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farm business NOTES

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MACHINERY COSTS ARE LOWER ON LARGE FARMS

John Ying and S. A. Engene

Average farm size continues to increase in Minnesota. Many people, concerned about this, wonder if the trend is desirable and if it will continue. The increasing use of machinery and the possibilities of spreading costs by operating more land are considered important causes of the increase in farm size. Therefore, study of the relationship of farm size to machinery costs and economies in crop production is desirable.

Most data used for this study were obtained from farm accounting records of members of the Southeastern and Southwestern Farm Management Services. Information was available for 138 farmers who kept records for all 6 years of 1955 to 1960.

Machinery and power costs are important in crop production. Annual costs for machinery and power for crop work on these farms averaged more than $16 per acre of tillable land. The average value of crops produced per acre was $51, at today's prices. Machinery and power costs, then, absorbed almost one-third of the value of the crops. Any material reduction in these costs would help increase operation profits.

Investment in power and machinery is also an important share of the total capital needed in farming. The average investment in power and machinery on farms of 240 acres (the average farm size in this study) was about $8,000. This was almost one-sixth of the total farm investment. It was more than half as big as the investment in livestock, even though most of these farms fed their crop production to livestock. This heavy investment in machinery may leave less capital available for other uses or force the farmer to borrow more money.

SPREAD YOUR COSTS

A farmer might reduce the cost per acre by increasing the amount of land he operates. There are two primary reasons for this.

First, machines are not used to capacity on many farms. By adding land, the field costs are spread over more acres, reducing the cost per acre. Fixed costs (depreciation, interest, taxes, insurance, etc.) are a large part of the total operation cost. Variable costs per acre (e.g., gas, oil) do not increase.

Second, with more land, the farmer may be able to use larger machines.

Table 1. Average machinery and power investments,* annual machinery and power costs, and index of crop yields for farms of different sizes

Acres per farm	Number of farms	Average size	Investments per tillable acre†	Annual costs per tillable acre†	Index of crop yields†
		acre	dollars	dollars	
Under 140	9	121	23.93	16.12	97
141 to 180	24	161	29.34	18.80	106
181 to 220	25	201	29.68	17.13	104
221 to 260	31	243	27.31	16.05	100
261 to 300	18	280	30.94	16.36	101
301 to 400	27	332	26.78	15.35	99
401 to 500	4	453	21.04	12.20	95

* The portion charged to crop production only.
† Tested by analysis of variance. The difference between groups was not significant at the 5-percent level.

Table 2. Percentage of machinery and power costs in hired power

Acres per farm	Percent of costs
Under 140	20
141 to 180	15
181 to 220	13
221 to 260	12
261 to 300	13
301 to 400	10
401 to 500	8

Machine costs do not increase in proportion to machine capacity, so costs per acre fall. No careful analyses were made, but observation indicated that men on larger farms used larger machines.

This gain from larger machines may be partly offset by the tendency of large farm operators to use newer machines. With large acreages, breakdowns can cause heavy losses. Therefore, machines are kept only during the years when they are new and depreciation is high.

The average investment and annual costs per tillable acre for power and machinery are given in table 1. There is no clear-cut evidence that operators of large farms will have lower investments per acre than operators of small farms. Farmers with the largest farms —401 to 500 acres—had the lowest investments. But, operators of the smallest farms had the next lowest investments. The highest investments were on farms of 261 to 300 acres.

Several factors may explain this lack of a relationship to farm size. First, operators of small farms may use older machines. Moreover, many of these farmers do not own bigger machines, especially the big harvesting machines. Instead, they hire custom operators to do the work (see table 2).

Information as to the amount spent for machine hire is not readily avail-

able. However, the amount spent for the power share of custom work is known. On the small farms, 20 percent of the total power and machinery cost for crop production was for hired power; on the largest farms this was only 8 percent. The cost of hired machines probably was less but most likely declined by about the same proportion.

Second, examination of individual records shows a large difference in investments between farmers operating the same amount of land. This may be partly due to differences in the need to mechanize in order to save labor. It may also be due to differences in farmers' desires to own machines or in sales resistance.

Third, past studies showed that, on the average, operators of large farms have higher earnings than operators of small farms. Therefore, they may be able to afford the luxury of owning machines to reduce drudgery or as a consumptive investment.

It is possible that, on the average, operators of large farms may hold their investments lower. But, they will not always do so.

