilities, labor supply, and cash and credit available. There are some differences, however; a notable one being the harvesting of corn for silage. The most profitable organizations for typical farm 2 are shown in table 10.

Organization with Low Hog and Milk Prices

The most profitable farm organization with hogs at \$11.00 per cwt. and milk at \$2.50 per cwt. includes 13 dairy cows fed at a 1:4 grain to milk ratio, 16 beef cows, and 97 yearling feeder steers. Use of \$22,130 of chattel credit is required mainly to buy the steers and 4,620 bushels of corn needed in addition to that raised on the farm. All 53 acres of cropland are fertilized at the higher fertility level in a corn-oats-3 years alfalfa hay rotation.

Since this typical farm has consistently larger livestock enterprises with about the same cropland acreage as typical farm 1, it is profitable (for all price situations considered) to fill the 90-ton silo with corn silage in order to provide an adequate roughage supply. It is also profitable to increase the roughage supply by fertilizing all open, permanent pasture at the recommended rate.

This farm organization uses all available cash, real estate credit, and winter (January to March) labor. The estimated income net of operating expenses is \$5,340, about \$710 more than typical farm 1. Whereas labor is not a limiting resource for the livestock enterprises financed on typical farm 1, it is for all

Table 10. Most profitable farm organizations for typical farm 2

Organization	Price of milk (cwt.)					
	\$2.50	\$2.90	\$3.30	\$3.70	\$4.10	\$4.50
Price of hogs (cwt.)	\$11.00	\$11.00	\$11.00	\$11.00	\$11.00	\$11.00
Income (net of variable cost)	\$5,340	\$5,870	\$6,770	\$7,930	\$9,090	\$10,240
Number of cows milked	13	13	27	27	27	27
Dairy grain ration	1:4	1:4	1:2.5	1:2.5	1:2.5	1:2.5
Number of steers fed	97	97	35	35	35	35
Number of sows farrowed	0	0	0	0	0	0
Number of feeder pigs purchased	0	0	0	0	0	0
Number of beef cows	16	16	0	0	0	0
Acres of COHHH rotation	53	53	53	53	53	53
Acres of CCOHH rotation	0	0	0	0	0	0
Corn purchased (bushels)	4,620	4,620	3,590	3,590	3,590	3,590
Real estate credit	\$5,590	\$5,590	\$3,080	\$3,080	\$3,080	\$3,080
Chattel credit	\$22,130	\$22,130	\$13,970	\$13,970	\$13,970	\$13,970
Labor limiting periods*	1	1	1	1	1	1
Price of hogs (cwt.)	\$12.50	\$12.50	\$12.50	\$12.50	\$12.50	\$12.50
Income (net of variable costs)	\$5,340	\$5,870	\$6,770	\$7,930	\$9,090	\$10,240
Number of cows milked	13	13	27	27	27	27
Dairy grain ration	1:4	1:4	1:2.5	1:2.5	1:2.5	1:2.5
Number of steers fed	97	97	35	35	35	35
Number of sows farrowed	0	0	0	0	0	0
Number of feeder pigs purchased	0	0	0	0	0	0
Number of beef cows	16	16	0	0	0	0
Acres of COHHH rotation	53	53	53	53	53	53
Acres of CCOHH rotation	0	0	0	0	0	0
Corn purchased (bushels)	4,620	4,620	3,590	3,590	3,590	3,590
Real estate credit	\$5,590	\$5,590	\$3,080	\$3,080	\$3,080	\$3,080
Chattel credit	\$22,130	\$22,130	\$13,970	\$13,970	\$13,970	\$13,970
Labor limiting periods*	1	1	1	1	1	1
Price of hogs (cwt.)	\$14.00	\$14.00	\$14.00	\$14.00	\$14.00	\$14.00
Income (net of variable costs)	\$5,340	\$5,870	\$6,770	\$7,390	\$9,090	\$10,240
Number of cows milked	13	13	27	27	27	27
Dairy grain ration	1:4	1:4	1:2.5	1:2.5	1:2.5	1:2.5
Number of steers fed	97	97	35	35	35	35
Number of sows farrowed	0	0	0	0	0	0
Number of feeder pigs purchased	0	0	0	0	0	0
Number of beef cows	16	16	0	0	0	0
Acres of COHHH rotation	53	53	53	53	53	53
Acres of CCOHH rotation	0	0	0	0	0	0
Corn purchased (bushels)	4,620	4,620	3,590	3,590	3,590	3,590
Real estate credit	\$5,590	\$5,590	\$3,080	\$3,080	\$3,080	\$3,080
Chattel credit	\$22,130	\$22,130	\$13,970	\$13,970	\$13,970	\$13,970
Labor limiting periods*	1	1	1	1	1	1
Price of hogs (cwt.)	\$15.50	\$15.50	\$15.50	\$15.50	\$15.50	\$15.50
Income (net of variable costs)	\$5,390	\$5,900	\$6,950	\$7,990	\$9,110	\$10,270
Number of cows milked	10	10	23	26	27	27
Dairy grain ration	1:4	1:4	1:2.5	1:2.5	1:2.5	1:2.5
Number of steers fed	87	91	36	21	35	35
Number of sows farrowed (two-litter system)	6	5	5	5	0	0
Number of feeder pigs purchased	0	0	0	0	0	0
Number of beef cows	19	19	0	0	0	0
Acres of COHHH rotation	53	53	53	53	53	53
Acres of CCOHH rotation	0	0	0	0	0	0
Corn purchased (bushels)	5,300	5,180	4,000	3,890	3,590	3,590
Real estate credit	\$5,590	\$5,590	\$850	\$1,870	\$3,050	\$3,060
Chattel credit	\$21,660	\$22,070	\$13,880	\$12,600	\$13,950	\$13,970
Labor limiting periods*	1	1	1	1	1	1

