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**COSTS AND
RETURNS OF
PRODUCING
GRADE A MILK
IN ALABAMA**

**AGRICULTURAL EXPERIMENT STATION
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COSTS and RETURNS of PRODUCING GRADE A MILK in ALABAMA¹

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DAIRY FARMING IN ALABAMA

PRODUCING FLUID MILK has furnished a major source of income for a sizable number of farmers in Alabama for years. While income from some enterprises on farms in Alabama is considered secondary, the dairy enterprise is usually the primary source of income on farms that have a dairy operation. In fact, a large percentage of the dairy farmers in Alabama depend almost entirely on fluid milk as a source of income.

Economic pressure has caused most dairy farmers to expand production and improve efficiency or get out of the business. Thus, the cost-price squeeze has caused major changes in the dairy industry and has increased the importance of an efficient manager. The cost and quantity of qualified labor has caused dairy farmers to invest in labor-saving facilities, which has resulted in larger capital outlays and wider use of credit. The decreased profit margin is another reason for dairy farmers having to increase size and output.

¹ This report is based on research carried out under State Project Ala. 1-046 supported by Main Station Funds.

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OBJECTIVES OF THE STUDY

Alabama dairy farmers now need, more than ever, access to accurate up-to-date information about all phases of dairy operations. Much cost information available to Alabama dairy farmers is out of date. The rapid increase in price of inputs creates a constant need for accurate up-to-date information on cost of all inputs. Alabama dairy farmers also need data on amount of capital investment, machinery and equipment, and labor requirements. This study was conducted to provide such information.

The primary objectives of this study were:

1. To determine the dollar value of inputs (costs) used and the returns for producing Grade A milk.
2. To determine the effect of size of enterprise on dollar value of inputs, average production, investment required, and net returns.
3. To determine resources used and investment required for dairy enterprise.
4. To determine the effect of efficiency on dollar value of inputs (costs), investment, and net returns.

METHOD OF STUDY

Selection of Sample

Data used in this study were collected by personal interviews with dairy farmers throughout the State. All farmers taking part in the study were members of the Dairy Herd Improvement (DHI) Program. It is recognized that these farmers have access to records that may improve their efficiency and may not represent the average Grade A milk producer in Alabama.

An attempt was made to collect information from 100 dairy-men, 20 in each of five different size groups. However, because of the shortage of time and other conflicts, only 78 farmers were interviewed. After editing, only 75 of these schedules could be used in the study.

Farmers taking part in the study were selected by stratified random sampling all members of the DHI Program with the stratification being five different size groups in both northern and southern Alabama, Figure 1. All data used were based on milk production and feed produced and fed in 1969. The type of

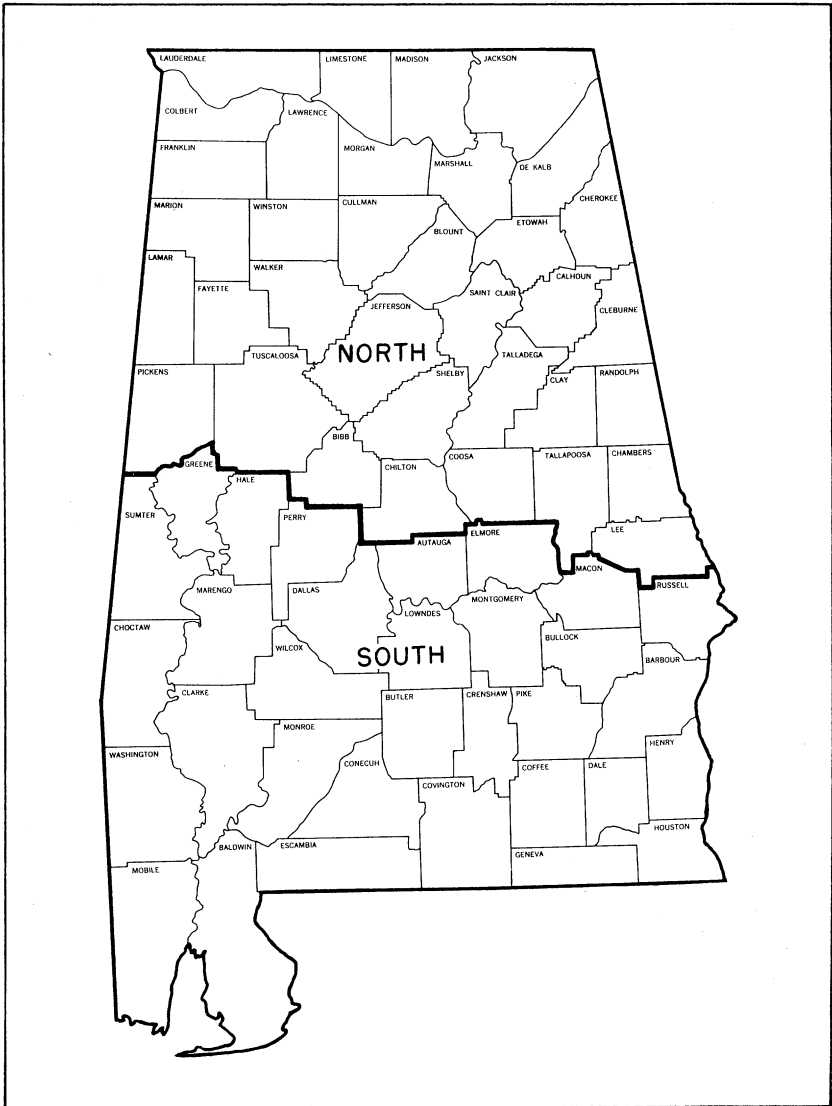


FIG. 1. Milk production areas, Alabama, 1969.

dairy operation did not limit the use of any data from any farmer. Therefore, all types of dairy operations and all size operations are represented in this study.

Cost Procedures

Silage, grain, and other feeds produced by the farmer were charged at a rate based on budgets developed as a part of this study, Appendix Tables 1 through 5. Only variable expenses, seed, fertilizer, and lime were charged and these were based on rates and prices reported by the farmer. All other feeds, mostly mixed dairy ration, were charged at costs reported by the farmer.

Pasture costs were based on temporary and permanent pasture budgets developed as a part of this study, Appendix Tables 6, 7, and 8. Only variable expenses of seed, fertilizer, and lime were based on rates and prices reported by the farmer.

All other variable costs, such as supplies, utilities, breeding fees, and other cash expenses, with the exception of interest on operating capital, were charged at the rate reported by the farmer. Interest on operating capital was charged at 8 per cent per annum for 3 months.

Charges for buildings, machinery, and equipment were based on an annual rate of depreciation as calculated using the straight line method of depreciation. An expected life as reported by the farmer and a salvage value equal to 10 per cent of the original cost were used on all buildings. The expected life of machinery and equipment was also recorded by the farmer with a zero salvage value used.

