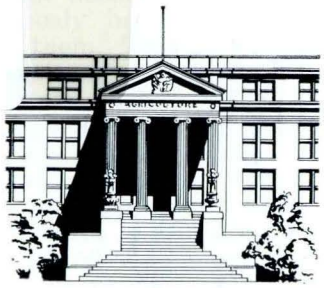

Competitive Position Of Small Dairy Herds On North-Central Iowa Farms

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SUMMARY

The number of farms with dairy herds in north-central Iowa has decreased sharply over the last decade. Whereas the majority of farms previously had dairy herds, many fewer now have them. This report is concerned with the competitive position of dairying on farms which now have small herds of 8-14 cows. It explores adjustment opportunities and appraises the possibilities of improving net incomes on north-central Iowa farms where dairying is an enterprise but not the basis of farm organization and where milk is sold on a grade B basis. Alternative adjustments considered are: (1) transfer of resources now used in dairying to other enterprises, including the use of more fertilizer; (2) improvement of the production practices used in the dairy enterprise; and (3) a combination of the two types of adjustments. The analysis is applied to owner-operated and tenant-operated 160-acre and 240-acre farms with current and additional amounts of operating capital and labor. The income changes reflected by these transfers refer to prices listed in table 3.

The transfer of resources now used for small grade B dairy herds to crop production, fertilization and hog production would increase net incomes significantly. This increase could be realized with the operating capital and labor already on these farms. The acreages of corn and soybeans and the use of fertilizer would be increased. The production of hogs would be increased from about 15 to 40 litters of spring and fall pigs. Where buildings and other facilities restrict hogs to 20 litters, however, the optimum farm plan is close to the present organization, except for the substitution of soybeans for part of the present acreage of oats and the use of higher rates of fertilizer on all crops. The dairy herd would be reduced to eight cows. Net income would be increased about 10 percent.

If some of the operators in this group prefer to retain their dairy herds, but are interested in improving their cropping systems, they can improve net incomes about 5 percent by transferring some of their operating capital from hog or poultry production to crop expenses. Again, this statement refers to the prices shown in table 3. On farms having around 13 dairy cows—a typical number for farms with small dairy enterprises—production of hogs would be decreased from 13 to 4 litters.

For farms with small dairy herds and grade B milk markets, the adoption of improved practices in dairying and the use of additional operating capital would not increase net incomes to the level that could be attained by shifting out of dairying and into hog production. If a grade A milk market is available, dairying is in a strong competitive position with respect to specialized hog production. As compared with the usual systems of dairy farming, net incomes would be increased about 60 percent by (a) shifting to grade A milk production, (b) expanding the dairy herd to resource limits and (c) improving dairy practices. Improvement of dairy practices and outlays for buildings and equipment to produce grade A milk would require about $5,000 additional capital.

Thus, owner-operators of 160-acre farms who want to use dairy herds to increase profits need to enlarge their present dairy operations by improving dairy production practices and enlarging the herd. Otherwise, those who do not need forage crops in the rotation as a soil conservation practice can obtain larger net incomes by moving toward more intensive grain and soybean rotations and greater specialization in hogs.

The opportunity to reorganize a rented 160-acre farm and increase profits is restricted, as compared with an owner-operated farm. The tenant has only his share of the farm-grown feed for feeding livestock. If, because of risk aversion, the tenant does not buy corn, his optimum organization includes a dairy herd of 10 cows, 18 litters of pigs and a crop rotation with hay and pasture. But if he uses part of his usual amount of operating capital to buy corn, his optimum farm plan does not include a dairy herd. By buying additional corn for feeding more hogs, he can raise his annual net income by about $350. Production of milk for a grade A market would raise his net income by about the same amount.

Landlords on some rented farms may require tenants to use a rotation such as corn-corn-oats-meadow. If a tenant then chooses to fit the most profitable livestock program to the feed produced on the farm, he will have essentially the same livestock system as previously outlined. His net income, using the amount of capital typical of tenants, will be about 10 percent less than under his optimum plan because of the substitution of oats and meadow for soybeans in the crop rotation. With added capital for improving dairy practices and investing in grade A facilities for milk, however, the tenant's profit-maximizing plan would include expansion of the dairy herd to 15 cows. By buying some corn, he could make this adjustment, thereby almost doubling his net income. But he would need to double his fund of operating capital.

The competitive position of dairy enterprises on owner-operated 240-acre farms about parallels the situation on 160-acre farms. With usual levels of capital and production practices, hogs and fattening cattle are more profitable than dairy cows. But if adequate capital and a grade A milk market were available and improved production practices were used, dairy farming would produce about 50 percent more net income than is obtained with current practices. On a one-man farm, the herd would increase from 12 to 15 cows. The optimum plan for a two-man farm would include 21 cows, and net income would increase by $3,061. Tenants on 240-acre farms have enough feed from their share of the crops

to balance labor and feed with a livestock system that includes hogs and fattening cattle. Thus, the optimum plans on owner-operated and tenant-operated farms are about the same.

The findings of this study are consistent with the trends in dairying that have been taking place in north-central Iowa. Under the usual dairy-management practices found on farms with small grade B herds in north-central Iowa, the dairy enterprise is in a poor competitive position with alternative uses of resources (i.e., growing more cash crops, using more fertilizer and expanding hog production). With improved dairy-management practices, greater investment in larger herds and more equipment and production for a grade A market, however, the dairy enterprise can have a profitable role in the farm organization.

Competitive Position of Small Dairy Herds on North - Central Iowa Farms[1]

By Ross V. Baumann, Earl O. Heady and Frank Orazem[2]

Before World War II, most farms in north-central Iowa had small dairy herds. Since that time, the number of farms with dairy enterprises has declined markedly. Dairying in the area has tended to shift to farms with large commercial herds producing in whole milk markets. This trend has resulted partly from changes in the price of milk and butterfat relative to other farm products and partly from relative changes in technology for the various crop and livestock enterprises of the area. This report deals with the current competitive position of small dairy herds in north-central Iowa.

The study reported explores the possibilities of improving net incomes of north-central Iowa farms on which dairying is a minor enterprise. Answers were sought to the following questions: (1) What effect would improved dairy practices have on farm organization and farm income? (2) Would farmers' financial positions be improved by increasing the size of the dairy enterprises or by transferring resources now used in dairying to other enterprises? (3) What resources do small dairy herds utilize efficiently on north-central Iowa farms when the goal is to maximize net incomes?

The study relates to soil types in the following 14 counties in north-central Iowa: Greene, Boone, Story, Hamilton, Webster, Calhoun, Pocahontas, Humboldt, Wright, Palo Alto, Emmet, Kossuth, Winnebago and Hancock. Clarion-Webster is the prevailing soil association. Topography varies from level to moderately rolling. Soil erosion is not a problem on most of the farms. The principal soil conservation and fertility decisions revolve around the application of barnyard manure and commercial fertilizers and the growing of forages. Climate and soils are favorable for production of corn, soybeans, small grains and forage crops.

[1] Project 1277, Iowa Agricultural and Home Economics Experiment Station.

[2] Respectively, agricultural economist, Farm Economics Research Division, Agricultural Research Service, U. S. Department of Agriculture, formerly stationed at Iowa State University; professor of agricultural economics, Iowa State University; and former agricultural economist, Farm Economics Research Division, Agricultural Research Service, U. S. Department of Agriculture, stationed at Iowa State University. The authors wish to thank C. W. Crickman for his guidance and counsel. Responsibility for conclusions rests with the authors.

METHOD OF STUDY

Five townships in Kossuth County—Harrison, Swea, Ledyard, Ramsey and Seneca—were chosen as representative of the soils and climate of the north-central cash-grain area where small dairy herds have previously been important. Many farmers in the area still have small dairy herds. Records of all 160-acre and 240-acre farms in the five townships for 1954, the year the study was initiated, were used in the selection of typical farms.[3] Typical situations for study were selected to represent 160-acre and 240-acre farms with no dairy or beef cows, with 7-10 dairy cows and with 11-14 dairy cows. Situations representing farms with commercial grade A dairies or with only a few cows for supplementary purposes were not analyzed. The main objective of the study was to analyze the prospect for the typical small dairy herd in north-central Iowa. The crop and livestock organization of each of the six farm situations previously mentioned is shown in tables 1 and 2. These are averages for all farms in the population in 1954. Farms with small dairy herds differ from those without cattle chiefly in the acreage of forage and soybeans and in the number of hogs produced.

Linear programming was used to determine optimum systems of farming. The plans so determined are those that maximize profits under the conditions specified later.

Typical Farm Resource Situations

In the short run, a farmer has under his control only a given amount of land, labor, operating capital, machinery and buildings. These resources limit the farm's production opportunities. Expansion of any enterprise cannot exceed the limitation imposed by the fixed quantity of resources. A description of the most typical resource situations found in north-central Iowa follows.

Land. The two most important farm-size groups are the 160-acre farms and the 240-acre

[3] Iowa Farm Census of Agriculture. 1954.

TABLE 1. AVERAGE CROP AND LIVESTOCK ORGANIZATION OF 160-ACRE FARMS HAVING 7-10 DAIRY COWS, 11-14 DAIRY COWS, OR NO CATTLE OF SPECIFIED KINDS IN HARRISON, SWEA, LEDYARD, RAMSEY AND SENECA TOWNSHIPS, KOSSUTH COUNTY, IOWA, 1954.

Item	Units	Farms with:		
		7-10 dairy cows	11-14 dairy cows	No beef or dairy cows
Number of farms	number	38	21	87
Crops:				
Corn	acres	62	53	59
Oats	acres	35	37	38
Soybeans	acres	17	15	31
Hay	acres	14	16	10
Rotation pasture	acres	13	17	7
Permanent pasture	acres	7	9	4
Roads, lots and buildings	acres	12	13	11
Total	acres	160	160	160
Livestock:				
Dairy cows	number	9	13	0
Beef cows	number	0	0	0
Litters of spring pigs	number	12	9	7
Litters of fall pigs	number	3	4	2
Hens	number	223	247	116
Cattle marketed	number	4	0	5
Labor	hours	2,415	2,888	1,006

TABLE 2. AVERAGE CROP AND LIVESTOCK ORGANIZATION OF 240-ACRE FARMS HAVING 7-10 DAIRY COWS, 11-14 DAIRY COWS OR NO CATTLE OF SPECIFIED KINDS IN HARRISON, SWEA, LEDYARD, RAMSEY AND SENECA TOWNSHIPS, KOSSUTH COUNTY, IOWA, 1954.