Table 10. (Continued) Most profitable farm organizations for typical farm 2

Organization	Price of milk (cwt.)					
	\$2.50	\$2.90	\$3.30	\$3.70	\$4.10	\$4.50
Price of hogs (cwt.)	\$17.00	\$17.00	\$17.00	\$17.00	\$17.00	\$17.00
Income (net of variable costs)	\$6,220	\$6,860	\$7,430	\$8,420	\$9,450	\$10,530
Number of cows milked	13	15	16	23	25	25
Dairy grain ration	1:6	1:4	1:4	1:2.5	1:2.5	1:2.5
Number of steers fed	0	0	0	0	0	0
Number of sows farrowed (two-litter system)	22	20	21	13	10	10
Number of feeder pigs purchased	22	20	21	17	10	10
Number of beef cows	10	6	5	0	0	0
Acres of COHHH rotation	53	53	53	53	53	53
Acres of CCOHH rotation	0	0	0	0	0	0
Corn purchased (bushels)	5,150	5,290	5,290	4,790	4,260	4,260
Real estate credit	\$5,100	\$4,430	\$4,780	\$3,020	\$2,720	\$2,720
Chattel credit	\$10,740	\$11,710	\$10,890	\$11,110	\$10,580	\$10,580
Labor limiting periods*	None	1	1	1	1	1
Price of hogs (cwt.)	\$18.50	\$18.50	\$18.50	\$18.50	\$18.50	\$18.50
Income (net of variable costs)	\$7,520	\$8,090	\$8,800	\$9,540	\$10,470	\$11,400
Number of cows milked	10	15	18	19	22	22
Dairy grain ration	1:6	1:6	1:4	1:4	1:2.5	1:2.5
Number of steers fed	0	0	0	0	0	0
Number of sows farrowed (two-litter system)	23	21	17	14	9	9
Number of feeder pigs purchased	34	32	95	164	194	194
Number of beef cows	10	6	0	0	0	0
Acres of COHHH rotation	53	53	53	53	53	53
Acres of CCOHH rotation	0	0	0	0	0	0
Corn purchased (bushels)	5,110	5,230	5,380	5,460	5,690	5,690
Real estate credit	\$5,590	\$5,160	\$4,410	\$4,400	\$3,380	\$3,380
Chattel credit	\$9,710	\$10,780	\$11,360	\$12,410	\$13,550	\$13,550
Labor limiting periods*	None	1	1	1	1	1

* Months included in labor periods are: (1) January, February, March; (2) April, May; (3) June, July; (4) August; (5) September, October; and (6) November, December.

except 2 of the 36 farm organizations for typical farm 2 (see table 10).