Interest on average investment was charged at 6 per cent per annum. Average investment used was actual investment the farmer had in 1969, which included buildings, machinery, equipment, and all livestock. Other fixed costs, such as insurance and taxes, were charged at the rate reported by the farmer.

Hired labor costs were charged at the rate reported by the farmer. Operator and family labor was charged at \$1.50 per hour. All labor used was based on number of months reported by the farmer.

Many dairymen have purchased milk quotas that have increased their capital assets. Milk quotas affect costs only by an interest charge on average investment. Because of this small cost, milk quotas were not considered in this study.

CHARACTERISTICS OF DAIRY FARMS IN ALABAMA IN 1969

The number of dairy farms in Alabama has been decreasing in recent years. In 1969 this number had decreased to approximately 850 Grade A milk producers. This was about 57 per cent less than in 1958 and nearly 35 per cent less than in 1963. Every county in Alabama that had dairies in 1958 has shown a decrease in number of dairies from 1958 to 1969.³

Crops Used for Dairy and Other Enterprises

Crops grown for dairy cattle were sorted into five categories: corn silage, other silage, grain, hay, and Coastal bermudagrass. Coastal bermudagrass for hay was treated separate from other hay crops because of the higher production cost.

The number and per cent of farmers growing certain crops for dairy operations and non-dairy crops are shown in Appendix Table 9. Costs of producing all varieties of hay except Coastal bermudagrass were averaged because of the large number of different types of hay produced.

Size of Farm

There was a wide variation in the number of acres in crops and pastures on each farm. This was partly because of variation in the type of dairy operations. Some farmers produced no feed while others produced almost all.

The total farm operation had an average of 756 acres with the smallest being 100 acres and the largest 3,900 acres. Amount of land used in the dairy operation averaged 434 acres with an average of 322 acres for non-dairy use.

Personal Characteristics of Farmers

Some personal characteristics of the 75 farmers interviewed were as follows:

<i>Characteristics</i>	<i>No. of years</i>
	<i>Av.</i>
Age.....	46
Formal education.....	13
Experience operating farm.....	21
Experience producing milk.....	18

³ Thomas McPherson Long, Jr., "Supply Adjustments in the Grade A Milk Industry of Alabama," (unpublished master's thesis, Auburn University, 1970), p. 18.

Twenty-eight producers indicated they had received some type of additional training for dairy operations. This training consisted of eight farmers attending breeding courses, eight farmers attending Extension short courses, and five farmers attending 4 years of college.

Twenty-seven reported entering the dairy business because of parental influence, 13 said they enjoyed working with dairy cattle, 10 reported dairying provided a high and steady income, and the remainder gave several different reasons for going into dairy business. The number and type of ownership of the farms were as follows:

<i>Ownership</i>	<i>No. of farms</i>	<i>Per cent of total</i>
Individual.....	47	63
Partnership.....	24	32
Corporation.....	4	5

Twenty-nine producers indicated they planned to expand herd size in the near future. Reasons for expansion were varied but the two most commonly given were to use resources more efficiently and the need to enlarge or get out of business. Only seven farmers planned to decrease herd size. The main reasons given were age of farmer and lack of dependable labor.

Artificial breeding was used by 70 farmers on 80 per cent of their herds with bulls being used primarily on heifers. Average per cow lactation period was 299 days. Certain production practices normally used by dairymen were adopted by some of these farmers. The number and per cent of farmers adopting these practices are shown in Table 1.

Several systems were given by which the farmers culled cows but in most cases farmers used a combination of all or some of the following methods: DHIA records, milk production of cow,

TABLE 1. NUMBER AND PER CENT OF MILK PRODUCERS USING SELECTED PRACTICES, 75 DAIRY FARMS, ALABAMA, 1969

<i>Practice</i>	<i>Using practice</i>	
	<i>No.</i>	<i>Pct.</i>
Clip or mow permanent pasture.....	73	97
Adjust grain ration according to cost of grain.....	43	57
Mix own feed.....	33	44
Isolate new animals.....	32	43
Grind own feed.....	31	41
Chemical weed control on pasture.....	26	35
Compute cost of ration.....	20	27
Weigh own milk.....	6	8

breeding ability, health, and age of cow. DHIA records were the means used most often with 22 farmers using only this method for culling cows.

Breed of Cattle and Type Facilities Used

Holstein has become the major breed of dairy cattle used in Alabama in recent years and in 1969, 63 of the 75 farmers interviewed were using Holstein as the major breed. Many farmers had Jersey cattle as a secondary breed and nine farmers were using Jerseys as a primary breed. Two farmers had Guernseys and one was using Brown Swiss as a major breed. Most farmers using Jersey as secondary breed were doing so to get a higher butterfat content in milk when Holstein was the major breed. There were 33 farmers that had only one breed.

Sixteen per cent of replacement heifers needed were purchased. Reasons for buying replacement heifers were as follows: can not raise enough, improve herd, inadequate facilities for raising heifers, and to increase herd size. Farmers that raised their own replacement heifers said these heifers were cheaper, better quality, and they could raise enough to replace culled cows.

All types of milking barns were used but the stanchion type was most common with 33 farmers using this type. Housing, other than dairy barn, was furnished for cows by 34 of the 75 farmers and the most common type housing was freestall and loafing barns.

Source of Labor

A wide variation was reported in labor requirements per farm. This was a result of the difference in management ability of farmers, size of farms, and amount of mechanization used in dairy operations. Hired labor was used on 68 of 75 farms and supplied more than half of the labor required on 54 farms. The amount of hired labor used ranged from none to 100 per cent. Seven of 75 farms used operator and/or family labor to perform all work required. A herd manager was hired by 15 per cent of the farmers and on 18 farms all the labor was hired. Many farmers using hired labor had some type of bonus pay system. For example, when milk production reached and surpassed a certain level hired labor received an extra \$50 that month. Farmers using incentive pay felt it prompted hired labor to do a better job and was a worthwhile expense.

Non-Farm Income

Only 14 farmers had income from off-farm jobs and the amount earned by farmers that worked off farm was as follows:

<i>Yearly income</i>	<i>No. of farmers</i>
\$2,500 to \$5,000.....	2
\$5,000 to \$7,500.....	5
\$7,500 to \$10,000.....	2
\$10,000 and over.....	5

Income from dairy enterprises accounted for more than half of total income on all farms except two. Income on these farms was from off-farm jobs and also from other crop and livestock enterprises. Thirty-one farmers received all income from the dairy operation, while 20 farmers had income from other crop enterprises, and 10 farmers received income from other livestock enterprises and other sources.

When reporting income for tax purposes, 65 farmers used the cash method with 10 using the accrual method. Also, 54 farmers reported capital gains or losses and 57 depreciated their cattle for income tax purposes.