Item	Units	Farms with:		
		7-10 dairy cows	11-14 dairy cows	No beef or dairy cows
Number of farms	number	12	5	13
Crops:				
Corn	acres	86	79	86
Oats	acres	58	56	44
Soybeans	acres	34	43	59
Hay	acres	14	17	21
Rotation pasture	acres	18	18	10
Permanent pasture	acres	11	11	6
Roads, lots and buildings	acres	19	16	14
Total	acres	240	240	240
Livestock:				
Dairy cows	number	9	12	---
Beef cows	number	0	0	---
Litters of spring pigs	number	12	14	4
Litters of fall pigs	number	3	4	1
Hens	number	237	300	200
Cattle marketed	number	2	5	15
Labor	hours	2,782	3,290	1,254

farms. The 160-acre farm is the modal size. Thirty-five percent of all farms in the area fall in the range of 140 to 179 acres. Next most common in the area are farms with 180 to 240 acres. According to the 1954 Census of Agriculture, the farm-size distribution is as follows: 20 percent of all farms reported an acreage of less than 140 acres; 59 percent had between 140 and 259 acres; and 21 percent had 260 acres or more. In the analysis that follows, 88 percent of the land for each size group is assumed to be usable for rotation crops. According to census figures for the townships, the remaining 12 percent is used for permanent pasture, roads, lots and waste.

Labor. The several labor situations used for determining optimum plans are: (1) the supply of labor includes only the operator's working time, a total of 280 hours per month; (2) the supply is typical of that on 240-acre farms, or 490 hours more per year than on 160-acre farms; and (3) the supply is that available from two full-time men. The amount of labor specified in each of the previous situations can be used for all enterprises except poultry, for which labor is supplied by the farmer's wife or other members of the family. The upper limit in size of the poultry enterprise was assumed to be 200 laying hens, since factors such as housing restrict the size of this enterprise.

Operating capital. Several levels of operating capital were used in deriving linear programs. The level that was adequate to bring all cropland into cultivation was the lower limit (about $1,000). The upper limit was that which caused resources other than capital to limit the nature of the farm plan. The upper level varied with the relative scarcity of other resources for the various situations.

Operating capital represents funds used for annual cash expenditures and for livestock investment. Operating capital can also be used for expansion of buildings if present building facilities are inadequate to house additional livestock. This procedure supposes the operator to have on hand the capital for machinery and equipment and, in the case of an owner-operator, for land.

Building space. In the short run, present building facilities in north-central Iowa limit the amount of livestock on most farms. Current barn space usually limits the dairy herd to about 10 cows on farms without milking parlors and to about 15 cows on farms with milking parlors.

The hog enterprise is limited by available buildings to 10 sows—10 litters in a one-litter system or 20 litters in a two-litter system. If the optimum plan includes more than 10 sows, it is assumed that additional buildings for hogs can be provided from operating capital.

Grain and hay supplies. Grain and hay supplies may vary, depending upon the cropping plan. The hay requirements for relevant enterprises cannot exceed production. Typically, farms in the area use only the hay produced on the farm. Growth on meadows not needed for livestock feed is used as a crop residue for soil improvement. Grain requirements (including grain for selling) must equal the supply of grain produced on the farm, plus purchases.

Prices Used

Prices used in the study represent the level of prices expected, at the time of initiating the research, to prevail over the next several years (table 3). They are long-term price projections developed solely for the purpose of research studies and are not forecasts. The price projections were based on the assumptions of continued population and economic growth and a stable general price level. They are about the same as prevailed in 1953-55.

TABLE 3. LONG-TERM PROJECTED PRICES USED IN THIS STUDY.

Item	Unit	Price
Corn	bushel	$ 1.20
Oats	bushel	0.65
Soybeans	bushel	2.40
Milk, grade A	cwt.	4.10
Milk, grade B	cwt.	2.88
Barrows and gilts	cwt.	16.00
Sows	cwt.	13.50
Feeder yearlings	cwt.	19.00
Feeder calves	cwt.	20.50
Fat steers, choice	cwt.	21.25
Fat calves, choice	cwt.	21.25
Chickens	pound	0.21
Eggs	dozen	0.35
Dairy cows, average	head	180.00
Dairy cows, above average	head	240.00
Cull heifers	cwt.	15.00
Cull cows (cutters and canners)	cwt.	11.00
Veal calves	cwt.	20.00

Crop Enterprises

Several crop enterprises were considered to allow a flexible cropping program that might vary with different resource situations. Three different rotations were included: (1) corn-corn-oats-meadow (CCOM), (2) corn-soybeans-corn-oats-meadow (CSbCOM) and (3) corn-corn-soybeans (CCSb). One set of rotations was used with no application of commercial fertilizer, a second with a low-level application of commercial fertilizer, and one with a somewhat higher level. The latter two sets of rotations had the recommended rates and proportions for the crops in the rotations. Thus there were nine alternative cropping systems: (1) $CCOM_0$, (2) $CCOM_1$, (3) $CCOM_2$, (4) $CSbCOM_0$, (5) $CSbCOM_1$, (6) $CSbCOM_2$, (7) $CCSb_0$, (8) $CCSb_1$ and (9) $CCSb_2$. The zero subscript refers to no fertilization in addition to manure. The 1 and 2 subscripts refer to the specified levels of chemical fertilizer (table 4).

All the rotation-fertilizer alternatives were included in the linear programming computations to determine the cropping program or programs best suited to a given resource situation. Estimated crop yields for the various rotations with and without fertilizer, the amounts of fertilizers needed for each individual rotation and estimated variable costs per acre of different crops are presented in tables 4 and 5. The variable costs do not include fertilizer, since these outlays are charged against each crop rotation as it is generated by the programming procedure. Similarly, the portion of fixed costs associated with machinery in the short run, as well as fixed costs as-

TABLE 4. YIELD ESTIMATES WITH DIFFERENT ROTATIONS AND LEVELS OF FERTILIZATION, CLARION-WEBSTER SOIL AREA.[a]

Rotation	Yields with specified fertility levels (bushels or tons)			Rates of fertilization in pounds								
				0			1			2		
	(0)	(1)	(2)	N	P	K	N	P	K	N	P	K
C-C-O-M												
Corn	58	65	67	0	0	0	5	20	10	10	50	20
Corn	48	54	57	0	0	0	30	20	10	60	25	20
Oats	32	38	41	0	0	0	10	20	0	15	20	0
Meadow	1.9	2.2	2.4	0	0	0	0	0	0	0	0	0
C-Sb-C-O-M												
Corn	58	65	67	0	0	0	5	20	10	10	50	20
Soybeans	20	22	24	0	0	0	0	0	0	0	0	0
Corn	50	56	59	0	0	0	15	20	10	45	50	20
Oats	32	38	41	0	0	0	10	20	0	15	10	0
Meadow	1.9	2.2	2.4	0	0	0	0	0	0	0	0	0
C-C-Sb												
Corn	40	50	57	0	0	0	15	20	10	45	50	20
Corn	32	42	49	0	0	0	30	20	10	50	25	20
Soybeans	19	21	23	0	0	0	0	0	0	0	0	0

[a] Data supplied by Department of Agronomy, Iowa State University. Yields are average for period 1955 - 65, assuming normal weather conditions.

TABLE 5. ESTIMATED VARIABLE COSTS IN DOLLARS PER ACRE OF DIFFERENT CROPS.

Item	Corn	Oats	Soybeans	Meadow
Power	3.41	1.96	2.41	2.86[a]
Machinery (repair and upkeep)	2.70	0.95	1.01	5.05[a]
Seed	1.54[b]	2.34	3.80	5.71

[a] This cost is charged to the forage-consuming livestock.

[b] The seeding rate of corn varies with the level of fertilization. The following seeding rates are assumed: 0.14 bushel of hybrid corn per acre with no fertilizer; 0.18 bushel per acre with the first level of fertilizer; and 0.20 bushel per acre with the second level of fertilizer.

sociated with real estate and farm overhead, are not included in table 5, although they are subtracted in computing net incomes.

Livestock Enterprises

Although the area under investigation is known as a cash-grain area, livestock is found on most of the farms. The livestock enterprises considered are: pasture-fed yearlings, pasture-fed steer calves, a beef cow-calf enterprise, a two-litter hog system, a one-litter hog system, an average dairy enterprise, an above-average dairy enterprise and a poultry enterprise. Input-output data for livestock enterprises are included in table 6.

Pasture-feeding yearlings is the most common cattle-feeding system in north-central Iowa. Hence, only pasture systems of feeding are included in the analysis. Good-to-choice yearling steers are bought in November at an average weight of 610 pounds. Steers are wintered with roughage and a small amount of grain. In May or June, they are put on pasture, and grain feeding is increased to full feed. In August, they are taken off pasture and finished in drylot. They are marketed in October at an average weight of 1,110 pounds. The ration for these cattle is 47.5 bushels of corn,[4] 3 tons of hay equivalent and 100 pounds of supplement. Death loss is estimated at 1.5 percent.

Pasture-fed steer calves are purchased in October and sold the following September. They are wintered on roughage and a limited amount of grain. Grain feeding is increased from May to July after the calves are put on pasture, and the calves are full-fed in drylot after being taken off pasture until sold. The initial weight of the calves is 430 pounds and the market weight 990 pounds. The ration consists of 50 bushels of corn, 1.83 tons of hay equivalent and 230 pounds of supplement. The average gain per animal is 560 pounds with a 2.5-percent death loss.

[4] Or equivalent weight of other grains. This is in terms of the total ration of grains produced and fed on the farms in the area.

The beef cow-calf enterprise includes a beef cow herd for raising feeder calves. The feeding system for the calves is the same as for the pasture-fed steer calves. A 90-percent calf crop is assumed with replacement of the cow every 8 years; beef sold annually includes 150 pounds of cull cow and 767 pounds of calf. The ration includes 46 bushels of corn, 6.82 tons of hay equivalent and 178 pounds of supplement.

The two-litter hog system has spring pigs farrowed in April and marketed the following October. The fall pigs are farrowed in October and marketed in April (table 7). The spring pigs are fed on pasture, and the fall pigs are fed in drylot. Pigs are sold at 225 pounds.

The estimated production per sow with 13.6 pigs weaned is 3,100 pounds of pork—2,700 pounds of gilts and barrows and 400 pounds of sow. The weight of gilts used as sows the following year is not included. A 5-percent death loss is deducted. The feeding ration for this enterprise consists of 220 bushels of corn, 0.7 ton of hay equivalent from pasture and 1,180 pounds of supplement.

The one-litter hog system consists of spring

TABLE 7. INPUT-OUTPUT DATA FOR HOG ENTERPRISES PER TWO-LITTER OR ONE-LITTER UNIT.