Changes With Higher Dairy Prices

With milk prices of \$3.30 per cwt. or higher, it becomes profitable to expand the dairy herd to 27 cows and to feed the heaviest grain ration (1 pound grain for every 2.5 pounds milk). This increase from 13 cows can be accomplished by reducing the number of steers fed from 97 to about 35 head. With this shift, real estate credit requirements are reduced by about \$2,500 and chattel credit requirements by more than \$8,000. Since stanchion space is available for only 23 cows, the

expansion requires building stanchion space for four more cows. Again, available winter labor is fully used in this farm organization.

Changes With Higher Hog Prices

Hog production becomes profitable with prices of \$15.50 for hogs but only with use of already existing farrowing and feeding facilities. With prices of \$17.00 or more, it becomes profitable to eliminate all feeder cattle and to go into commercial hog production. From 9 to 23 sows are farrowed (on a two-litter system), depending on the milk price and dairy enterprise size. The large number of feeder pigs that it is profit-

able to purchase when hogs and milk are both at higher prices reflects that:

1. It is profitable to produce hogs at these prices; but

2. The high winter labor requirement for the dairy herd uses most of the available labor supply and does not leave enough labor to take care of a large breeding herd of sows, particularly during the farrowing period.

The Most Profitable Farm Organization With Intermediate Prices

The most profitable farm organization for typical farm 2 with prices of \$15.50 for hogs and \$3.30 for milk differs substantially from that for typical farm 1. Almost twice as many cows are milked (23 as compared with 12); five instead of three sows are farrowed, and only 36 instead of 82 steers are fed out. Several things account for this difference in organization. One important factor is the availability of stanchion barn facilities. In both instances the existing barns are filled to capacity, but it is not profitable to build additional dairy barn space.

The 23 cows are fed the heaviest grain ration considered. It is also profitable to use a corn-oats-3-years alfalfa hay rotation; to fertilize this rotation at the recommended rate; and to fill the 90-ton silo with corn silage. This farm organization requires the purchase of almost 4,000 bushels of corn, the use of about \$850 of real estate

credit, and \$13,880 of chattel credit to produce an income, net of operating expenses, of \$6,950. This compares with an income of \$5,830 for typical farm 1 with the same prices.

Alternative Organizations With Intermediate Prices

As with typical farm 1, organization of this farm without a dairy enterprise reduces income substantially. An organization with neither dairy nor feeder cattle produces an income, net of operating expenses, of only \$4,000. This organization specializes in hogs and beef cows and produces more corn in the crop rotation.

A farm organization with no feeder cattle (determined again by substituting the most profitable organization with \$17.00 hogs and recomputing the income for \$15.50 hogs) includes: 16 dairy cows fed the medium grain ration, 21 sows farrowed twice a year, 21 purchased feeder pigs, and 5 beef cows. Again, the 90-ton silo is filled and a heavily fertilized corn-oats-3-years alfalfa hay rotation produced.

This farm organization produces about \$750 less income than the one with 36 feeder steers and 23 dairy cows or about \$6,200 as compared to \$6,950. Total credit requirements are slightly higher in order to provide adequate farrowing and feeding facilities for the large number of hogs and to purchase almost 5,300 bushels of corn. Again, all available winter labor is fully utilized in taking care of livestock.

Profitable Adjustments on the Larger Farms

The third typical farm studied is representative of farms with 80 or more crop acres. It contains 98 crop acres (about twice the acreage for typical farms 1 and 2), 42 acres of open pasture, and 27 acres of wooded pasture. Twenty-seven dairy cow stanchions are available for use in producing grade B milk. Other dairy facilities include a two-unit milker, a litter carrier, and drive-through cleaning system, but neither pipeline nor bulk tank installations. Five sows can be farrowed in both spring and fall with existing buildings.