Production of Grade A Milk

Herd size on dairy farms in this study averaged 145 cows with an average production per cow of 10,378 pounds of milk per year. The 75 dairy farms had an average production of approximately 1.5 million pounds of milk per farm. Total cost of producing milk varied from \$3.58 to \$8.69 per hundredweight of milk sold with the average total cost being \$6.73, Table 2. Total cost included a charge for labor but did not include a charge for land. Feed was the major cost item and averaged \$2.82 per hundredweight of milk sold. Included in feed cost were production costs of hay, grains, and silage crops. Feed cost accounted for 42 per cent of total cost with produced feed accounting for 7 per cent and purchased feed 35 per cent of total cost. Also included in total feed cost was the cost of feed for replacement heifers, calves, and bulls as well as feed for milking herd.

Pasture cost was the largest non-feed variable cost and non-feed variable costs accounted for 23 per cent of total cost. Labor accounted for 18 per cent of total cost and hired labor averaged 10 per cent.

Average gross returns per hundredweight of milk for the 75 dairy farms were higher than the average price of milk because

**TABLE 2. AVERAGE COSTS PER HUNDREDWEIGHT OF MILK SOLD,
75 DAIRY ENTERPRISES, ALABAMA, 1969**

Item	Amount
	<i>Dollars</i>
Feed costs	
Purchased.....	2.35
Produced.....	.47
Total.....	2.82
Non-feed variable costs	
Hauling.....	.29
Veterinary.....	.08
Supplies.....	.16
Breeding fees.....	.06
DHIA.....	.06
Pasture.....	.48
Utilities.....	.10
Machinery and equipment operation.....	.08
Other.....	.18
Interest on operating capital.....	.08
Total.....	1.57
Fixed costs	
Capital depreciation.....	.50
Interest, taxes, insurance.....	.63
Total.....	1.13
Labor costs	
Hired.....	.68
Operator and family.....	.53
Total.....	1.21
TOTAL COST.....	6.73
<i>Average 100 lb. of milk sold</i>	<i>14,966</i>

**TABLE 3. AVERAGE COSTS AND RETURNS PER HUNDREDWEIGHT
OF MILK SOLD, 75 DAIRY ENTERPRISES, ALABAMA, 1969**

Item	Amount
	<i>Dollars</i>
Gross receipts	
Milk sales.....	6.59
Livestock sales.....	.64
Inventory change.....	.28
Total.....	7.51
Costs	
Feed.....	2.82
Non-feed variable.....	1.57
Total fixed.....	1.13
Total.....	5.52
Returns	
Returns to land, labor, and management.....	1.99
Labor cost.....	1.21
Returns to land and management ¹.....	.78
Average investment.....	9.00
Return to investment.....	1.32
Per cent return to investment.....	14.7
<i>Average 100 lb. of milk sold</i>	<i>14,966</i>

¹ No charge for land was used. Average amount of land was 434 acres.

gross returns included the sale of cull cows, bulls, heifers, and calves. These sales were included because the cost of feed for replacement heifers and calves was included in total cost. The average gross return per 100 pounds of milk sold was \$7.51 and the average gross milk sales per hundredweight was \$6.59, Table 3. Also included in average gross receipts was the change in inventory of the dairy enterprise per hundredweight of milk sold.

Average net return to land, labor, and management was \$1.99 per hundredweight of milk sold for the 75 farmers interviewed. Operator and family labor was charged at \$1.50 per hour and hired labor was charged at the cost reported by the farmer. When average total labor cost was subtracted, average net return to land and management was \$.78 per hundredweight of milk sold. In addition to net return to land and management, the dairy farmers were receiving \$1.50 an hour labor income and 14.7 per cent return on average investment (excluding land).

Total labor utilized per hundredweight of milk sold was .90 hour with hired labor accounting for .55 hour per hundredweight, Table 4. Average total investment (new) is also included in Table 4 and averaged \$12.49 per 100 pounds of milk sold. The largest investment item (buildings, machinery, and equipment)

TABLE 4. AVERAGE INVESTMENT IN CAPITAL ASSETS (NEW) AND AVERAGE LABOR UTILIZED PER HUNDREDWEIGHT OF MILK SOLD, 75 DAIRY ENTERPRISES, ALABAMA, 1969

Item	Amount
	<i>Dollars</i>
Buildings and equipment	
Dairy barn.....	1.14
Hay barn.....	.63
Silo.....	.68
Other buildings.....	.68
Machinery and equipment.....	3.92
Total.....	7.06
Livestock	
Cows.....	4.06
Heifers.....	.95
Calves.....	.34
Bulls.....	.08
Total.....	5.43
TOTAL INVESTMENT (NEW) ¹	12.49
	<i>Hours</i>
Labor utilized	
Hired.....	.55
Operator and/or family.....	.35
Total.....	.90
<i>Average 100 lb. of milk sold</i>	14,966

¹ Total investment does not include land value.

accounted for \$7.06. Cows were the major single investment item amounting to \$4.06 per hundredweight and all livestock averaged \$5.43 per hundredweight of milk sold. Buildings, machinery, and equipment accounted for 56 per cent of average total investment and livestock accounted for 44 per cent. Land was not included in total investment.

Size of Enterprise

To determine if economies of size existed, the data were divided into five groupings. The average herd size and production of milk per cow for the five size groups were as follows:

<i>Herd size group</i>	<i>No. of cows</i>	<i>Pounds of milk produced per cow</i>
	<i>Av.</i>	<i>Av.</i>
Below 51.....	42	10,328
51 to 101.....	73	10,200
101 to 151.....	128	10,474
151 to 201.....	173	10,388
201 and over.....	338	10,139

Costs and Returns. The average total cost of production decreased at a decreasing rate as size of enterprise increased with the largest size group having the lowest average cost of \$6.47 per hundredweight of milk sold, Table 5. Feed cost per hundredweight of milk decreased as herd size increased up to the size group of 151 to 201 cows. Above this size feed cost increased and the two largest groups had the highest feed cost. The high feed cost in these two size groups resulted partially because these farmers bought a larger percentage of feed than those of other size groups. Non-feed variable cost, fixed cost, and labor cost decreased some as herd size increased. Labor cost was the major factor that decreased average total cost as herd size increased. Labor cost showed a definite decreasing cost trend as herd size increased, decreasing from \$1.52 for the smallest group to \$1.01 for the largest group.

Feed cost was the largest single cost item for all size groups with feed cost accounting for a larger percentage of average total cost as herd size increased. Feed cost increased in per cent of total cost from 39 per cent for the smallest group to 47 per cent for the largest group. Labor was the only cost item that decreased, in per cent of total cost, by a definite trend as herd size increased.