Item	Units	Two-litter system	One spring litter system
Pigs weaned	number	13.6	6.8
Death loss	number	0.6	0.3
Pigs saved	number	13.0	6.5
Pigs marketed	number	12.0	5.5
Feed requirements:			
Corn	bushels	220	110
Protein supplement	pounds	1,180	520
Hay equivalent (pasture)	tons	0.7	0.7
Annual cash expenditures:			
Protein	dollars	49.56	21.84
Power	dollars	9.30	4.61
Equipment use and repair	dollars	3.72	2.15
Boar service	dollars	4.00	2.00
Miscellaneous supplies	dollars	2.94	1.47
Veterinary and medicine	dollars	13.16	6.58
Taxes and insurance	dollars	4.38	2.19
Building repairs	dollars	2.48	1.23
Total annual expense	dollars	89.54	42.07
Investment in equipment	dollars	34.50	23.89
Investment in sow	dollars	33.75	33.75
Receipts:			
Gilts, barrows and sow	dollars	486.00	238.50

TABLE 6. INPUT-OUTPUT DATA (PER HEAD) FOR BEEF-CATTLE ENTERPRISES.

Item	Units	Pasture-fed yearling	Pasture-fed steer calf	Beef cow-calf and replacement stock
Purchased		November	October	------
Sold		October	September	------
Initial weight	pounds	610	430	------
Death loss	percent	1.5	2.5	------
Selling weight	pounds	1,110	990	------
Gain	pounds	500	560	------
Feed requirements:				
Corn equivalent	bushels	47.5	50	46
Supplement	pounds	100	230	178
Hay	tons	1.2	0.88	1.88
Pasture in hay equivalent	tons	1.8	0.95	4.94
Annual cash expenditures:				
Haying[a]	dollars	4.75	3.48	7.45
Supplement	dollars	4.20	9.66	7.49
Power	dollars	2.05	2.35	2.99
Equipment use and repair	dollars	2.14	2.46	3.31
Miscellaneous	dollars	2.00	2.30	4.56
Investment:				
Livestock	dollars	115.90	88.15	265.72
Equipment[b]	dollars	13.50	13.50	28.06
Receipts	dollars	235.87	210.37	180.99

[a] Includes power and the use and repair of machinery associated with harvesting and storing of hay.

[b] Includes part of the cost of watering tank (8′ x 2′), hay feeder, loading chute and water heater.

TABLE 8. INPUT-OUTPUT DATA PER UNIT OF 1 COW AND CORRESPONDING REPLACEMENT STOCK FOR DAIRY ENTERPRISES.

Item	Units	Average dairy cow, grade B milk	Above-average dairy cow	
			Grade B milk	Grade A milk
Feed requirements:				
Corn equivalent	bushels	35.0	47.0	47.0
Hay	tons	3.0	3.2	3.2
Pasture in hay equivalent	tons	2.5	2.5	2.5
Supplement	pounds	160.0	280.0	280.0
Annual cash expenditures:				
Haying	dollars	11.88	12.67	12.67
Supplement	dollars	6.72	11.76	11.76
Power:				
Tractor	dollars	1.34	1.34	1.34
Truck	dollars	1.64	1.64	1.64
Auto	dollars	0.34	0.34	0.34
Electricity	dollars	1.98	2.25	2.25
Equipment use and repair	dollars	1.18	1.77	1.77
Buildings and fences repair	dollars	6.45	8.61	8.61
Veterinary, taxes and insurance	dollars	2.56	3.84	3.84
Mineral supplement	dollars	1.28	1.28	1.28
Artificial insemination	dollars	6.00	6.00	6.00
Investment:				
Basic stock	dollars	242.00	320.00	320.00
Dairy equipment	dollars	71.30[a]	71.30[a]	284.00[b]
Receipts	dollars	217.12	293.36	434.00

[a] Includes part of the cost of watering tank, hay feeder, loading chute, water heater, milk can, milk cooler and milker unit.

[b] Also includes part of the cost of milking parlor with stalls, feed manger and feed opening, pipeline and bulk tank. The cost varies with size of dairy herd.

pigs farrowed in March or April and marketed the following September or October (table 7). The number of pigs weaned per litter is estimated at 6.8—the average for Iowa. Sales average 1,537 pounds of pork—1,237 pounds of gilts and barrows and 300 pounds of sow. One gilt is kept on the farm to be used as a brood sow the following year. Hogs in this enterprise use 110 bushels of corn per litter, 0.7 ton of hay equivalent from pasture and 520 pounds of supplement.

The average dairy enterprise represents the average dairy practices found in the area (table 8). Milk production per cow is about the same as the average for the state. Annual milk sales include 6,000 pounds of 3.7 percent milk. Three milk-selling situations are considered. In one, milk is sold as grade B on a butterfat basis, the most common practice in the area. The other two situations considered were for tenant-operated farms: (1) Cream selling in which the milk is separated on the farm and only butterfat is sold. The skimmilk is fed to hogs or other livestock on the farm. Formerly, this was a common practice on a majority of the farms, but recently, more farmers are selling fluid milk. (2) Milk is sold as grade A, which requires additional investment in a milk cooler, barn alterations and other improvements to meet sanitary requirements specified by state and local ordinances. Grade A milk is not often sold on farms with small dairy herds.

The system assumes a grain ration of 35 bushels of corn (or corn equivalent in other grains), 5.5 tons of hay equivalent and 160 pounds of supplement per cow, including the feed needed for replacements. The cow is replaced every 5 years. In addition to the sales of milk or cream, the annual sales per cow include 240 pounds of cull cow, 32 pounds of veal calf and 78 pounds of cull heifer.

The above-average dairy enterprise produces 9,500 pounds of milk per cow. Although this is higher than the average production per cow in Iowa, it is not as high as for many of the better dairy herds of the state. It is assumed that milk can be sold either as grade B or as grade A. The grade A milk enterprise requires a larger investment in buildings and equipment. It is assumed that for grade A milk, a milking parlor with two stalls and a 100-gallon bulk tank for everyday pickup are installed, in addition to the investment already present on the farm. A larger bulk tank is needed for herds with more than 25 cows. A grade B milk enterprise assumes a milk cooler with a 6-can capacity. The feeding ration per cow and associated replacement stock consists of 47 bushels of corn, 5.7 tons of hay (3.2 tons of hay and 2.5 tons of hay equivalent from pasture) and 280 pounds of supplement. Annual sales per cow of veal calf, cull heifer and cull cow are the same as those for the average dairy enterprise.

The poultry enterprise consists of a small laying flock cared for entirely by the farmer's wife or other nonoperator family labor. The poultry enterprise is supplementary in the use of labor but competes with other farm enterprises in the use of capital and feed. The laying flock is replaced annually by purchased chicks. Feed requirements for the laying and growing flock on a per-hen basis consist of 92.5 pounds of corn equivalent and 43.9 pounds of laying mash. The annual output per hen is 16 dozen eggs and 4.3 pounds of meat. Mortality rates for laying hens and chicks are estimated at 12 and 14 percent, respectively.

SYSTEMS OF FARMING UNDER DIFFERENT RESOURCE AND TENURE SITUATIONS

Dairying is a profitable way of using available hay and pasture and the ample labor on some farms. But a system of farming that in-

cludes a dairy herd may not be a good choice on those farms on which the resources now used in forage crops and dairying could be shifted to other enterprises without neglecting the soil.

The competitive position of dairying with other enterprises was appraised through development of optimum systems of farming for different resource situations. Resource use and farm organization to give the largest net income were specified. Optimum plans were developed for 160-acre and 240-acre farms, both owned and rented. The plans were developed for various levels of operating capital, different amounts of labor and the alternative crop and livestock practices as set forth on the previous pages.

160-Acre Owner-Operated Farms

USUAL FARM ORGANIZATIONS

Typical farm organizations at the time of the initiation of this study are shown in table 9. Three plans are presented: (1) a plan for farms with 7-10 dairy cows, (2) a plan for farms with 11-14 dairy cows and (3) a plan for farms with neither beef nor dairy cows. These farm plans are "benchmarks" with which the alternative optimum plans are compared. The criterion for comparing plans is net income, as defined later, rather than profit.

The cropping program and the acreages of corn and oats are nearly the same in all plans. Farms with neither beef nor dairy cows have more acres in soybeans and fewer acres in hay and rotation pasture than farms with a more extensive livestock program.

The capital requirements and receipts and expenditures of the plans for the basic situations were computed with the same input-output data and prices as were used for the alternative plans that follow. This procedure facilitates comparisons between the usual and alternative plans. It also allows "net income" to become a criterion for measuring the relative efficiency of the group of plans.

TABLE 9. USUAL ORGANIZATIONS OF 160-ACRE OWNER-OPERATED FARMS WITH CAPITAL REQUIREMENTS, RECEIPTS AND EXPENDITURES COMPUTED WITH PROJECTED PRICES, 1954.

Item	Units	With 7-10 dairy cows	With 11-14 dairy cows	With no dairy or beef cows
		Plan 1	Plan 2	Plan 3
Operating capital	dollars	6,461	7,738	2,313
Investment in livestock and equipment	dollars	3,866	5,048	625
Labor used	hours	2,415	2,888	1,006
Total cropland	acres	141	138	145
Corn	acres	62	53	59
Oats	acres	35	37	38
Soybeans	acres	17	15	31
Hay and rotation pasture	acres	27	33	17
Permanent pasture	acres	7	9	4
Production:				
Corn equivalent	bushels	4,156	3,666	4,030
Soybeans	bushels	340	300	620
Hay equivalent	tons	61	78	38
Livestock:				
Dairy cows	number	9	13	—
Litters of spring pigs	number	12	9	7
Litters of fall pigs	number	3	4	2
Hens	number	223	247	116
Sales:				
Dairy products	dollars	1,954	2,823	—
Hogs	dollars	3,577	3,100	2,146
Poultry	dollars	1,449	1,605	754
Corn	dollars	2,331	1,733	3,676
Soybeans	dollars	816	720	1,488
Total	dollars	10,127	9,981	8,064
Annual cash expenditures:				
Crops	dollars	935	896	972
Livestock	dollars	1,640	1,794	716
Depreciation on buildings and machinery	dollars	1,616	1,616	1,616
Net income	dollars	5,936	5,675	4,760

The amounts of operating capital used to carry out the usual systems of farming vary from $2,313 on cash-grain farms to $7,738 on farms with 13 dairy cows. As previously explained, operating capital includes funds for annual cash expenditures (fuel, machinery repair, seed, fertilizer, supplement, etc.) as well as for investment in livestock and livestock equipment. Farms with 13 dairy cows have more than three times as much operating capital as farms with no livestock.

On cash-grain farms having no cattle, 1,006 hours of labor are used, as compared with 2,888 hours used on farms with 13 dairy cows. These estimates of labor do not include time spent on supplementary poultry or time needed for general farm maintenance work such as construction and maintenance of fences and buildings, repair of machinery and equipment, general land maintenance and miscellaneous work that varies from farm to farm.