In 1959 farmers in this typical farm group were using 22 of the 27 stanchions available for dairy cows and all available hog facilities for farrowing spring litters only. A 130-ton hand unloaded tower silo was available for forage storage. Cash, livestock, and feed inventories were valued at \$5,580 after deducting the amount of outstanding notes and chattel mortgages. Also available was \$6,330 of chattel credit and \$4,680 of real estate credit. In addition to the operator, some family labor was available on a year-round basis.

For all price situations studied here, it is profitable to include a dairy enterprise on the farm. In no price situation considered does the income potential of this typical farm without a dairy enterprise come within \$1,800 of the income with dairy.

The size of the dairy enterprise varies from 23 to 36 cows, depending upon milk and hog prices. Heavier rates of grain feeding are profitable with higher milk prices. In all cases, the crop rotation grown provides adequate hay for roughage. No corn is put up as silage. The most profitable organizations for this typical farm with varying prices are shown in table 11.

Organization With Low Prices For Hogs and Milk

With \$11.00 hogs and \$2.50 milk, the farm is most profitably organized with 107 feeder steers and 27 dairy cows fed at a 1:4 grain to milk ratio. All existing cash and real estate credit are used and \$27,030 of non-real-estate credit is required. This large sum of credit is required largely to purchase the feeder steers and 4,460 bushels of corn. About 81 acres of the cropland is used in a corn-oats-3-years alfalfa hay rotation and 17 acres in a corn-corn-oats-2-years alfalfa hay rotation. All crops are fertilized at the recommended or high level. This farm organization produces an income, net of operating expenses, of about \$7,420.

Organization With Higher Dairy Prices

Dairy cow numbers are fairly stable for this typical farm. It is most profitable to fill the 27 cow stanchion barn for 35 of the 36 dairy-hog price combinations shown in table 11. It is profitable to add stanchions with only four price situations—after milk prices increase to \$4.50 per cwt. With prices at \$3.70 per cwt. or higher, it becomes profitable to shift from the medium to the heavy grain ration of 1 pound grain for every 2.5 pounds milk.

Organization With Higher Hog Prices

It is profitable to produce hogs with prices of \$14.00 per cwt. or higher. With \$14.00 hogs, it is profitable to farrow four sows (both spring and fall). Five sows are most profitable with a price of \$15.50 for market hogs. With prices of \$17.00 or higher, it becomes profitable to add farrowing and feeding fa-