ANNUAL COSTS

Annual cost per tillable acre decreases more consistently with increasing farm size. Here, too, costs are low for the smallest farms. This is probably due in part to: (1) the ownership of older and fewer machines, and (2) less substitution of machinery for labor.

Machinery and power costs included depreciation, interest on investment, taxes, insurance, repair and upkeep, gas and oil, custom work hired, and electric bills. The full cost of crop machinery was included. Only that part of the expenses for tractors, trucks, autos, and electricity used for crops was included.

Let us assume that the annual costs per tillable acre shown in table 1 are truly representative of costs on farms of different sizes. Then, the large farms have a substantial advantage over small farms. Costs on the farms of 141 to 180 acres (quarter-section farms) averaged $18.80 per acre. Costs on the farms with 401 to 500 acres (almost three quarter-sections each) averaged only $12.20 per acre. This is an advantage of $6.60 per acre.

If other costs per acre and income per acre were not influenced by farm size, large farms could earn an additional profit of $6.60 per acre. This is a substantial gain compared with the average profit of farmers.

This advantage is even more striking if we look at the data in a slightly different way. Assume that a farm with 480 acres, of which 390 is tillable, has machinery costs of $12.20 per acre—the same as on farms with 401 to 500 acres. Total machinery costs would be about $4,800. Now assume that this farm is broken into three farms of 160 acres each. With costs of $18.80 per acre, or about $2,400 for each farm, the total cost for the 480 acres would be about $7,200. Operating this land as one farm saves $2,400 in machinery and power.

But, yields were not the same on all of these farms. The index of yields on farms with 141 to 180 acres was 106, or 6 percent above average. If the average value per acre of crops is $51, as indicated earlier, the value produced on these farms would be $54. The farms with 401 to 500 acres, on the other hand, had yields 5 percent below average, or a value of $48 per acre.

The value of crops on the quarter-section farms was $6 more than on the group of largest farms. This almost offset the higher machinery costs. In other words, if power and machinery costs were subtracted from the value of the crops, the net margin available to pay other costs was about the same for the two farm sizes.

Differences in crop yields shown on these farms were greater than shown by other studies. Differences in crop yields between farms of different sizes usually are small. In some cases, operators of large farms have higher yields than operators of small farms.

SUMMARY

Data from these farms indicate that large farms can operate with lower crop machinery and power costs per acre than small farms. This difference may be large enough to be significant.

On larger farms the yields will probably be somewhat lower, although the difference may be smaller than found in this study. These lower yields will offset part of the advantage the larger farms have in reducing costs.

However, there is a good opportunity for any farmer to hold his power and machinery costs down by (1) careful planning and buying, and (2) careful maintenance of machines. A farmer on a small farm may be able to hold his costs below the average large farm operator.

These advantages in lower costs will tend to cause farms to grow larger, but it is not an extremely strong force.

Characteristics of Efficient Dairy Farmers

Roger Johnson and S. A. Engene

Efficient production is essential for a dairy farmer to show a profit under present price relationships. How do efficient farmers differ from those who are less efficient? To find an answer, 46 dairy farmers, members of the Southeast or Southwest Minnesota Farm Management Services, were studied.

It was concluded that efficient dairy farmers:

1. Prefer working with the dairy enterprise.
2. Have a high level of knowledge concerning dairy production facts and relationships.
3. Follow most generally recommended dairy production practices.
4. Do a superior job in carrying out dairy production tasks as indicated by conditions on their farms.

Efficiency in dairy production was measured in terms of the average butterfat production per cow adjusted for the amount of grain fed. This efficiency measure was determined for each farmer in the study using his average farm record results of the 5 years 1956 to 1960.

Work Preferences

Farmers who like working with dairy, or at least do not prefer working with other farm enterprises, are likely to spend the time and effort necessary to attain efficient production levels.

Each farmer in the study was asked, "Do you prefer doing field work or do you prefer working with livestock?" Then they were asked, "Not taking into account which you think makes you the most money, do you prefer working with dairy or hogs?"

The farmers were not forced to make a choice; therefore, some farmers indicated no preference. The adjusted butterfat production per cow achieved by farmers answering the above questions in each possible way is presented in table 1.