Gross sales per hundredweight of milk sold did not show any trend toward increasing as herd size increased. Gross sales ranged

TABLE 5. AVERAGE COSTS PER HUNDREDWEIGHT OF MILK SOLD, BY SIZE OF ENTERPRISE, 75 DAIRY ENTERPRISES, ALABAMA, 1969

Item	Size of enterprise by no. of cows				
	Below 51	51 to 101	101 to 151	151 to 201	201 and over
	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>
Feed costs					
Purchased.....	2.48	2.12	2.10	2.55	2.65
Produced.....	.46	.54	.51	.42	.40
Total.....	2.94	2.66	2.61	2.97	3.05
Non-feed variable costs					
Hauling.....	.30	.31	.30	.26	.26
Veterinary.....	.09	.06	.07	.08	.08
Supplies.....	.23	.14	.18	.13	.11
Breeding fees.....	.07	.07	.07	.04	.06
DHIA.....	.08	.07	.06	.06	.05
Pasture.....	.43	.44	.62	.49	.39
Utilities.....	.10	.11	.10	.07	.12
Machinery and equipment operation.....	.08	.08	.08	.08	.08
Other.....	.24	.21	.14	.13	.14
Interest on operating capital.....	.09	.08	.08	.09	.09
Total.....	1.71	1.57	1.70	1.43	1.38
Fixed costs					
Capital depreciation.....	.57	.54	.51	.43	.41
Interest, taxes, insurance.....	.68	.65	.62	.59	.62
Total.....	1.25	1.19	1.13	1.02	1.03
LABOR COST	1.52	1.26	1.13	1.11	1.01
TOTAL COST	7.42	6.68	6.57	6.53	6.47
<i>No. of producers</i>	13	17	18	14	13
<i>Average 100 lb. of milk sold</i>	4,338	7,458	13,459	18,001	34,233

TABLE 6. AVERAGE COSTS AND RETURNS PER HUNDREDWEIGHT OF MILK SOLD, BY SIZE OF ENTERPRISE, 75 DAIRY ENTERPRISES, ALABAMA, 1969

Item	Size of enterprise by no. of cows				
	Below 51	51 to 101	101 to 151	151 to 201	201 and over
	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>
Gross receipts					
Milk sales.....	6.57	6.74	6.58	6.70	6.41
Livestock sales.....	.85	.61	.59	.49	.70
Inventory change.....	-.05	.17	.47	.35	.39
Total.....	7.37	7.52	7.64	7.54	7.50
Costs					
Feed.....	2.94	2.66	2.61	2.97	3.05
Non-feed variable.....	1.71	1.57	1.70	1.43	1.38
Total fixed.....	1.25	1.19	1.13	1.02	1.03
Total.....	5.90	5.42	5.44	5.42	5.46
Net returns					
Returns to land, labor, and management.....	1.47	2.10	2.20	2.12	2.04
Labor cost.....	1.52	1.26	1.13	1.11	1.01
Returns to land and management....	-.06	.84	1.07	1.01	1.03
Average investment ¹	9.58	9.40	8.87	8.42	8.68
Returns to investment.....	.51	1.40	1.60	1.52	1.55
Per cent return to investment.....	5.3	14.9	18.0	18.0	17.9
<i>No. of producers</i>	13	17	18	14	13
<i>Average 100 lb. of milk sold</i>	4,338	7,458	13,459	18,001	34,233

¹ Average investment does not include land value.

from a low of \$7.37 for the smallest group to a high of \$7.64 for the size 101 to 151 cows and then decreased, Table 6. The smallest group was the only group showing a negative net return to land and management. The group of 101 to 151 cows had the highest returns to land and management with an average of \$1.07 per hundredweight of milk sold. Although dairy farmers in the smallest group were receiving a negative return to land and management, they had a labor income of \$1.50 an hour and a return to investment of \$.51 per hundredweight of milk sold. The per cent earned on investment was higher for the three largest groups and was about the same for all three groups.

Average (new) investment in buildings and equipment per hundredweight of milk sold was \$8.41 for the smallest group and the two largest groups had the smallest investment per hundredweight of milk sold in buildings and equipment, Table 7. This resulted because producers with larger herds could utilize fixed facilities more efficiently and thereby spread fixed costs over a larger output than producers with smaller herds.

TABLE 7. AVERAGE INVESTMENT IN CAPITAL ASSETS (NEW) AND AVERAGE LABOR UTILIZED PER HUNDREDWEIGHT OF MILK SOLD, BY SIZE OF ENTERPRISE, 75 DAIRY ENTERPRISES, ALABAMA, 1969

Item	Size of enterprise by no. of cows				
	Below 51	51 to 101	101 to 151	151 to 201	201 and over
	Dollars	Dollars	Dollars	Dollars	Dollars
Buildings and equipment					
Dairy barn.....	1.65	1.21	1.19	.74	.94
Hay barn.....	1.11	.44	.87	.42	.40
Silo.....	.48	.92	.65	.40	.64
Other buildings.....	.37	.92	.75	.42	.79
Machinery and equipment.....	4.80	3.86	4.18	3.60	3.08
Total.....	8.41	7.35	7.64	5.58	5.86
Livestock					
Cows.....	4.06	4.22	3.80	4.25	3.98
Heifers.....	1.15	.83	.74	1.06	1.07
Calves.....	.34	.36	.32	.32	.34
Bulls.....	.06	.09	.06	.11	.07
Total.....	5.61	5.50	4.92	5.74	5.46
TOTAL INVESTMENT (NEW) ¹	14.02	12.85	12.56	11.32	11.32
	Hours	Hours	Hours	Hours	Hours
Labor utilized					
Hired.....	.22	.57	.66	.65	.58
Operator and/or family.....	.88	.46	.17	.19	.10
Total.....	1.10	1.03	.83	.84	.68
No. of producers.....	13	17	18	14	13
Average 100 lb. of milk sold.....	4,338	7,458	13,459	18,001	43,233

¹ Total investment does not include land value.

The average investment in livestock varied among herd size groups with no definite trend. The lowest investment in livestock was \$4.92 per hundredweight of milk sold and this was the group from 101 to 151 cows. The largest investment in livestock was \$5.74 by the group of 151 to 201 cows. Total investment per hundredweight sold showed a marked decrease as herd size increased.

The amount of labor utilized by dairy farmers also showed a definite decrease as herd size increased. Labor hours utilized per hundredweight of milk sold decreased from 1.10 for the smallest group to .68 hours for the largest group. The amount of family labor used on farms showed a very marked decrease as herd size increased. Family labor accounted for 80 per cent of total labor utilized in the smallest group and only 15 per cent in the largest group.

Investments in machinery and equipment and cows were the largest investment in all size groups. Investment in buildings, machinery, and equipment accounted for a larger per cent of total investment than investment in livestock in all herd sizes except one.

Statistical Analysis. Analysis of variance was used to analyze the difference in cost per hundredweight of milk sold for the five size groups, Appendix Table 10. Although average fixed cost and average total cost decreased as herd size increased, labor was the only cost item that showed a significant difference among size groups. Feed, non-feed variable, fixed, and total costs were not significantly different among size groups. This analysis indicated that size of enterprise was not the major factor causing the difference in cost of producing Grade A milk.