The net farm income of plan 1, which includes 9 dairy cows, is $5,936; of plan 2, with 13 dairy cows, $5,675; and of plan 3, with no cattle, $4,760. Net income includes returns to labor, land, capital and management. Nothing has been subtracted for interest on borrowed capital because different operators would have different equities in operating funds, machinery, real estate, etc. For farmers with borrowed funds, the net incomes would have to be decreased accordingly. Also, taxes on personal property and real estate have not been deducted. These amounts would also need to be subtracted in computing true net farm income. These fixed costs were not subtracted in this study since the differences among plans would not have been affected. Note that the income of plan 2, which includes 13 dairy cows, is $261 less than the income of plan 1 which has only 9 dairy cows.

The incomes from plans in table 9 show net incomes for three different systems of farming. Comparisons of these incomes with the incomes derived from alternative plans based on the same or other resources indicates the adjustments needed to improve net farm incomes.

OPTIMUM PLANS FOR ONE-MAN FARMS WITH USUAL LEVELS OF CAPITAL AND PRODUCTION PRACTICES

All enterprises flexible. The optimum plans in table 10 for owner-operated one-man farms are based on the same resources and farming practices as the usual plans shown in table 9. In the optimum plans, however, limited resources are used for the combinations of enterprises that give the largest returns. The place of a small dairy herd on north-central Iowa farms is the focal point of inquiry. Hence the levels of operating

TABLE 10. OPTIMUM PLANS FOR 160-ACRE OWNER-OPERATED ONE-MAN FARMS WITH USUAL LEVELS OF PRODUCTION PRACTICES AND OF OPERATING CAPITAL AND PROJECTED PRICES.

Item	Units	All enterprises flexible		Dairy enterprise specified		Hog enterprise specified and high capital
		Low capital	High capital	Low capital	High capital	
		Plan 1	Plan 2	Plan 3	Plan 4	Plan 5
Operating capital	dollars	6,461	7,483	6,393	7,343	7,021
Investment in livestock and equipment	dollars	2,058	2,457	3,523	4,522	3,365
Labor used	hours	1,991	2,108	2,620	2,798	2,493
Rotations:						
$CCSb_2$	acres	126	128	28.5	—	41
$CSbCOM_1$	acres	15	—	112.5	96	—
$CCOM_2$	acres	—	13	—	—	—
$CCOM_1$	acres	—	—	—	45	—
$CSbCOM_2$	acres	—	—	—	—	100
Crops:						
Corn	acres	90	92	64	60	67
Oats	acres	3	3	22.5	31	20
Soybeans	acres	45	42	32	19	34
Hay and rotation pasture	acres	3	4	22.5	31	20
Permanent pasture	acres	7	7	7	7	7
Production:						
Corn equivalent	bushels	4,891	4,992	4,157	4,197	4,361
Soybeans	bushels	1,038	966	713.5	418	802
Hay equivalent	tons	14.2	16.6	56.5	75.2	55
Livestock:						
Dairy cows	number	—	—	9	13	8
Sows, two litters each	number	19	22	10	4	10
Hens	number	200	200	28	200	200
Sales:						
Dairy products	dollars	—	—	1,954	2,823	1,737
Hogs	dollars	9,234	10,692	4,860	1,944	4,860
Poultry	dollars	1,300	1,300	182	1,300	1,300
Corn	dollors	495	—231	2,075	3,292	2,016
Soybeans	dollars	2,491	2,318	1,712	1,003	1,925
Total	dollars	13,520	14,079	10,783	10,362	11,838
Annual cash expenditures:						
Crops	dollars	2,244	2,271	1,521	1,371	1,876
Livestock	dollars	2,255	2,524	1,345	1,500	1,780
Depreciation on buildings and machinery	dollars	1,616	1,616	1,616	1,616	1,616
Net income	dollars	7,405	7,668	6,301	5,875	6,566

capital used in plans 1 and 2 in table 9 ($6,461 and $7,738) are also used in the plans in table 10. (Although these amounts are available, they need not be entirely used by a particular plan.) The problem is: With the capital available, can the income from the farm be increased either (1) by changing the relative sizes of the enterprises or (2) by transferring all resources now used in dairying into other enterprises?

Even though the small dairy herd in plan 1 in table 9, for example, is profitable in the sense that its returns exceed its costs, there may be other enterprises that would be more profitable than a 9-cow dairy herd. With respect to operating capital, plan 1 in table 10 is parallel to the usual plan 1 in table 9 which includes 9 dairy cows. But the organization of the adjusted plan differs from the organization of the usual plan. The livestock program does not include dairy cows. The operating capital used in dairying in the usual plan is transferred, largely in the form of fertilizer, to crops. The number of hogs is increased by shifting to a two-litter system. More intensive grain-producing rotations ($CCSb_2$ and $CSbCOM_1$) are brought into the adjusted plan. The latter includes 90 acres of corn and 45 acres of soybeans, as compared with 62 acres of corn and 17 acres of soybeans in the usual cropping system.

The net income from plan 1 in table 10 is $7,405, or $1,469 more than that obtained from the usual system of farming (plan 1 in table 9). The price of milk would need to increase from $2.88 to $5.60 per 100 pounds, or the price of hogs would need to decrease from $16 to $13.45 per 100 pounds, for the income of the usual plan in table 9 to be at the level of plan 1, table 10. In other words, so long as the price of hogs is above $13.45 and other prices are at the projected levels, the net farm income would be increased by omitting the cow herd and substituting hogs and soybeans in the use of capital, labor and feed.

The level of operating capital used in plan 2, table 10, parallels that in plan 2 in table 9, which represents the usual farm organization including 11-14 dairy cows. The reorganized farm business does not include any dairy cows. The operating capital is used to buy more fertilizer and to increase the number of sows to 22. The cropping system in optimum plan 2 of table 10 includes 128 acres of $CCSb_2$ rotation and 13 acres of $CCOM_2$ rotation—92 acres of corn and 42 acres of soybeans. This crop pattern compares with only 53 acres in corn and 15 acres in soybeans in plan 2, table 9. The new plan increases net income by $1,993 over the usual plan.

The small dairy enterprise is in a weak competitive position with row crops and hogs at the usual levels of operating capital. Capital requirements for a dairy enterprise are relatively high compared with the rate returned on capital through fertilization and hog production. In the usual farm organization (plans 1 and 2 in table 9), about half the operating capital and labor is used in the dairy enterprise, but at prevailing prices dairy products sales account for only 19 percent of the farm receipts for plan 1.

Size of dairy herd specified. For farmers who might want to retain dairy cows as a supplementary enterprise for use of forage crops, optimum plans 3 and 4 in table 10 have been computed. These plans "force" the specified number of cows into the farm organization, but allow other phases of the business to be reorganized to maximize net income. The plans are based on the same resources as those in plans 1 and 2 in table 10 and specify the usual number of dairy cows, the number shown in table 9. Plans 1 and 2 in table 10 are determined on the basis that all resources are used in enterprises that yield the largest returns and that the dairy enterprise can be expanded or contracted. In plans 3 and 4, however, only resources not used in dairying can be reallocated among other enterprises to maximize net income. These plans were developed to learn whether net incomes might be improved even if farmers retained their usual dairy programs and practices.

The farm organization and farm output in plans 3 and 4 of table 10 are somewhat similar to those in plans 1 and 2 in table 9, but they include more

soybeans and fewer hogs. The cropping program in plan 3, table 10, consists of 64 acres of corn, 22.5 acres of oats, 32 acres of soybeans and 22.5 acres of hay and rotation pasture, as compared with 62 acres of corn, 35 acres of oats, 17 acres of soybeans and 27 acres of hay and rotation pasture in plan 1, table 9. In addition to 9 dairy cows, the livestock program in plan 3, table 10, includes 10 sows (two-litter hog system) and 28 hens.

The net income of plan 3 in table 10, the optimum dairy enterprise plan with the lower capital level, is only $365 more than that of the usual plan 1 in table 9. But it is $1,104, or 15 percent, less than the income obtained from plan 1 in table 10 in which all available resources can be shifted among enterprises to give the maximum net income. Plan 3 in table 10 allows the maximum net income for the given collection of resources when the number of cows is fixed at 13, but this would not be the maximum if all resources were free for allocation among enterprises.

The use of resources for the higher capital level in plan 4 of table 10 also is similar to what farmers have been doing on the average. It also forces 13 dairy cows into the farm organization. The net income of this plan is only $200 more than the net income of plan 2 in table 9. With the capital level used in plan 4 in table 10, it appears that a reorganization of enterprises on 160-acre owner-operated farms, with no changes in the dairy enterprises, would improve net farm income by only 4 percent.

Size of hog enterprise specified. The size of hog enterprises in optimum plans which include the dairy enterprise (plans 3 and 4 in table 10) is about the same as in the usual plans (table 9), but hog numbers increase in plans where all resources can be shifted to enterprises which give the greatest returns (plans 1 and 2 in table 10). Farmers, on the average, would need to provide additional space and equipment for plans in which the number of sows is more than 10. If farmers shifted from dairying to producing more hogs, unused dairy barns might be remodeled for hogs at small additional cost. In some situations, portable hog housing might be preferred. It is assumed in this study that an additional investment of $65 per sow will provide building space (i.e., in plans in which the number of sows exceeds 10).

Plan 5 in table 10 is an optimum plan in which the size of the hog enterprise is limited to 10 sows (20 litters of pigs in a two-litter hog system). Hence, in this plan we suppose that more building space for hogs is not available. A beef-cattle breeding herd, fattening yearlings and fattening calves were also considered, but hogs and dairy cows outcompete the beef enterprises. In addition to 20 litters of pigs, the plan includes 8 dairy cows and 200 hens. In this situation, the average dairy herd is more profitable than beef cattle.

The amount of operating capital used in plan 5 in table 10 is similar to that used for other plans in table 10. The net income of plan 5, however, is 11.3 and 14.4 percent less than the incomes of plans 1 and 2, respectively, of the same table.

If grasses and legumes are needed on the farm as a soil management practice, a dairy enterprise may be an economical means of using the hay and pasture. This is especially true if buildings are already available and operator or family labor is plentiful. But if, as on many north-central Iowa farms, the land in the farm will stand a more intensive rotation of corn and soybeans, the operator can increase his income by transferring operating funds and other resources from the dairy enterprise to hogs and to the use of fertilizer on more intensive grain-producing rotations. Limited capital will return more if invested in fertilizer and other improved crop production practices than if used to keep a small dairy herd with the practices usually followed with such herds. This is especially true with the recent ratios between prices of corn, soybeans and hogs and the price of grade B milk.

OPTIMUM FARM PLANS WITH VARIOUS LEVELS OF CAPITAL

The analysis so far has included plans based on the usual level of operating capital. Plans in table 11 are based on various levels of capital and usual farming practices.

To bring all 141 acres of cropland into cultivation, $944 of operating capital is needed for seed, machinery repairs and fuel (plan 1, table 11). A $CSbCOM_0$ rotation is used, and a net income

TABLE 11. OPTIMUM PLANS FOR 160-ACRE OWNER-OPERATED ONE-MAN FARMS WITH USUAL PRODUCTION PRACTICES, PROJECTED PRICES AND VARIOUS LEVELS OF OPERATING CAPITAL.