Table 11. Most profitable farm organizations for typical farm 3

Organization	Price of milk (cwt.)					
	\$2.50	\$2.90	\$3.30	\$3.70	\$4.10	\$4.50
Price of hogs (cwt.)	\$11.00	\$11.00	\$11.00	\$11.00	\$11.00	\$11.00
Income (net of variable costs)	\$7,420	\$8,500	\$9,580	\$10,760	\$11,930	\$13,170
Number of cows milked	27	27	27	27	27	36
Dairy grain ration	1:4	1:4	1:4	1:2.5	1:2.5	1:2.5
Number of steers fed	107	107	107	107	107	18
Number of sows farrowed	0	0	0	0	0	0
Number of feeder pigs purchased	0	0	0	0	0	0
Acres of COHHH rotation	81	81	81	61	61	92
Acres of CCOHH rotation	17	17	17	37	37	6
Corn purchased (bushels)	4,460	4,460	4,460	5,140	5,140	2,340
Real estate credit	\$4,680	\$4,680	\$4,680	\$4,680	\$4,680	\$4,680
Chattel credit	\$27,030	\$27,030	\$27,030	\$27,780	\$27,780	\$15,370
Labor limiting periods*	None	None	None	None	None	None
Price of hogs (cwt.)	\$12.50	\$12.50	\$12.50	\$12.50	\$12.50	\$12.50
Income (net of variable costs)	\$7,420	\$8,500	\$9,580	\$10,760	\$11,930	\$13,170
Number of cows milked	27	27	27	27	27	36
Dairy grain ration	1:4	1:4	1:4	1:2.5	1:2.5	1:2.5
Number of steers fed	107	107	107	107	107	18
Number of sows farrowed	0	0	0	0	0	0
Number of feeder pigs purchased	0	0	0	0	0	0
Acres of COHHH rotation	81	81	81	61	61	92
Acres of CCOHH rotation	17	17	17	37	37	6
Corn purchased (bushels)	4,460	4,460	4,460	5,140	5,140	2,340
Real estate credit	\$4,680	\$4,680	\$4,680	\$4,680	\$4,680	\$4,680
Chattel credit	\$27,030	\$27,030	\$27,030	\$27,780	\$27,780	\$15,370
Labor limiting periods*	None	None	None	None	None	None
Price of hogs (cwt.)	\$14.00	\$14.00	\$14.00	\$14.00	\$14.00	\$14.00
Income (net of variable costs)	\$7,590	\$8,670	\$9,750	\$10,920	\$12,100	\$13,330
Number of cows milked	27	27	27	27	27	35
Dairy grain ration	1:4	1:4	1:4	1:2.5	1:2.5	1:2.5
Number of steers fed	107	107	107	107	107	29
Number of sows farrowed (two-litter system)	4	4	4	4	4	4
Number of feeder pigs purchased	0	0	0	0	0	0
Acres of COHHH rotation	91	91	91	71	71	98
Acres of CCOHH rotation	7	7	7	27	27	0
Corn purchased (bushels)	5,440	5,440	5,440	6,130	6,130	3,700
Real estate credit	\$4,680	\$4,680	\$4,680	\$4,680	\$4,680	\$4,680
Chattel credit	\$28,610	\$28,610	\$28,610	\$29,360	\$29,360	\$18,600
Labor limiting periods*	None	None	None	None	None	None
Price of hogs (cwt.)	\$15.50	\$15.50	\$15.50	\$15.50	\$15.50	\$15.50
Income (net of variable costs)	\$7,830	\$8,910	\$9,990	\$11,160	\$12,340	\$13,560
Number of cows milked	27	27	27	27	27	34
Dairy grain ration	1:4	1:4	1:4	1:2.5	1:2.5	1:2.5
Number of steers fed	104	104	104	104	104	32
Number of sows farrowed (two-litter system)	5	5	5	5	5	5
Number of feeder pigs purchased	0	0	0	0	0	0
Acres of COHHH rotation	93	93	93	73	73	98
Acres of CCOHH rotation	5	5	5	25	25	0
Corn purchased (bushels)	5,590	5,590	5,590	6,280	6,280	4,030
Real estate credit	\$4,680	\$4,680	\$4,680	\$4,680	\$4,680	\$4,680
Chattel credit	\$28,480	\$28,480	\$28,480	\$29,230	\$29,230	\$19,280
Labor limiting periods*	None	None	None	None	None	None

Table 11. (Continued) Most profitable farm organizations for typical farm 3

Organization	Price of milk (cwt.)					
	\$2.50	\$2.90	\$3.30	\$3.70	\$4.10	\$4.50
Price of hogs (cwt.)	\$17.00	\$17.00	\$17.00	\$17.00	\$17.00	\$17.00
Income (net of variable cost)	\$8,280	\$9,360	\$10,440	\$11,610	\$12,790	\$13,970
Number of cows milked	27	27	27	27	27	27
Dairy grain ration	1:4	1:4	1:4	1:2.5	1:2.5	1:2.5
Number of steers fed	18	18	18	18	18	18
Number of sows farrowed (two-litter system)	19	19	19	19	19	19
Number of feeder pigs purchased	19	19	19	19	19	19
Acres of COHHH rotation	98	98	98	78	78	78
Acres of CCOHH rotation	0	0	0	20	20	20
Corn purchased (bushels)	5,220	5,220	5,220	5,900	5,900	5,900
Real estate credit	\$4,680	\$4,680	\$4,680	\$4,680	\$4,680	\$4,680
Chattel credit	\$17,890	\$17,890	\$17,890	\$18,640	\$18,640	\$18,640
Labor limiting periods*	None	None	None	None	None	None
Price of hogs (cwt.)	\$18.50	\$18.50	\$18.50	\$18.50	\$18.50	\$18.50
Income (net of variable costs)	\$9,900	\$10,890	\$11,970	\$13,050	\$14,180	\$15,360
Number of cows milked	23	27	27	27	27	27
Dairy grain ration	1:4	1:4	1:4	1:4	1:2.5	1:2.5
Number of steers fed	18	18	18	18	18	18
Number of sows farrowed (two-litter system)	5	10	10	10	13	14
Number of feeder pigs purchased	475	325	325	325	228	193
Acres of COHHH rotation	95	98	98	98	98	90
Acres of CCOHH rotation	3	0	0	0	0	8
Corn purchased (bushels)	6,520	6,470	6,470	6,470	6,610	6,640
Real estate credit	\$4,680	\$4,680	\$4,680	\$4,680	\$4,680	\$4,680
Chattel credit	\$22,470	\$22,560	\$22,560	\$22,560	\$21,610	\$21,270
Labor limiting periods*	None	None	None	None	None	None