The relationship between size of enterprise and cost of producing Grade A milk as size varied was estimated by least-squares regression techniques, Appendix Table 11. Costs were calculated for each of the 75 observations. Costs were determined using the price and factors presented and included cost of labor but excluded cost of land. The equation derived to estimate the influence of size of enterprise on cost was $Y = 7.677 - .01196X - .00003X^2 - .00000019X^3$, where Y = total cost per 100 pounds of milk sold and X = size of enterprise.

The cost curve, which was fitted to the preceding equation, is shown in Figure 2. The lowest point on the average cost curve was at a herd size of about 284 cows. This indicated economies to size existed up to herd size of 284 cows.

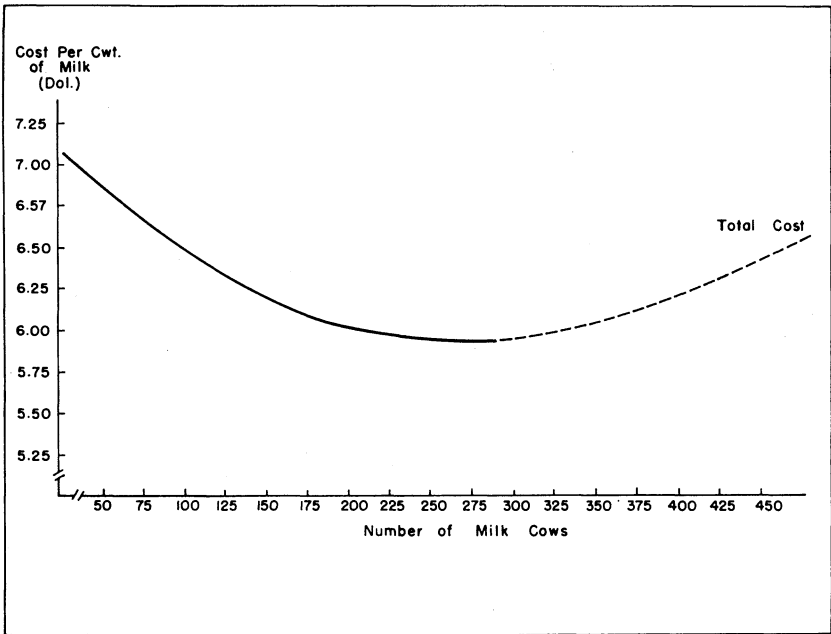


FIG. 2. Relationship between the unit cost of producing Grade A milk and size of enterprise for 75 dairy enterprises, Alabama, 1969.

The relationship between size of enterprise and each major cost item was also estimated, Appendix Table 11. This analysis indicated that labor cost was the only major cost item that showed a significant trend as size increased.

Average total cost also showed a significant trend and this was an indication that the average total cost of producing Grade A milk decreased as herd size increased from 26 cows to 284 cows. Beyond this herd size average total cost showed diseconomies to size. This analysis indicated that producers were able to utilize input factors more efficiently with larger outputs.

Cost of Production

The 75 milk producers were divided into three groups according to cost of production. These groups were designated as low, middle, and high cost groups with 25 producers in each group. Producers with the lowest cost were assumed to be the most efficient farmers. Average production per cow showed a decreasing trend from the low cost group to the high cost group and this was one explanation of the degree of variation in cost among the three

groups. Average herd size and production per cow for the three producer groups were as follows:

<i>Producer group</i>	<i>No. of cows</i>	<i>Pounds of milk produced per cow</i>	
		<i>Av.</i>	<i>Av.</i>
Low cost.....	155	11,183	
Middle cost.....	153	10,634	
High cost.....	129	9,319	

The breed of cows was one of the major reasons for the higher production and therefore lower cost per hundredweight of milk produced. The average composition of the herds for the low and high cost groups was as follows:

<i>Breed</i>	<i>Cost group</i>	
	<i>Low Pct.</i>	<i>High Pct.</i>
Holstein.....	85	56
Jersey.....	5	31
Guernsey.....	4	5
Brown Swiss.....	1	6
Mixed.....	5	2
Total.....	100	100

Costs and Returns. Average total cost of production per hundredweight of milk sold showed a marked difference among the three groups. Average total cost for the low, middle, and high cost groups was \$5.38, \$6.76, and \$7.90, respectively, Table 8. The low cost group of producers had a greater efficiency in all cost areas.

Feed cost showed the largest decrease from the high to the low cost group. The largest difference was in purchased feed cost with the low cost group averaging \$1.94 per hundredweight of milk and the high cost group averaging \$2.62 per hundredweight for purchased feed.

Non-feed variable, fixed, and labor costs also decreased from the high to the low cost group. The cost per hundredweight for hauling milk was the only cost that did not show a marked decrease among producer groups.

Feed cost accounted for 43 per cent of total cost in the low and middle cost groups but only 40 per cent for the high cost group. Hired labor accounted for 12 per cent of total cost for the low cost group while for the middle and high cost group hired labor accounted for 10 and 9 per cent of total cost, respectively.

Gross receipts showed an increase from the low to the high cost group. The low, middle, and high cost groups had gross sales of \$7.10, \$7.59, and \$7.80 per hundredweight of milk sold, respec-

TABLE 8. AVERAGE COSTS PER HUNDREDWEIGHT OF MILK SOLD FOR MILK PRODUCER GROUPS, BY COSTS OF PRODUCTION 75 DAIRY ENTERPRISES, ALABAMA, 1969

Item	Producer groups		
	Low cost	Middle cost	High cost
	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>
Feed costs			
Purchased.....	1.94	2.48	2.62
Produced.....	.40	.43	.58
Total.....	2.34	2.91	3.20
Non-feed variable costs			
Hauling.....	.28	.28	.29
Veterinary.....	.06	.07	.09
Supplies.....	.11	.16	.20
Breeding fees.....	.05	.06	.08
DHIA.....	.05	.06	.08
Pasture.....	.37	.48	.58
Utilities.....	.07	.11	.12
Machinery and equipment operation.....	.08	.08	.08
Other.....	.12	.16	.23
Interest on operating capital.....	.06	.08	.09
Total.....	1.25	1.54	1.84
Fixed costs			
Capital depreciation.....	.37	.53	.59
Interest, taxes, insurance.....	.52	.64	.73
Total.....	.89	1.17	1.32
LABOR COST.....	.90	1.14	1.54
TOTAL COST.....	5.38	6.76	7.90
<i>No. of producers</i>	25	25	25
<i>Average 100 lb. of milk sold</i>	17,246	15,861	11,793

tively, Table 9. These gross receipts included milk and livestock sales, and inventory change.