Plan	Operating capital				Farm organization				
	Annual cash expenditures		Investment in livestock and livestock equipment	Total	Crop rotations	Corn sold or purchased	Livestock		Net income
	Crops	Livestock					Sows[a]	Hens	
	(dollars)	(dollars)	(dollars)	(dollars)	(acres)	(bushels)	(No.)	(No.)	(dollars)
1	944	—	—	944	141 $CSbCOM_0$	3,046	—	—	3,384
2	1,058	—	—	1,058	141 $CCSb_0$	3,384	—	—	3,868
3	1,690	—	—	1,690	141 $CCSb_1$	4,324	—	—	4,684
4	2,310	—	—	2,310	141 $CCSb_2$	4,982	—	—	5,145
5	2,310	895	682	3,887	141 $CCSb_2$	2,782	10	—	6,250
6	2,310	1,449	858	4,617	141 $CCSb_2$	2,452	10	200	6,567
7	2,240	2,345	2,191	6,776	125 $CCSb_2$; 16 $CSbCOM_2$	90	20	200	7,512
8	2,259	2,703	2,724	8,516[b]	124 $CCSb_2$; 17 $CCOM_2$	—615	24	200	7,838

[a] Two litters each.

[b] Includes the capital used for purchase of 615 bushels of corn.

of $3,384 is obtained with a cash-grain system of farming. An addition of $114 to the operating fund would make it profitable to change the cropping from the $CSbCOM_0$ rotation of plan 1 to the more intensive grain-producing $CCSb_0$ rotation of plan 2. The change in the cropping system increases net farm income by $484, or 14.3 percent, over that in plan 1. No commercial fertilizer would be used in either of the two plans.

The additional operating capital in plans 3 and 4 is used to purchase fertilizer. The fertilizer increases the value of crops by $816 under plan 3 and $1,277 under plan 4. The smaller increase between plans 3 and 4 than between plans 2 and 3 is a result of diminishing returns to fertilizer. The net income from plan 3 is $4,684 and from plan 4 is $5,145. These incomes compare with $3,868 obtained with plan 2 where the cropping system is the same but no commercial fertilizer is used.

None of the previous plans includes livestock. When the operating capital reaches $2,500 or more, livestock is added. Plan 5 in table 11 includes 10 sows with a two-litter hog system. The cropping program is a $CCSb_2$ rotation, the same as for plan 4 of the same table. To carry out the cropping and livestock programs as indicated in plan 5, $3,887 in operating capital is required —$2,310 for crops, $895 for livestock and $682 for equipment needed in the hog enterprise. The addition of the 20 litters of pigs in plan 5 improves net farm income by 21.5 percent over plan 4.

The next increment of operating capital, as shown in plan 6 of table 11, is used most profitably for a laying flock of 200 hens. Beyond plan 6, further increases in the amount of capital would be used for an expansion of the hog enterprise. At the $8,516 level of operating capital, the optimum organization includes 24 sows (plan 8). The cropping plan at this capital level includes 124 acres of a $CCSb_2$ rotation and 17 acres of $CCOM_2$. Four acres of hay are included in this plan to allow increase in spring litters of pigs raised on pasture. Net income from plan 8 is $7,838.

Farmers representative of the population for which this study is made would need to expand their present building facilities if the number of sows were to be increased beyond 10. New portable housing for hogs is assumed for plans 7 and 8, and the capital outlays are included in the operating fund. Some farmers, however, could increase pig litters at less cost by converting dairy barns to house hogs. Little additional expense would be involved in many cases.

OPTIMUM PLANS WITH FLEXIBLE CAPTIAL AND IMPROVED DAIRY PRACTICES[5]

Production of milk in small herds in north-central Iowa is inefficient relative to production of most other commodities. The production per cow in these small herds is relatively low, and the labor requirements are relatively high. Accordingly, limited supplies of capital and labor can be used more profitably on crops and hog production. An alternative for strengthening the competitive position of dairying, however, would be improvement of dairy production practices. Accordingly, we now examine the effect of this type of adjustment on farm organization and income.

One-man farms. Improved dairy practices are introduced in plans shown in table 12. The quality of the dairy cows and the level of management of the herd is high enough to produce 9,500 pounds of milk per cow. This level of production represents a sizable increase over the 6,000 pounds used in preceding plans and tables, but it is not as high as that obtained from many of the better dairy herds in the state.

Two markets for milk are considered with improved production practices: (1) sales of grade B milk at the same price as in the plans already described ($2.88 per hundredweight) and (2) sales of grade A milk at $4.10 per hundredweight. While the production of grade B milk does not require additional investment—except for more milk cans and a larger milk cooler—the production of grade A milk requires a substantial increase in capital investment to meet sanitary requirements. For grade A milk, a milking parlor with

TABLE 12. OPTIMUM PLANS FOR 160-ACRE OWNER-OPERATED ONE-MAN AND TWO-MAN DAIRY FARMS WITH UNLIMITED OPERATING CAPITAL, PROJECTED PRICES AND IMPROVED DAIRY PRACTICES WITH COWS AVERAGING 9,500 POUNDS OF MILK.

Item	Units	One-man		Two-man	
		Grade B milk[a]	Grade A milk[a]	Grade B milk[a]	Grade A milk[a]
		Plan 1	Plan 2	Plan 3	Plan 4
Operating capital	dollars	8,524	12,808	12,781	15,383
Investment in livestock and equipment	dollars	4,771	8,848	7,916	10,518
Labor used	hours	2,754	2,879	3,830	3,473
Rotations:					
$CSbCOM_2$	acres	120	101	.....	.....
$CCOM_2$	acres	.....	40	141	141
$CCSb_2$	acres	21	.....	.....	.....
Crops:					
Corn	acres	62	60	71	71
Oats	acres	24	30	35	35
Soybeans	acres	31	20	.....	.....
Hay and rotation pasture	acres	24	31	35	35
Permanent pasture	acres	7	7	7	7
Livestock:					
Dairy cows	number	10	13	14	14
Sows, two litters each	number	10	11	19	19
Hens	number	200	200	200	200
Sales:					
Dairy products	dollars	2,934	5,642	4,107	6,076
Beef	dollars	.....	.....	.....	.....
Hogs	dollars	4,860	5,346	9,234	9,234
Poultry	dollars	1,300	1,300	1,300	1,300
Corn	dollars	1,635	1,318	—65	—65
Soybeans	dollars	1,769	1,152	.....	.....
Total	dollars	12,498	14,758	14,576	16,545
Annual cash expenditures:					
Crops	dollars	1,789	1,752	1,889	1,889
Livestock	dollars	1,964	2,208	2,976	2,976
Depreciation on buildings and machinery	dollars	1,616	1,820	1,616	1,820
Net income	dollars	7,129	8,978	8,095	9,860

[a] Grade B milk at $2.88 per hundredweight and grade A at $4.10 per hundredweight.

[5] The size of the dairy herd is specified in the four plans discussed in this section.

two stalls and a 100-gallon bulk tank for everyday pickup are assumed to be added at a cost of $3,500.

A dairy enterprise with 10 cows producing grade B milk priced at $2.88 per 100 pounds still cannot displace the hog enterprise, even with the increased milk production per cow, when the price of hogs is $16 per 100 pounds. This is illustrated by comparing plan 1 in table 12 with plan 8 in table 11. The level of operating capital is approximately the same in both plans, yet the net income of plan 1 in table 12 is $709, or 9 percent, less than that of plan 8 in table 11. Improvement of dairy practices does increase net income, however, by about 6 percent over income from the initial or usual farm organization which includes cows producing only 6,000 pounds of milk.

When the sale of grade A milk and improved dairy production practices are introduced together (plan 2 in table 12), net income is increased to $8,978, as compared with $5,675 obtained from the usual plan (plan 2 in table 9). The optimum plan has about the same cropping system as the usual plan, except that more fertilizer is used. The number of dairy cows remains the same, but more milk is produced. The number of litters of pigs raised is increased from 13 to 22. Plan 2 in table 12, however, uses $12,808 of operating capital, while plan 2 in table 9 uses only $7,738. A shortage of capital would prevent some farmers in the area from adopting the optimum plan because it requires about $5,000 additional capital. This analysis indicates, however, that farmers who prefer a dairy enterprise and have enough capital to buy fertilizer and modernize the dairy enterprise can remain in dairying and increase net income with a grade A market.

Two-man farms. The amount of labor available on a farm is an important factor in the size and choice of enterprises. In the last two decades, much progress has been made in mechanization and in reducing man-hours of labor used on the farms. But all enterprises have not been affected equally. The decrease in man-hours used per acre of crops has been relatively larger than the reduction in chore time required in livestock enterprises.[6] Dairy cows are still the most labor-intensive among the livestock enterprises. Mechanical methods of handling milk cows and milk have not been adopted on most of the farms with small dairy herds and may be uneconomical for such farms.

In the plans already discussed, the labor supply was that of a one-man farm. In plans at lower capital levels, labor is not usually a limiting resource, but it becomes limiting as more livestock is added. Two plans were developed without any labor restriction (plans 3 and 4 in table 12) to determine the competitive position of the average dairy enterprise with other enterprises when ample labor is available.

A farm plan with ample capital and labor, improved dairy practices and with a grade B milk market is shown in plan 3, table 12. The cropping system includes a $CCOM_2$ rotation instead of a $CSbCOM_2$ rotation as in plan 1 in table 12. Soybeans are excluded from the cropping program, and the acreage of hay is increased from 24 to 35 acres. The number of cows is increased from 10 to 14 and the number of litters of pigs from 20 to 38. Net income of this plan is 13.5 percent higher than that of plan 1.

A shift to selling grade A milk does not change the cropping and the livestock system (plan 4, table 12). Net income is, however, increased from $8,095 in plan 3 to $9,860 in plan 4.

The analysis in this section suggests the adjustments owner-operators in north-central Iowa need to make if dairying is to be a profitable alternative to other systems of farming. Their present dairy operations should be enlarged by improving dairy production practices and increasing the number of cows. Otherwise, larger net incomes can be obtained by shifting resources in the direction of intensive grain and soybean rotations and hog production, thus increasing the volume of business with only a limited addition to capital investment and labor requirements of the farm. Building and equipment requirements for hogs are comparatively modest. Dairy cattle, on the other hand, require a larger investment and use more man-hours of labor per $100 of product than do beef cattle or hogs.