* Months included in labor periods are: (1) January, February, March; (2) April, May; (3) June, July; (4) August; (5) September, October; and (6) November, December.

cilities and to establish hog production on a commercial basis. The purchase of a large number of feeder pigs (as shown in table 11), becomes profitable with \$18.50 hogs. This increases credit requirements above those of a hog enterprise specializing in farrowing and feeding out of home-raised pigs.

Organization With Intermediate Prices

With milk at \$2.90 to \$3.30 and hogs at \$14.00 to \$15.50 per cwt. the most profitable farm organization is varied. Twenty-seven cows are milked and fed a 1:4 concentrate ration. In addition, 104 to 107 steers are fed out and four or five sows farrowed in both spring

and fall. A rotation consisting primarily of corn-oats-3-years alfalfa hay is fertilized at the recommended rate.

To produce an income of almost \$10,000 with \$3.30 milk and \$15.50 hogs, this type of farm organization requires \$28,480 of chattel credit and \$4,680 of real estate credit. The large amount of chattel credit is needed for the purchase of large numbers of feeder cattle and almost 5,600 bushels of corn.

An Alternative Farm Organization With Intermediate Prices

Substitution of the most profitable farm organization with \$17.00 hogs for the one listed above reduces credit re-

quirements by about \$10,590. Feeder cattle are reduced from 104 to 18 head. Dairy cow numbers remain the same at 27 head. The hog enterprise, however, is expanded to include 19 sows farrowed twice a year and the feeding of 19 purchased feeder pigs. The most profitable crop rotation changes little. Corn purchases are reduced by less than 400 bushels to about 5,220 bushels.

Using this farm organization instead of the one with 104 feeder steers, and with hogs still selling at \$15.50 per cwt., net profits are reduced by about \$700. An income, net of operating expenses, of about \$9,290 is produced. Again, the entire amount of \$4,680 of real estate credit available for expanding building and feeding facilities for livestock is used.

General Guidelines

By viewing tables 9-11 and reading the accompanying text, it is possible to determine the most profitable enterprise alternatives at different prices for the three typical situations studied. The current resource bases of the typical farms were used as benchmarks from which adjustment alternatives were considered. These organizations were estimated to be most profitable assuming a particular set of production relations, such as feed conversion rates, labor requirements, costs for expanding building facilities, crop yields, and production requirements (see tables 2 through 8). Many farmers will find that adjustments in both efficiency and volume are necessary to attain the farm organizations listed in tables 9-11.

Several guidelines that seem valid for the three typical farm situations are:

1. In all instances, the higher level of fertility and minimum tillage practices are more profitable than the current level of fertilizer use and associated tillage practices.

2. In all instances, it is most profitable to include a dairy enterprise. Moreover, many farmers will find it profitable to improve the efficiency and size of their dairy enterprise relative to current operations. With 100 acres or

less of cropland, most farms have an abundant supply of labor. This can only be profitably employed with livestock enterprises or in off-farm employment. If labor is in short supply and capital is available, a conversion to a labor efficient milking parlor-loose housing dairy system may be a profitable adjustment. This was not considered here because adequate real estate credit was not typically available to finance such a shift.

3. As milk prices increase, it becomes profitable to feed the dairy cows a higher grain ration. In some instances, the move is from a 1:6 to a 1:2.5 milk to grain ratio as milk prices increase from \$2.50 to \$4.50 per cwt. A 1 pound grain to 4 pounds milk ratio is usually most profitable for intermediate milk prices of \$2.90 to \$3.30 per cwt.