The farmers who preferred livestock over field work and also preferred dairy

Table 1. Adjusted butterfat production per cow for farmers indicating various work preferences*

Livestock preferences	Preferences between crop and livestock					
	Field work		Livestock		No preference	
	Number farmers	Pounds of butterfat	Number farmers	Pounds of butterfat	Number farmers	Pounds of butterfat
Prefer hogs	4	301	1	261	7	334
Prefer dairy	4	327	6	376	10	371
No preference	2	356	2	322	10	358
Total or average	10	322	9	351	27	357

* Butterfat production per cow was adjusted to the estimated production with 3,000 pounds of grain fed per cow per year.

over hogs had the most efficient production. Nearly as efficient production was achieved by farmers with no preference between field work and livestock but who preferred dairy over hogs. The least efficient production was achieved by those preferring hogs over dairy.

Knowledge

In addition to liking dairy a farmer must make good decisions concerning production practices and problems if he is to attain efficient production. Good decisions cannot be made without sufficient knowledge of dairy production facts and relationships. Each farmer in the study was tested to measure his dairy knowledge. Farmers who scored highest on this test tended to have the most efficient production; those who scored lowest had the least efficient production (see table 2).

Table 2. Adjusted butterfat production per cow related to the score obtained in test of dairy knowledge

Test score	Number of farmers	Pounds butterfat per cow
20 to 22	5	376
18 to 19	14	364
16 to 17	14	335
14 to 15	9	348
Under 14	4	315

Table 3. Number of recommended dairy practices followed as related to the score attained in test of dairy knowledge

Knowledge score	Number of farmers	Number of practices
20 to 22	5	6.4
18 to 19	14	6.0
16 to 17	13	5.9
14 to 15	9	5.9
10 to 12	4	4.5

Production Practices Followed

That a high level of knowledge results in better decisions is further brought out by another fact. Farmers with the highest level of dairy knowledge also followed more production practices generally recommended by production specialists. The farmers were asked whether they followed these production practices:

1. Feed grain to each cow according to her level of production.
2. Feed grain to cows that are dry.
3. Keep individual cow production records.
4. Feed grain with pasture.
5. Mark and keep records of all heifer calves born.
6. Specify the bulls to be used in artificial breeding.
7. Use rotational grazing or confined summer forage feeding.
8. Use a hay conditioner or grass silage to improve forage quality.

The relationship between the number of these practices followed and the score attained in the dairy knowledge test is presented in table 3.

The farmers who followed a large number of these practices achieved more efficient production (see table 4).

Carrying Out Practices

It is not enough just to decide to follow certain production practices. They must be carried out properly to obtain the desired results.

For example, the decision may be made to feed cows grain according to their production level. One detail necessary for implementing this decision is that of keeping feed mangers clean. If they are not clean, feed may be wasted due to mixing with dirt and stale feed. Then the cows do not eat the quantity of feed fed them.

The most efficient dairy producers did a better job in carrying out the tasks than less efficient producers.

The ability or desire to carry out tasks was measured by observation on the farm of how well certain tasks had been done. Included were such items as cleanliness of barns and repair of fences. Each task observed was given a rating from which a total score was determined. The relationship between the score the farmer received in carrying out tasks and his production efficiency is shown in table 5.

Conclusions

Dairy farmers who wish to improve efficiency need to ask themselves:

Do I like dairying?

Am I willing to take the time and effort necessary to become well informed about feeding, breeding, diseases, and new technology?

Do I follow the production practices that I know should be followed?

Do I do a good job in carrying out necessary daily tasks such as keeping barn and equipment clean and in good repair?

Farmers who cannot answer yes to most of these questions are not likely to achieve the production levels necessary to earn an adequate return for the time and resources devoted to dairy. They should consider shifting to nonfarm work or other livestock enterprises that fit their farm resources and for which they can give "yes" answers to these questions.

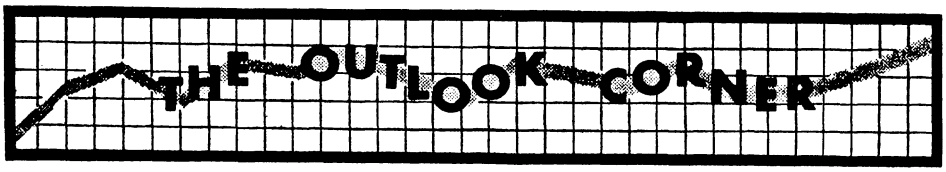
Table 4. Adjusted butterfat production per cow as related to the number of recommended production practices followed

Number of practices followed	Number of farmers	Pounds of butterfat per cow
8	9	386
7	13	358
5 to 6	14	343
3 to 4	6	338
0 to 2	4	272

Table 5. Adjusted butterfat production per cow as related to score received in carrying out tasks*

Score	Number of farmers	Pounds of butterfat per cow
15 to 17	3	357
13 to 14	8	371
11 to 12	7	351
8 to 10	6	352
Below 8	5	294

* Includes only the 29 farmers selling manufacturing milk; producers of grade A milk are excluded because their scores were not comparable.