160-Acre Tenant-Operated Farms

Returns from the farm as a whole should be the same for tenant-operated farms as for owner-operated farms, unless there are leasing imperfections. The prevailing rental agreement in north-central Iowa is a crop-share-cash lease.[7] The payment to the landlord is a share of cultivated crops and a cash payment of around $10 per acre for land used for hay and pasture. Corn and soybeans are generally shared on a 50-50 basis. Seed and fertilizer expenditures for corn are also divided equally between the tenant and the landlord. The rest of the corn costs, including corn picking, are usually paid by the tenant. The landlord receives two-fifths of the oats crop, and the tenant pays all the expenses, except for any grass seed that may be included. Part of the cost of fertilizer on hay is paid by the landlord. The tenant's share of the cost of soybeans differs among farmers.

Usual Farm Organizations

The usual systems of farming on tenant-operated farms are the same as those shown in table 9 for owner-operated farms, except that tenants, on the average, have more acres in soybeans, a cash crop, and fewer acres in corn. This difference probably is partly the result of leasing agreements. Net incomes to the tenants from the three plans corresponding to those in table

[6] Hecht, Reuben W. Labor used for livestock. U. S. Dept. Agr. Stat. Bul. 161. 1955.

[7] Seventy-five percent of all leases in north-central Iowa are crop-share and crop-share-cash leases. Hurlburt, Virgil L. Farm rental practices and problems in the Midwest. Iowa Agr. Exp. Sta. Res. Bul. 416. U. S. Dept. Agr. and 13 states cooperating. 1954.

9, when budgeted for tenant-operated farms are:

Plan 1 (grade B milk market)	$3,342
Plan 2 (grade A milk market)	3,397
Plan 3 (grade B milk market with corn purchases allowed)	2,037

PLANS WITH THE USUAL LEVEL OF CAPITAL AND PRODUCTION PRACTICES

The modal level of operating capital used on tenant-operated farms is $7,000—the same as that used on the owner-operated farms. This level of capital was used in developing the alternative plans outlined in table 13 in which usual production practices in the dairy enterprise are assumed. Plans are shown for marketing milk as grade A and as butterfat. In the plans in which butterfat is sold, the skimmilk is utilized on the farm.

Flexible cropping and livestock systems. In the three plans in table 13, the tenant is free to choose his cropping system. (A cropping system specified by the landlord is considered later.) The cropping system is determined jointly with the livestock program to maximize tenant income. Plans 1 and 2 in table 13 are those which maximize returns to the tenant from the crops produced on the farm assuming that the tenant's share of crops is fed to livestock, and no additional grain is purchased.[8] In plan 1, with a grade B milk market, the cropping system includes 88 acres of $CCOM_2$ rotation and 53 acres of $CCSb_2$ rotation. The livestock program consists of 18 litters of pigs (9 sows), 200 hens and 10 average dairy cows. The net income of this plan is $3,620, which is $278, or 8.3 percent, more than the net income of $3,342 obtained by a tenant under the usual farm plan.

Plan 2 in table 13 assumes a grade A market for milk, although few tenants produce for grade A markets. Rented farms ordinarily do not have the buildings and facilities required under grade A ordinances.

The dairy enterprise in this plan meets only the minimum requirements for grade A milk production. The investment, beyond that already on the farm, includes barn alterations, a milk house and a milk cooler. A water vat, a utensil rack and other cleaning equipment are also included to meet the sanitation requirements. The price for milk, $3.90 per 100 pounds, is 20 cents less than is ordinarily obtained when a bulk tank is available on the farm.

The additional capital needed to produce grade A milk (plan 2 of table 13) curtails operating capital for other purposes, and soybeans are substituted for some of the acreage of corn included in plan 1 in the same table. Plan 2 contains 8 cows instead of the 10 in plan 1, and the number of pigs is decreased from 18 to 14 litters. The higher price for milk and the sale of additional soybeans, however, more than offset the decrease in livestock production. The net income from plan 2 is $4,069, which is $449 more than the income from plan 1.

When additional corn is purchased, as in plan 3 of table 13, the dairy enterprise drops out of the farm plan. The cropping system also changes from a $CCOM_2$ to a $CCSb_2$ rotation. This change comes about because forage is needed for the dairy enterprise in plan 1 and is not needed in plan 3. An additional 1,384 bushels of corn are purchased to supplement the tenant's share of corn (2,466 bushels). The net income from plan 3 is $349 more than that from plan 1. Fewer man-hours are used for plan 3 than for plan 1.

Study of these three plans indicates that, for the tenant on 160 acres who does not want to assume the risk of buying corn for feeding hogs, the best system of farming includes a herd of around 8 to 10 dairy cows. If he has a grade A market for milk he may do as well as his neighbor who keeps no cows and buys about 1,400 bushels of corn to add to his share of the production on the farm for raising hogs. If he has a grade B milk market he can expect a net income about 10 percent lower than might be obtained through buying corn and raising hogs.

Availability of operating capital. Increases in operating capital have about the same effects on the optimum farm organization for a tenant-operated as for an owner-operated farm. A progression of plans for a tenant-operated farm is shown in table 14, along with the capital level consistent with each plan. These plans maximize

[8] Because of rounding the number of livestock (litters of pigs), Plan 1 calls for a purchase of 89 bushels of corn.

TABLE 13. OPTIMUM PLANS FOR 160-ACRE TENANT-OPERATED ONE-MAN FARMS WITH ALL ENTERPRISES FLEXIBLE, USUAL DAIRY PRACTICES AND PROJECTED PRICES.

Item	Units	No corn bought		Corn bought
		Grade B milk	Grade A milk	Grade B milk
		Plan 1	Plan 2	Plan 3
Operating capital	dollars	7,232	7,058	7,114
Investment in livestock and equipment	dollars	3,745	4,035	1,658
Labor used	hours	2,739	2,339	1,811
Rotations:				
$CCOM_2$	acres	88	----	----
$CSbOM_2$	acres	----	85	9
$CCSb_2$	acres	53	56	132
Crops:				
Corn	acres	79	71	91
Oats	acres	22	17	2
Soybeans	acres	18	36	44
Hay and rotation pasture	acres	22	17	2
Permanent pasture	acres	7	7	7
Livestock:				
Dairy cows	number	10	8	----
Sows, two litters each	number	9	7	16
Hens	number	200	200	200
Sales:				
Dairy products	dollars	2,025	2,228	----
Beef	dollars	----	----	----
Hogs	dollars	4,374	3,402	7,776
Poultry	dollars	1,300	1,300	1,300
Corn (minus indicates purchases)	dollars	—120	133	—1,868
Soybeans	dollars	585	1,206	1,526
Total	dollars	8,164	8,269	8,734
Annual cash expenditures:				
Crops	dollars	1,593	1,511	1,601
Livestock	dollars	1,774	1,512	1,987
Depreciation on buildings and machinery	dollars	1,177	1,177	1,177
Net income	dollars	3,620	4,069	3,969

TABLE 14. OPTIMUM PLANS FOR 160-ACRE TENANT-OPERATED ONE-MAN FARMS WITH USUAL PRODUCTION PRACTICES, PROJECTED PRICES AND VARIOUS LEVELS OF OPERATING CAPITAL.

Plan	Operating capital				Farm organization					
	Annual cash expenditures		Investment in livestock and livestock equipment	Total	Crop rotations	Corn sold or purchased	Livestock			Net income
	Crops	Livestock					Sows[a]	Yearling feeders	Hens	
	(dollars)	(dollars)	(dollars)	(dollars)	(acres)	(bushels)	(No.)	(No.)	(No.)	(dollars)
1	986	----	----	986	141 $CCSb_0$	1,692	----	----	----	1,322
2	1,301	----	----	1,301	141 $CCSb_1$	2,162	----	----	----	1,752
3	1,611	----	----	1,611	141 $CCSb_2$	2,491	----	----	----	2,007
4	1,611	895	683	3,189	141 $CCSb_2$	291	10	----	----	3,111
5	1,611	1,383	837	3,831	141 $CCSb_2$	----	10	----	176	3,390
6	1,611	1,449	859	3,972[b]	141 $CCSb_2$	—39	10	----	200	3,426
7	1,586	2,703	2,724	11,298[b]	120 $CCSb_2$; 21 $CSbCOM_2$	—3,174	24	----	200	4,683
8	1,446	5,599	3,766	18,454[b]	141 $CSbCOM_2$	—5,662	30	18	200	5,236

[a] Two litters each.

[b] Includes the capital used for the purchases of corn.

net income to the tenant when he follows usual practices in dairying but can select the optimum allocation of resources among crop, beef, hog, dairy and poultry enterprises. If funds are available for buying corn to feed hogs, dairying with the usual production practices is not as profitable an enterprise as hogs at any of the capital levels shown.

Plan 8 in table 14 represents a situation in which the tenant has a large amount of operating capital, a total of $18,454. At this capital level, the major rotation shifts from corn, corn and soybeans to corn, soybeans, corn, oats and meadow. The livestock system consists of 30 sows raising 2 litters, 18 yearling feeder steers and 200 hens. The plan requires the purchase of 5,662 bushels of corn.

Cropping system specified. Plans 1 and 2 in table 15 assume that a CCOM rotation, with or without fertilizer, is specified by the landlord. The tenant must adjust the livestock program to the feed produced on the farm. If milk is marketed as grade B, as in plan 1, the optimum plan with the usual dairy practices includes 10 average dairy cows, a two-litter hog system of 9 sows and 200 hens. In plan 2, the availability of a grade A market changes the optimum organization only slightly. With limited funds for operating capital, the investment in production of grade A milk replaces investment in fertilizer and a poultry enterprise. The net income, however, is about 10 percent higher under plan 2 with a grade A market than under plan 1 with a grade B market.

Dairy cows are favored in both plans because the CCOM rotation specified by the landlord produces 77 tons of hay for which the tenant pays a cash rent of $10 per acre. With sufficient family labor, the return to all scarce resources is greater when forage is used for a dairy enterprise than when it is used for beef cattle. Although the tenant operating under this rental situation maximizes profits by keeping a small dairy herd, income is less than when he is free to select a rotation with more grain and does not keep a dairy herd. The net income from plan 1 in table 15 is $3,168, which is 12.5 percent less than the net income from plan 1 in table 13. The two plans, both of which include milk marketed as grade B, represent identical resource situations, except that in plan 1 of table 15, the tenant must follow a CCOM rotation, while in plan 1 of table 13 he can select a larger acreage of cash grains.

TABLE 15. OPTIMUM PLANS FOR 160-ACRE TENANT-OPERATED ONE-MAN FARMS WITH A CCOM ROTATION, FLEXIBLE LIVESTOCK ENTERPRISE AND PROJECTED PRICES.