4. The purchase of a large number of feeder steers and/or pigs requires heavy use of capital and credit relative to a dairy enterprise providing a comparable net income. However, increased capitalization of all three typical farm businesses, relative to current capitalization, is necessary to attain a good farm income regardless of the livestock enterprises selected.

5. Many of the most profitable farm organizations involve extensive pur-

chase and feeding of feeder cattle and/or farrowing and feeding of hogs. Currently, little cattle feeding is taking place in east central Minnesota. Some farmers have little experience in hog production. Individual farmers will find it profitable to assess the capital and management requirements of these enterprises, as well as their own managerial experience, before establishing them on their farms. Furthermore, access to the large amounts of credit required for these enterprises will probably depend upon farmers having at least some experience in management.

6. By using the enterprise budgets in tables 2 to 8, it is possible to determine the changes in profits and resource requirements that result from alternative farm organizations to those shown in tables 9 to 11. Such alternative organizations may be preferable on individual farms if they better fit the interests and opportunities of individual operators. Also, it may be desirable in some instances to eliminate small livestock enterprises (such as a two sow-hog enterprise or a five cow-beef herd) and specialize in other enterprises, particularly dairy (use enterprise budgets).

Other Adjustment Possibilities

Other routes for expanding the farm business are available to some farmers. For example, adding to the acreage of cropland, obtaining a grade A milk market, producing feeder pigs, specializing in poultry production, or obtaining off-farm employment might be income-improving possibilities for some farmers. Some appreciation of income benefits that can be achieved by increasing crop acreage may be gained

by comparing the income potential of typical farms 2 and 3 (see table 12).

Although there are other differences in their resource base (see table 1), the primary differences are in cropland acreage and building facilities available for livestock. Typical farm 2 includes 53 acres of cropland, 54 acres of open pasture, and 27 acres of wooded permanent pasture. Typical farm 3 contains 98 crop acres, 42 acres of open pasture,

Table 12. Income potential and credit requirements for two typical farm situations

Product prices per cwt.	Income* farm 2	Total credit required farm 2	Income* farm 3	Total credit required farm 3
			dollars	
Hogs — \$11.00	5,340	27,720	7,420	31,710
Milk — \$ 2.50				
Hogs — \$14.00	5,870	27,720	8,670	33,290
Milk — \$ 2.90				
Hogs — \$15.50	6,950	14,730	9,990	33,160
Milk — \$ 3.30				
Hogs — \$18.50	11,400	16,930	15,360	25,950
Milk — \$ 4.50				

* Net of operating expenses and costs for expansion. Fixed costs for depreciation on machinery and buildings have not been subtracted nor have charges been made for land, other owned capital, or operator and family labor.

and 27 acres of wooded permanent pasture.

Although we do not expect price fluctuations as extreme as those shown in

table 12, these comparisons show the substantial income advantage of the larger farm unit for all price situations considered.

Aggregate Supply Considerations

As mentioned earlier, not all farm price and income problems are likely to be solved in their entirety by improved efficiency and size adjustments on individual farms. If individual farmers in the study area of east central Minnesota make the adjustments suggested as profitable with intermediate prices for hogs and milk, they would milk about 25 percent more cows than were milked in 1959. The increase in production of hogs and finished cattle would be even greater. Without a corresponding increase in the market for livestock products, these expansions would result in surplus production. Unfavorable prices would likely result.

The occurrence of surplus production in such amounts is unlikely for several reasons:

1. Not all farmers will choose to milk more cows or feed more cattle or hogs

because of the additional work, costs, and risks involved.

2. Some people currently farming in east central Minnesota will quit to retire or to accept off-farm employment and their livestock facilities may go unutilized.

3. Governmental farm programs may curb production via land retirement and supply control.

Before making substantial adjustments in farming operations, individual farmers will do well to assess the future price, production, and demand possibilities for the specific farm products considered. In so doing, they may determine what, if any, participation and support they should give to group action designed to improve their price-income position.

A second phase of the farm adjustments reported in this study will be to aggregate adjustment possibilities for a number of the major dairy states where similar studies are underway. These production adjustments and the resulting supply of dairy products will be matched with aggregate demand estimates to further examine profitable adjustments on Minnesota dairy farms.