Net returns to land, labor, and management ranged from \$2.62 per hundredweight for the low to \$1.44 for the high cost group. The high cost group was the only group that had a negative net return to land and management. Even though the high cost group had a negative return, they were receiving \$1.50 per hour for operator labor income and 5.0 per cent return to investment. The low cost group was receiving a 29.2 per cent return to investment. The average investment did not include land value.

Average investment in buildings, machines, equipment, and livestock was \$10.11 per hundredweight of milk sold for the low cost group, \$12.55 per hundredweight for the middle and \$14.67 for the high cost group, Table 10. This is another indication that milk producers in the low cost group were the most efficient operators. This increased efficiency in the use of capital was a result

TABLE 9. AVERAGE COSTS AND RETURNS PER HUNDREDWEIGHT OF MILK SOLD, BY COST OF PRODUCTION, 75 DAIRY ENTERPRISES, ALABAMA, 1969

Item	Producer groups		
	Low cost	Middle cost	High cost
	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>
Gross receipts			
Milk sales.....	6.20	6.69	6.87
Livestock sales.....	.59	.58	.74
Inventory change.....	.31	.32	.19
Total.....	7.10	7.59	7.80
Costs			
Feed.....	2.34	2.91	3.20
Non-feed variable.....	1.25	1.54	1.84
Total fixed.....	.89	1.17	1.32
Total.....	4.48	5.62	6.36
Net returns			
Returns to land, labor, and management.....	2.62	1.70	1.44
Labor cost.....	.90	1.14	1.54
Returns to land and management.....	1.72	.83	.26
Average investment ¹	7.53	9.16	10.29
Return to investment.....	2.20	1.38	.52
Per cent return to investment.....	29.2	15.1	5.0
No. of producers.....	25	25	25
Average 100 lb. of milk sold.....	17,246	15,861	11,793

¹ Average investment does not include land value.

TABLE 10. AVERAGE INVESTMENT IN CAPITAL ASSETS (NEW) AND AVERAGE LABOR HOURS UTILIZED PER HUNDREDWEIGHT OF MILK SOLD, BY COST OF PRODUCTION, 75 DAIRY ENTERPRISES, ALABAMA, 1969

Item	Producer groups		
	Low cost	Middle cost	High cost
	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>
Buildings and equipment			
Dairy barn.....	.78	1.27	1.39
Hay barn.....	.46	.58	.90
Silo.....	.56	.83	.52
Other buildings.....	.57	.65	.78
Machinery and equipment.....	3.10	3.74	4.95
Total.....	5.47	7.07	8.54
Livestock			
Cows.....	3.48	4.12	4.57
Heifers.....	.85	.95	1.04
Calves.....	.27	.35	.38
Bulls.....	.04	.06	.14
Total.....	4.64	5.48	6.13
TOTAL INVESTMENT (NEW) ¹	10.11	12.55	14.67
	<i>Hours</i>	<i>Hours</i>	<i>Hours</i>
Labor utilized			
Hired.....	.49	.52	.63
Operator and/or family.....	.20	.31	.54
Total.....	.69	.83	1.17
No. of producers.....	25	25	25
Average 100 lb. of milk sold.....	17,246	15,861	11,793

¹ Total investment does not include land value.

partially of economies of size but mostly from better utilization of existing facilities by producers in the low cost group.

Another demonstration of greater efficiency by the low cost group was the hours of labor utilized per hundredweight of milk sold. The low cost group used .69 hour of labor per hundredweight of milk sold while middle and high cost groups used .83 and 1.17 hours, respectively. Difference in labor efficiency was an important reason for the large variation in cost among the three producer groups. Hired labor furnished 71, 63, and 54 per cent of total labor utilized for the low, middle, and high cost groups, respectively.

Cows were the major investment item for the low cost group and accounted for 34 per cent of total investment. Investment in all livestock was 46 per cent of total investment per hundredweight of milk sold for the low cost group with the middle and high cost groups being 44 and 42 per cent of total investment. Buildings, machinery, and equipment accounted for 54, 56, and 58 per cent of total investment for the low, middle, and high cost groups, respectively.

Statistical Analysis. Analysis of variance was used to analyze the difference in cost per hundredweight of milk sold for the three producer groups, Appendix Table 12. There was a significant difference in all major cost items among the three producer groups. The low cost group had costs that were significantly lower than the cost of the middle and high cost groups at all levels of the significance used in the test. This was expected because of the wide range in average total cost of production. This analysis demonstrates a significant difference in efficiency among the three producer groups.

Milk Production in Northern and Southern Alabama

To determine if there was any difference in costs and returns of producing Grade A milk in northern and southern Alabama, the data collected were sorted into two sections, based on location of the dairy farms.

Milk producers in southern Alabama had an average herd size larger than those in northern Alabama, but milk producers in northern Alabama had an advantage in production per cow. This higher average production per cow for milk producers in northern

Alabama was the major reason for the lower average total cost of production. The average herd size and production per cow for northern and southern Alabama were as follows:

Producer group	No. of cows	Pounds of milk produced per cow
	Av.	Av.
Northern Alabama.....	124	10,559
Southern Alabama.....	167	10,193

Cost and Returns. Gross receipts for producers in northern Alabama were slightly higher than gross receipts for producers in southern Alabama and this was a direct result of change in inventory, Table 11. Gross receipts averaged \$7.57 per hundredweight of milk sold for producers in northern Alabama and \$7.42 per hundredweight for those in southern Alabama.

Net returns to land, labor, and management were \$2.09 and \$1.73 for producers in northern and southern Alabama, respectively. After subtracting labor cost, net return to land and management was \$.87 for producers in northern Alabama and \$.54 for those in southern Alabama. In addition to the net returns to land and management the dairy farmers were receiving \$1.50 per hour labor income and 16 and 13 per cent returns to investment for producers in northern and southern Alabama, respectively.

TABLE 11. AVERAGE COSTS AND RETURNS PER HUNDREDWEIGHT OF MILK SOLD, BY LOCATION, 75 DAIRY ENTERPRISES, ALABAMA, 1969

Item	Location in Alabama	
	Northern	Southern
	<i>Dollars</i>	<i>Dollars</i>
Gross receipts		
Milk sales.....	6.57	6.60
Livestock sales.....	.62	.66
Inventory change.....	.38	.16
Total.....	7.57	7.42
Costs		
Feed.....	2.75	2.89
Non-feed variable.....	1.53	1.61
Total fixed.....	1.14	1.12
Total.....	5.42	5.62
Returns		
Returns to land, labor, and management.....	2.15	1.80
Labor cost.....	1.22	1.19
Returns to land and management.....	.93	.61
Average investment ¹	9.29	8.69
Returns to investment.....	1.49	1.13
Per cent return to investment.....	16.0	13.0
No. of producers.....	38	37
Average 100 lb. of milk sold.....	13,174	16,807

¹ Average investment does not include land value.