Item	Units	Average dairy practices		Improved dairy practices
		Grade B milk	Grade A milk	grade A milk
		Plan 1	Plan 2	Plan 3
Operating capital	dollars	7,099	6,925	14,559
Investment in livestock and equipment	dollars	3,745	4,772	9,923
Labor used	hours	2,658	2,596	3,059
Rotations:				
$CCOM_1$	acres	141	----	----
$CCOM_0$	acres	----	141	----
$CCOM_2$	acres	----	----	141
Crops:				
Corn	acres	71	71	71
Oats	acres	35	35	35
Soybeans	acres	----	----	----
Hay and rotation pasture	acres	35	35	35
Permanent pasture	acres	7	7	7
Livestock:				
Dairy cows	number	10	10	15
Sows, two litters each	number	9	9	10
Hens	number	200	----	200
Sales:				
Dairy products	dollars	2,025	2,785	6,510
Beef	dollars	----	----	----
Hogs	dollars	4,374	3,888	4,860
Poultry	dollars	1,300	----	1,300
Corn	dollars	—217	134	—832
Soybeans	dollars	----	----	----
Total	dollars	7,482	6,807	11,838
Annual cash expenditures:				
Crops	dollars	1,363	1,023	1,582
Livestock	dollars	1,774	1,130	2,222
Depreciation on buildings and machinery	dollars	1,177	1,177	1,381
Net income	dollars	3,168	3,477	6,653

OPTIMUM PLANS WITH FLEXIBLE CAPITAL AND IMPROVED DAIRY PRACTICES

Plan 3 in table 15 was designed for a tenant who must follow a CCOM rotation but who has available equipment and sufficient capital for producing grade A milk. Ordinarily, the landlord would have to provide the necessary building arrangements, which few landlords might be willing to do under a crop-share lease. Under this arrangement, however, a larger dairy herd would be profitable to the tenant—even more profitable than a farm plan including beef. The optimum organization, as indicated by plan 3 in table 15, would include 15 dairy cows, 20 litters of pigs and 200 hens. The net farm income, $6,653, is

considerably higher than for any of the other plans in tables 13 and 15.

Owner-Operated 240-Acre Farms

The analysis of 240-acre farms begins with the presentation of the typical or usual plans that serve as a benchmark for comparing alternative plans and provide the resource situations for which optimum plans are developed. Optimum plans for 240-acre farms are determined in the same way as those for 160-acre farms. Plans are shown with and without dairy enterprises.

USUAL FARM ORGANIZATIONS

Farms of 240 acres included in the analysis were classified into the same groups for study as the 160-acre farms: those with 7-10 dairy cows, those with 11-14 dairy cows and cash-grain farms with no dairy or beef cows. The usual organizations, computed from census data, are shown in table 16. The cropping systems on the three groups of farms were essentially the same in 1954, except that the farms with no cattle produced more soybeans and less oats. The farms with larger dairy herds also had a few more hogs. The cash-grain farms with no cattle had an average of only five litters of pigs.

The organization of 240-acre farms differed only slightly from that of 160-acre farms. On 240-acre farms, the proportion of the cropland used for corn was slightly less and for soybeans and oats slightly more than for the quarter-section units. The proportion of cropland in hay and rotation pasture was also slightly less, but more forage was available per animal produced.

The amounts of operating capital used on 240-acre farms exceeded the investments on 160-acre farms by $400 to $850, depending upon the system of farming. The difference was smallest on the cash-grain farms. The labor used on the 240-acre farms ranged from 250 to 400 man-hours more than on the 160-acre farms. The largest difference was on farms with the larger dairy herds. Net incomes on 240-acre farms ranged from about $1,975 to $2,750 more than on 160-acre farms.

TABLE 16. USUAL ORGANIZATIONS OF OWNER-OPERATED 240-ACRE FARMS WITH CAPITAL REQUIREMENTS, RECEIPTS AND EXPENDITURES COMPUTED WITH PROJECTED PRICES, 1954.

Item	Units	With 7 - 10 dairy cows	With 11 - 14 dairy cows	With no dairy or beef cows
		Plan 1	Plan 2	Plan 3
Operating capital	dollars	6,974	8,595	2,730
Investment in livestock and equipment	dollars	3,899	5,069	466
Labor used	hours	2,782	3,290	1,254
Total cropland	acres	210	213	220
Corn	acres	86	79	86
Oats	acres	58	56	44
Soybeans	acres	34	43	59
Hay and rotation pasture	acres	32	35	31
Permanent pasture	acres	11	11	6
Production:				
Corn equivalent	bushels	5,572	5,162	5,348
Soybeans	bushels	680	860	1,180
Hay equivalent	tons	71.8	77.5	64.9
Livestock:				
Dairy cows	number	9	12	----
Litters of spring pigs	number	12	14	4
Litters of fall pigs	number	3	4	1
Hens	number	237	300	200
Sales:				
Dairy products	dollars	1,954	2,605	----
Hogs	dollars	3,578	4,293	1,193
Poultry	dollars	1,540	1,950	1,300
Corn	dollars	4,142	2,895	5,795
Soybeans	dollars	1,632	2,064	2,832
Total	dollars	12,846	13,807	11,120
Annual cash expenditures:				
Crops	dollars	1,391	1,409	1,492
Livestock	dollars	1,684	2,117	772
Depreciation on buildings and machinery	dollars	1,861	1,861	1,861
Net income	dollars	7,910	8,420	6,995

OPTIMUM FARM PLANS WITH USUAL LEVELS OF CAPITAL AND FARM PRACTICES

All enterprises flexible. The most profitable adjustments for 240-acre owner-operated farms are similar to those developed for 160-acre farms and are represented by the plans in table 17. If resources on these 240-acre farms were used for the enterprises which gave the largest returns, the acreage in corn and soybeans would exceed the acreage usually found on such farms by 40 percent and 33 percent, respectively. If profits were to be maximized under present practices, resources now used for a small dairy enterprise would be diverted to crops. Larger acreages of

TABLE 17. OPTIMUM PLANS FOR 240-ACRE OWNER-OPERATED ONE-MAN FARMS WITH USUAL LEVELS OF PRODUCTION PRACTICES AND OPERATING CAPITAL AND WITH PROJECTED PRICES.

Item	Units	All enterprises flexible		Dairy enterprise specified	
		Low capital	High capital	Low capital	High capital
		Plan 1	Plan 2	Plan 3	Plan 4
Operating capital	dollars	6,985	8,469	7,005	8,469
Investment in livestock and equipment	dollars	1,100	1,783	3,064	4,345
Labor used	hours	2,105	2,279	2,580	3,242
Rotations:					
$CCSb_2$	acres	169	135	123	77
$CSbCOM_1$	acres	----	----	65	136
$CSbCOM_2$	acres	44	78	25	----
Crops:					
Corn	acres	130	120	118	106
Oats	acres	9	16	18	27
Soybeans	acres	65	61	59	53
Hay and rotation pasture	acres	9	16	18	27
Permanent pasture	acres	10	10	10	10
Production:					
Corn equivalent	bushels	7,245	6,988	6,899	6,529
Soybeans	bushels	1,495	1,419	1,349	1,192
Hay equivalent	tons	31.6	48.4	50.6	69.5
Livestock:					
Dairy cows	number	----	----	9	12
Feeders, yearling steers	number	8	14	----	----
Spring litters of pigs	number	11	10	1	6
Fall litters of pigs	number	11	6	1	6
Hens	number	200	200	200	200
Sales:					
Dairy products	dollars	----	----	1,954	2,605
Beef	dollars	1,887	3,302	----	----
Hogs	dollars	5,346	6,291	486	2,916
Poultry	dollars	1,300	1,300	1,300	1,300
Corn	dollars	5,349	4,073	7,844	5,797
Soybeans	dollars	3,588	3,406	3,238	2,861
Total	dollars	17,470	18,372	14,822	15,479
Annual cash expenditures:					
Crops	dollars	3,298	3,150	2,925	2,536
Livestock	dollars	2,587	3,536	1,016	1,588
Depreciation on buildings and machinery	dollars	1,861	1,861	1,861	1,861
Net income	dollars	9,724	9,825	9,020	9,494

corn and soybeans would be grown, and more fertilizer would be applied. Production of hogs would be increased, and cattle feeding would be added. The livestock system in optimum plan 1 of table 17 consists of 8 yearling feeder steers, 22 litters of pigs and 200 hens, as compared with the usual livestock program (plan 1, table 16) of 9 dairy cows, 15 litters of pigs and 237 hens. Net income of plan 1 in table 17 is $1,814 larger than that of plan 1 in table 16, although operating capital is about the same in both cases.

Plan 2 in table 17 is based on about the same amount of capital as plan 2 in table 16, but the former has been computed to maximize net return. The optimum system—plan 2 in table 17—includes 14 yearling feeder steers, 16 litters of pigs and 200 hens. The net income from this plan would be $1,405 more than from the corresponding plan in table 16 which includes 12 dairy cows. Part of this increase would come from shifting capital out of dairying to heavier fertilization of corn, as well as from a shift of resources to feeder cattle.

Size of the dairy herd specified. The analysis in this section supposes that the farmer will prefer to keep a dairy enterprise. Plans 3 and 4 in table 17 for owner-operated farms have livestock programs in which the size of the dairy herd is the same as in the usual plans 1 and 2 in table 16. The farming practices and milk output per cow are assumed to be the same.

The net income obtained from plan 3 is 14 percent ($1,110) larger than from plan 1 in table 16, in which less capital is used. The increase in income comes about through a more intensified cropping program. The cropping system includes larger acreages of corn and soybeans and more fertilizer. Some of the funds previously used on hogs are reallocated to crops. In addition to 9 dairy cows, plan 3 in table 17 includes two litters of pigs and 200 hens, as compared with plan 1 in table 16 using 9 dairy cows, 15 litters of pigs and 237 hens. The cropping system has two rotations and, because of capital limitations, has two different fertilization levels: 65 acres in $CSbCOM_1$, 25 acres in $CSbCOM_2$ and the balance in $CCSb_2$.

Similar adjustment possibilities are indicated in plan 4 in table 17, which includes a dairy herd of 12 cows. Because of a larger dairy herd, the acreages of corn and soybeans are less than in plan 3. The cropping system consists of 136 acres of $CSbCOM_1$ and 77 acres of $CCSb_2$ rotations. The net income of this plan is $1,074, or 12.8 percent, more than from the usual plan 2 (table 16) with about the same amount of operating capital. Hence, it appears that if the entire farm is reorganized, a 240-acre farm with a dairy herd can attain an income level greater than that provided by the plans typically being followed on farms with dairy herds.

The opportunities for improving net incomes while retaining a dairy herd evidently are greater for 240-acre farms than for 160-acre farms. Cropping and livestock systems now being followed deviate further from optimum systems on 240-acre farms than on 160-acre farms. Farms of 240 acres tend to have more acres of hay and rotation pasture in relation to the number of forage-consuming livestock. Net income from the usual 160-acre farm could be increased only 4.8 percent without changing the scale of dairy operations (assuming the usual level of capital and production practices). On the other hand, net income from the usual 240-acre farm could be increased 13 percent without a change in the dairy herd. The additional income would be obtained largely from increased production of corn and soybeans, more intensive fertilization of crops and an increase in acreage of crops.