W. A. Tinsley and S. A. Engene

More and more Minnesota farmland is being operated in large farms. This has caused concern to many people. They fear that the agricultural production of the state will be dominated by large operators.

What are the facts at the present time? What are probable future trends?

People differ in their concept of a large farm. The 1959 U.S. Census of Agriculture reports that 1 percent of the farmland in Minnesota is in farms of 2,000 acres or more. If these are "large farms," then only a little land is handled by large operators.

What if we reduce the limits of what we mean by a large farm? In 1959 farmers with 1,000 acres or more operated 4 percent of the farmland; farmers with 500 acres or more operated 16 percent.

The quarter-section farm has long been a standard of size in large parts of Minnesota. Almost three-fourths (72 percent) of the farmland is in farms bigger than this (see table 1).

The proportion of land operated in large units increased in the last 20 years (there was little change in the decade from 1930 to 1940). For example, land in farms of 500 acres or more increased from 8 to 16 percent of all farmland. This shift became more rapid in recent years.

This shift to large farms has been taking place in all parts of Minnesota (see table 2). In the six Red River Valley counties of northwest Minnesota, one-half of the land is now in farms of 500 acres or more. The acreage in farms of this size rose from 1.3 million acres in 1940 to 2 million in 1959. Even a farm of 500 acres cannot be considered very large in the Red River Valley. With modern machinery and cash crops, a 500 acre farm can be operated by one man with only a little extra help.

The trend to larger farms has been equally rapid in other parts of Minnesota. But, the change started from smaller farms. In the eastern two-thirds of Minnesota (top three sets of figures in table 2), with more than half of the state's farmland, 1.9 million acres were in farms of 500 acres or more in 1959. This had increased from 1.1 million in 1940. In this area, however, 5.9 million acres out of 17.3 million are in farms with less than 180 acres—that is, farms of a quarter section or less.

Why did this trend toward larger farms take place?

1. Profit margins have narrowed. Therefore, farmers are anxious to increase farm size, and thus business volume, whenever possible.

2. Larger machinery enables farmers to operate larger farms. At the same time it necessitates larger acreages in order to reduce machinery overhead costs to profitable levels.

3. Land can be combined into larger farms only when some farmers retire or move to nonfarm employment. Established farmers have found it easier to acquire this land than have farmers who would operate the land as a single unit.

Will the trend toward larger farms continue? The answer appears to be yes. Low prices for farm products coupled with increasing cash-operating costs will encourage farmers to increase their farm size.

The rate at which farm sizes will increase depends upon the rate at which farmland becomes available for consolidation into larger farms. Many farmers wish to expand their farms but land is not available. The rate of migration from agriculture will dictate the rate of increase in farm size during the coming decade.

Table 1. Distribution of Minnesota farmland by size of farm

Year	Acres per farm: Under 140	140 to 179	180 to 259	260 to 499	500 and over
	percent of total farmland				
1930	20	22	22	28	8
1940	20	21	22	28	9
1945	17	20	23	30	10
1954	13	18	23	33	13
1959	12	16	21	35	16

Source: U. S. Census of Agriculture

Table 2. Acres of Minnesota farmland by size of farm and geographic area, 1940 and 1959

Area and year	Acres per farm: Under 140	140 to 179	180 to 259	260 to 499	500 and over
	millions of acres				
Northeast:					
1940	1.4	.7	.4	.4	.2
1959	.4	.3	.5	.7	.3
East central to north central:					
1940	1.7	1.4	1.4	1.7	.6
1959	.9	.9	1.4	2.1	1.0
Southeast to south central:					
1940	2.3	2.2	2.4	1.9	.3
1959	1.6	1.8	2.4	2.4	.6
Southwest to west central:					
1940	.7	2.2	2.2	3.6	.7
1959	.5	1.5	2.2	3.9	1.1
Northwest:					
1940	.2	.4	.5	1.6	1.3
1959	.1	.2	.3	1.4	2.0
State:					
1940	6.3	6.9	6.9	9.2	3.1
1959	3.5	4.7	6.8	10.5	5.0

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