The slightly larger fixed costs for producers in northern Alabama were reflected in the larger average investment by these producers. Average total investment per hundredweight of milk for producers in northern Alabama was \$13.04 and only \$11.84 for those in southern Alabama. Investment in machinery and equipment was the largest investment item for producers in northern Alabama while investment in cows was the largest investment item for producers in southern Alabama.

GRADE A DAIRY ENTERPRISE BUDGETS

Enterprise budgets were developed using the costs, returns, and investment data developed in the analysis of economies to size. The costs, returns, and investment data were averaged and computed to three different size enterprises. A 60-cow enterprise budget was developed by averaging the first two size groups (below 101 cows) in the economies to size data. A 125-cow budget was developed from the data in the middle size group (101 to 151 cows) and a 250-cow budget was developed by averaging data in the last two size groups (above 151 cows).

Enterprise Budget for a 60-Cow Herd

A 60-cow enterprise budget was developed because it conformed closely with the average number of cows for the first two size groups, in the economies to size section, and because a 60-cow herd is about the maximum size herd one man can operate.

The budgeted receipts for a 60-cow herd were \$45,842.77, Table 12. Average milk production per cow was 10,255 pounds sold at an average price of \$6.67 per hundredweight. Inventory change was included in total receipts because total cost included the cost of producing replacement heifers.

Purchased feed was the major cost item averaging \$14,028.84. Tractor and equipment operating expense for a manure spreader used in disposing of manure was charged at \$.89 per hour of use. It was estimated that it took 6 hours per cow per year for manure disposal. Milk equipment and facilities operating expense was charged at \$2.00 per cow. The charge for hauling livestock was also \$2.00 a head and this was charged on cull cows, bulls, and heifers. Calves were assumed to be sold at the farm. Interest on operating capital was charged at an annual rate of 8 per cent for 3 months.

TABLE 12. ESTIMATED VARIABLE COSTS AND RETURNS FOR PRODUCING GRADE A MILK, 60-COW HERD, ALABAMA, 1969

Item	Description	Unit	Quantity	Rate	Amount
					<i>Dollars</i>
Receipts					
Milk.....	10, 255 lb. per cow	cwt.	6,153	6.67	41,040.51
Cull cows.....	14 head	head	14	230.00	3,220.00
Heifers.....	Culls over 1 year old	head	1	200.00	200.00
Bulls.....		head	.3	240.00	72.00
Calves.....	Under 1 year old	head	37	22.15	819.55
Inventory change.....		-----	---	---	430.71
TOTAL RECEIPTS.....					45,842.77
Variable expenses					
Pasture.....	(Temporary and permanent)	-----	---	---	2,707.32
Purchased feed.....	(Mixed dairy ration, grain, hay, vitamins, and minerals)	-----	---	---	14,028.84
Produced feed.....	(Hay, grain, and silage)	-----	---	---	3,076.50
Milk hauling.....		cwt.	6,153	.30	1,845.90
Veterinary.....		mo.	12	35.89	430.68
Breeding fees.....		head	47	9.17	430.99
Utilities.....		mo.	12	51.28	615.36
Dairy supplies.....		head	60	18.46	1,107.60
Other cash expenses.....		mo.	12	143.57	1,722.84
Tractor and equipment operating expense.....	(Clean up)	hr.	360	.89	320.40
Equipment operating expense.....	(Milkers, bulk tank, etc.)	head	60	2.00	120.00
Hauling cull livestock.....		head	15.3	2.00	30.60
Interest on operating capital.....	(26,436.82 for 3 mo. @ 8%)	-----	---	---	528.74
TOTAL VARIABLE EXPENSES.....					26,965.77
Returns over variable expenses.....					18,817.00

TABLE 13. ESTIMATED COSTS AND RETURNS FOR PRODUCING GRADE A MILK, 60-COW HERD, ALABAMA, 1969

Item	Amount
	<i>Dollars</i>
Total receipts.....	45,782.77
Total variable expense.....	26,965.77
Returns over variable expenses.....	18,817.00
Fixed costs	
Capital depreciation.....	3,384.15
Insurance and taxes.....	615.30
Interest (Average investment @ 6% per annum).....	3,499.83
TOTAL FIXED COST.....	7,499.28
Net returns	
Returns to land, labor, and management.....	11,317.72
Charge for labor.....	8,429.61
Return to land and management.....	2,888.11
Average investment ¹	58,330.44
Returns to investment.....	6,387.94
Per cent return to investment.....	10.9

¹ Average investment does not include land value.

Average fixed cost is shown in Table 13 and interest on investment was the largest fixed cost item averaging \$3,499.83. Average total fixed cost was \$7,499.28 and when average total variable cost was added average total cost was \$34,465.05. This left a net return to land, labor, and management of \$11,317.72. When labor cost was subtracted net return to land and management was \$2,888.11. Average investment was a total of \$58,330.44 or an average investment per cow of \$972.17. Investment did not include value of land used.

An itemized list of fixed costs is shown in Appendix Table 13. The largest average investment item was cows averaging \$25,534.95 and accounted for 44 per cent of total investment. Machinery and equipment was the largest fixed cost item averaging \$2,801.94. New investment in machinery and equipment was the largest new investment item averaging \$26,273.31. The average total new investment was \$82,204.08.

Enterprise Budget for a 125-Cow Herd

A 125-cow enterprise budget was developed because the middle size group (101 to 151 cows), in the economies to size section, averaged close to 125 cows. This budget showed a significant increase in efficiency over the 60-cow herd.

One reason for the increase in efficiency was the average milk production per cow. While the 60-cow herd had average production per cow of 10,225 pounds the 125-cow herd had average production per cow of 10,474 pounds, Table 14. The 125-cow

TABLE 14. ESTIMATED VARIABLE COSTS AND RETURNS FOR PRODUCING GRADE A MILK, 125-COW HERD, ALABAMA, 1969

Item	Description	Unit	Quantity	Rate	Amount
					<i>Dollars</i>
Receipts					
Milk	10,474 lb. per cow	cwt.	13,092	6.58	86,145.36
Cull cows	26 head	head	26	234.33	6,092.58
Heifers	Culls 1 year and older	head	.89		
Bulls		head	.89	257.50	229.18
Calves	Under 1 year old	head	62	23.72	1,470.64
Inventory change					6,153.24
TOTAL RECEIPTS					100,091.00
Variable expenses					
Pasture					8,117.04
Purchased feed	(Mixed dairy ration, grain, hay, vitamins, and minerals)				27,493.20
Produced feed	(Hay, grain, and silage)				6,676.92
Milk hauling		cwt.	13,092	.30	3,927.60
Veterinary		mo.	12	76.37	916.30
Breeding fees		head	101	9.07	916.07
Utilities		mo.	12	109.10	1,309.20
Dairy supplies		head	125	18.85	2,356.25
Other cash expenses		mo.	12	218.20	2,618.40
Tractor and equipment operating expense	(Clean up)	hr.	760	.89	676.40
Equipment operating expense	(Milking facilities)	head	125	2.00	250.00
Hauling cull livestock		head	27.78	2.00	55.56
Interest on operating capital	(55,313.31 for 3 mo. at 8%)				1,106.27
TOTAL VARIABLE EXPENSES					56,419.21
Returns over variable expenses					43,671.79

herd had an average of 62 calves sold at a price per head of \$23.72. Milk sales for the 125-cow herd were \$86,146.36 and the average price of \$6.58 per hundredweight of milk was lower than the price of \$6.67 per hundredweight received by the farmers in the smaller size group. Total receipts for the 125-cow budgets were \$100,901.00.