OPTIMUM PLANS WITH FLEXIBLE CAPITAL AND IMPROVED DAIRY PRACTICES

One-man farms. The previous section dealt with income opportunities when dairy management practices were the same as those now found on 240-acre farms. Can income be increased by using improved practices in the dairy enterprise? Adoption of improved dairy practices alone, without other changes in farm organization and practices, would increase net farm incomes by 5.8 percent for the situation in plan 3 of table 17, and by 7.2 percent for the situation in plan 4 of table 17. But the incomes still would be 8 and 14 percent less, respectively, than those obtained from plans 1 and 2, which do not include dairy herds.

If plans 3 and 4 of table 17 were revised to allow for adopting both improved dairy practices and improved cropping systems and for reorganizing the farm to maximize profit, the resulting net incomes would be almost identical with those shown for plans 1 and 2 which do not include dairying but which allow complete reorganization of the farm. The adjustments in the cropping systems would involve the application of more commercial fertilizer and an increase in the acreage of corn and soybeans. These changes, however, would require about $2,000 more operating capital than is used in plans 1 and 2.

If in addition, a shift were made to grade A milk production, at $4.10 per 100 pounds, as in plans 1 and 2 in table 18, the system with dairy farming would be more profitable than the corn-hog systems in plans 1 and 2 in table 17. But investment would be much higher. Plan 1 in table 18, for example, requires $14,634 of operating capital. More than two-thirds of this capital is in livestock and livestock equipment, including a milking parlor and a 100-gallon bulk tank. The livestock program includes a dairy herd of 15 cows, a two-litter hog system of 9 sows and 200 hens. The cropping system is similar to that prevailing on many of the farms in 1954 (see tables 1 and 16), except that more fertilizer would be used. The net income from plan 1, table 18, is $12,268. The dairy enterprise contributes 34 percent of the gross income.

TABLE 18. OPTIMUM PLANS FOR 240-ACRE ONE-MAN AND TWO-MAN OWNER-OPERATED FARMS WITH FLEXIBLE CAPITAL, IMPROVED DAIRY PRACTICES AND A GRADE A MARKET FOR MILK.

Item	Units	One-man	Two-man
		Plan 1	Plan 2
Operating capital	dollars	14,634	22,136
Investment in livestock and equipment	dollars	9,855	15,051
Labor used	hours	3,381	4,825
Rotations:			
$CCSb_2$	acres	19	.....
$CSbCOM_2$	acres	194	.....
$CCOM_2$	acres	.....	213
Crops:			
Corn	acres	90	107
Oats	acres	39	53
Soybeans	acres	45	.....
Hay and rotation pasture	acres	39	53
Permanent pasture	acres	10	10
Production:			
Corn equivalent	bushels	6,356	7,721
Soybeans	bushels	1,077	.....
Hay equivalent	tons	103	138
Livestock:			
Dairy cows	number	15	21
Sows, two litters each	number	9	29
Hens	number	200	200
Sales:			
Dairy products	dollars	6,510	9,114
Beef	dollars	.....	.....
Hogs	dollars	4,374	14,094
Poultry	dollars	1,300	1,300
Corn	dollars	4,343	31
Soybeans	dollars	2,585	.....
Total	dollars	19,112	24,539
Annual cash expenditures:			
Crops	dollars	2,647	2,853
Livestock	dollars	2,132	4,232
Depreciation on buildings and machinery	dollars	2,065	2,125
Net income	dollars	12,268	15,329

Two-man owner-operated farms. The availability of more labor affects the optimum plan when improved dairy practices are used and capital is plentiful. In plan 2 in table 18, the size of the dairy herd is increased to 21 cows. Net farm income is considerably larger than that obtained from the usual organization of typical 240-acre farms, and the use of operating capital is increased threefold. Plan 2 uses $22,136 of operating capital. In addition to the investment in livestock and livestock equipment, the operating capital also includes the outlays needed for an expansion of the dairy barn. The larger income shown, however, is the return to the time of two men as well as to the other resources represented by the farming situation.

The increase to 21 cows in dairy operations in plan 2 of table 18 lowers the average fixed cost per cow over that of plan 1, with 15 dairy cows, by about 28 percent. The fixed costs per cow decrease because the same dairy facilities (milking parlor, milk house, bulk tank, milker units) that are used for the herd of 15 cows could be used for the herd of 21 cows.

Optimum Plans For 240-Acre Tenant-Operated Farms

The procedure used in analyzing 160-acre tenant-operated farms has been followed in determining and analyzing optimum plans for 240-acre tenant-operated farms. The same assumptions are used with respect to rental agreement, farming practices, feasible enterprises and capital resources, except that the 240-acre farms include 72 more acres of cropland than the 160-acre farms.

USUAL FARM ORGANIZATIONS

Census data indicate no significant differences in organization or output between owner-operated and tenant-operated farms of the same size and organization. Thus, the usual organizations presented for owner-operated farms (table 16) can be considered representative of tenant-operated 240-acre farms. The net incomes to tenants obtained from the three representative plans in table 16 are:

Plan 1 (9 dairy cows) $4,350
Plan 2 (12 dairy cows) 4,814
Plan 3 (no dairy cows) 3,134

VARIOUS LEVELS OF CAPITAL AND USUAL PRODUCTION PRACTICES

The changes in organization of a 240-acre tenant-operated farm associated with the successive increases in operating capital (table 19) follow the same general pattern as those for the tenant-operated 160-acre farm. At lower capital levels (less than $2,500) the plans that maximize returns include only an intensive grain-producing rotation (CCSb) with no livestock. Livestock enterprises enter the plans after enough capital

TABLE 19. OPTIMUM PLANS FOR 240-ACRE TENANT-OPERATED FARMS WITH DIFFERENT LEVELS OF OPERATING CAPITAL AND SPECIFIED PRICES.

Plan	Operating capital				Farm organization						
	Annual cash expenditures		Investment in livestock and equipment	Total operating capital	Crop rotations	Corn sold or purchased	Livestock				Net income
	Crops	Livestock					Sows	Yearlings	Beef cows	Hens	
	(dollars)	(dollars)	(dollars)	(dollars)	(acres)	(bushels[a])	(No.)	(No.)	(No.)	(No.)	(dollars)
1	1,490	—	—	1,490	213 $CCSb_0$	2,556	—	—	—	—	2,415
2	1,966	—	—	1,966	213 $CCSb_1$	3,266	—	—	—	—	3,066
3	2,434	—	—	2,434	213 $CCSb_2$	3,763	—	—	—	—	3,449
4	2,434	806	614	3,854	213 $CCSb_2$	1,783	9	—	—	—	4,443
5	2,434	1,360	790	4,584	213 $CCSb_2$	1,453	9	—	—	200	4,760
6	2,410	1,974	912	5,296	193 $CCSb_2$	942	10	—	—	200	4,921
					20 $CSbCOM_2$	—	—	4	—	—	—
7	2,342	3,070	1,274	6,686	135 $CCSb_2$	—	12	—	—	200	5,077
					78 $CSbCOM_2$	—	—	11	—	—	—
8	2,289	4,387	1,781	9,929[b]	90 $CCSb_2$	—1,091	15	—	—	200	5,406
					123 $CSbCOM_2$	—	—	19	—	—	—
9	2,239	4,081	3,329	11,624[b]	47 $CCSb_2$	—1,462	16	—	—	200	5,530
					166 $CSbCOM_2$	—	—	15	5	—	—

[a] Plus sign indicates corn sold while a minus sign indicates corn purchased.

[b] It also includes the outlay made for the purchase of additional corn.

is available to apply the second level of fertilizer. The second fertilization level requires 45 pounds of nitrogen, 50 pounds of phosphorus and 20 pounds of potassium for each acre of first-year corn in the $CCSb_2$ rotation, and 50 pounds of nitrogen, 25 pounds of phosphorus and 20 pounds of potassium per acre of second-year corn. These amounts are 50 percent more than those used by farmers in the area in 1954.[9]

Plan 4 in table 19 is the first plan for which operating capital is sufficient to include livestock. This plan has sows raising two litters (18 litters of pigs). Plan 4 uses $3,854 of operating capital and yields a net income of $4,443. About the same net income would be obtained by a tenant following the usual plan 1 in table 16 but using more labor and 44 percent more capital. A reorganization of the farm enterprises as in plan 7, table 19, that uses the same amount of resources as the usual plan 1 in table 16 would improve farm net income by around 20 percent.[10] This point can be illustrated with a comparison of the usual plan 1 of table 16 with plan 7, table 19. Actually, plan 7 uses $223 less capital but its net income is still $727, or 16.7 percent, more than the $4,350 obtained by a tenant operator from the usual plan 1. The cropping system in plan 7 includes more corn and soybeans and calls for more fertilizer. Crops under plan 7 require $2,342 for annual cash expenditures, as compared with $1,462 under the usual plan 1 of table 16. In plan 7, the livestock system includes the same number of sows as the usual plan, but the herd of 9 dairy cows in the usual plan is replaced with a cattle-feeding enterprise of 11 yearlings. All the feed produced is fed to the livestock. Hogs and fat steers are the primary source of income.

With a larger livestock program, additional feed must be purchased. For example, plan 8 in table 19 has a livestock system of 30 litters of pigs (15 sows), 19 yearlings and 200 hens. The plan uses $9,929 of operating capital, including $1,473 for purchase of 1,091 bushels of corn. The additional capital, $3,243, used in plan 8 gives a return of 14.5 percent, suggesting that tenants could productively use additional capital. With the going rate of interest, projected price relationships and farming practices, it is estimated that an average tenant could profitably invest $4,000 in addition to the capital now being used on typical rented farms.

Competitive Position of the Dairy Enterprise

The results of this study are highly consistent with trends in north-central Iowa over the last decade. The number of farms with small dairy herds has been decreasing quite rapidly, and to an increasing extent, herds have come to be concentrated on farms with larger commercial dairy enterprises. This study indicates that with the usual practices and with the markets available to farmers with small dairy herds, farm plans or organizations which do not include dairying can be more profitable. With improved dairy management practices, particularly under grade A markets, however, the dairy enterprise is in a favorable competitive position as compared with other enterprises when typical management practices found in north-central Iowa are used. Nevertheless, a competitive dairy enterprise generally requires a larger herd and greater investment in dairy cows and equipment. Hence, a continued trend toward further concentration of dairy production on farms with larger commercial herds can be expected.

It should be emphasized, however, that as trends such as those represented by changes among plans may occur, the outcome for the individual farm may differ from that for the masses of farmers.

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[9] U. S. Dept. Agriculture and Iowa Dept. Agriculture, cooperating. Iowa Census of Agriculture, Crop and Other Farm Statistics of Selected Townships. 1954.

[10] Usual plan 1 in table 14 can be compared also with plans 1 and 2 in table 19.