Feed cost accounted for a major portion of total variable expenses averaging \$27,493.20. Breeding fees per head were computed by using the average per cent of the herd the farmers artificially bred which averaged 101 head. Total variable expenses for the 125-cow herd were \$56,419.21.

The average return over variable expenses for the 125-cow budget was \$43,671.79. This indicated an increase in efficiency of the 125-cow herd over the 60-cow herd.

Interest on average investment was the largest fixed cost item accounting for \$6,967.56 of total fixed cost, Table 15. The 125-cow budget showed a marked decrease in labor cost per cow, compared to the 60-cow budget. Labor cost for the 125-cow budget was \$14,793.96.

To show the efficiency gained from a 60-cow budget to 125-cow budget, return to land and management was \$14,055.07 for the 125-cow budget and only \$2,888.11 for the 60-cow budget. Return to investment for the 125-cow budget was \$21,022.63 or 18.1 per cent compared to only 10.9 for the 60-cow herd.

TABLE 15. ESTIMATED COSTS AND RETURNS FOR PRODUCING GRADE A MILK, 125-COW HERD, ALABAMA, 1969

Item	Amount
	<i>Dollars</i>
Total receipts.....	100,091.00
Total variable expenses.....	56,419.21
Returns over variable expenses.....	43,671.79
Fixed costs	
Capital depreciation.....	6,676.92
Insurance and taxes.....	1,178.28
Interest (Average investment @ 6% per annum).....	6,967.56
TOTAL FIXED COST.....	14,822.76
Net returns	
Returns to land, labor, and management.....	28,848.97
Charge for labor.....	14,793.96
Return to land and management.....	14,055.07
Average investment ¹	116,126.04
Returns to investment.....	21,022.63
Per cent return to investment.....	18.1

¹ Average investment does not include land value.

Average total new investment for 125-cow budget was \$164,435.52, Appendix Table 14. Investment in livestock was the largest average investment item amounting to \$49,749.60.

Enterprise Budget for 250-Cow Herd

This budget was developed from the average costs of the two largest groups (above 151 cows) in the economies to size section. As shown by this budget, there was very little efficiency gained between a 125-cow herd and a 250-cow herd. The largest increase in economies of size was in the increase from a 60-cow herd to a 125-cow herd.

Average production per cow for the 250-cow budget was 10,268 pounds which was lower than the production per cow for the 125-cow budget. As a result the larger herd had gross receipts that were proportionally lower than the smaller herd. Gross receipts for the 250-cow budget were \$194,584.22, Table 16.

Purchased feed was the major variable cost accounting for \$66,742.00. Breeding fees averaged \$6.20 per cow and the 250-cow budget shows that 207 cows were artificially bred. Total variable expenses were \$113,020.45 which was about double the amount for the 125-cow budget and was an indication this larger herd showed no cost advantage. Returns over variable expenses for the 250-cow budget were \$81,563.77 and this was a slight decrease in returns per cow from the 125-cow herd.

The only noticeable advantage the 250-cow herd gained over the 125-cow herd was in the fixed cost. Average fixed cost was \$26,245.01, Table 17, which is proportionally lower than fixed cost for the smaller size herd.

Net return to land, labor, and management was \$55,318.76 for the 250-cow budget. After subtracting labor cost, return to land and management was \$28,108.56 which was almost double the net return to land and management for the 125-cow budget.

Average investment for this size herd was \$219,221.80 and return to investment was \$41,261.87 or 18.8 per cent. Average new investment in capital assets was \$290,071.00, Appendix Table 15. Investment in cows of \$105,760.40, was the largest single average investment item. This was a larger investment per cow for the 250-cow budget than for the 125-cow budget. While the investment in cows was proportionally larger for the 250-cow budget, the investment in machinery and equipment was proportionally smaller than the 125-cow budget.

TABLE 16. ESTIMATED VARIABLE COSTS AND RETURNS FOR PRODUCING GRADE A MILK, 250-COW HERD, ALABAMA, 1969

Item	Description	Unit	Quantity	Rate	Amount
					<i>Dollars</i>
Receipts					
Milk.....	10,268 lb. per cow	cwt.	25,670	6.56	168,395.20
Cull cows.....	60 head	head	60	225.78	13,546.80
Heifers.....	Culls 1 year and older	head	3.78	234.31	885.69
Bulls.....		head	.81	438.36	355.07
Calves.....	Under 1 year old	head	87	21.88	1,903.56
Inventory change.....					9,497.90
TOTAL RECEIPTS					194,584.22
Variable expenses					
Pasture.....		-----	---	---	11,294.80
Purchased feed.....	(Mixed dairy ration, grain, hay, vitamins and minerals)	-----	---	---	66,742.20
Produced feed.....	(Hay, grain, and silage)	-----	---	---	10,524.70
Milk hauling.....		cwt.	25,670	.26	6,674.20
Veterinary.....		mo.	12	171.13	2,053.56
Breeding fees.....		head	207	6.20	1,283.40
Utilities.....		mo.	12	192.52	2,310.24
Dairy supplies.....		head	250	12.32	3,080.00
Other cash expenses.....		mo.	12	406.44	4,877.28
Tractor and equipment operating expense.....	(Clean up)	hr.	1,500	.89	1,335.00
Equipment operating expense.....	(Milking facilities)	head	250	2.00	500.00
Hauling cull livestock.....		head	64.59	2.00	129.18
Interest on operating capital.....	(110,804.76 for 3 mo. @ 8%)				2,216.09
TOTAL VARIABLE EXPENSES					113,020.45
Returns over variable expense.....					81,563.77

TABLE 17. ESTIMATED COSTS AND RETURNS FOR PRODUCING GRADE A MILK, 250-COW HERD, ALABAMA, 1969

Item	Amount
	<i>Dollars</i>
Total receipts.....	194,584.22
Total variable expenses.....	113,020.45
Returns over variable expenses.....	81,563.77
Fixed costs	
Capital depreciation.....	10,781.40
Insurance and taxes.....	2,310.30
Interest (Average investment @ 6% per annum).....	13,153.31
TOTAL FIXED COSTS	26,245.01
Net returns	
Returns to land, labor, and management.....	55,318.76
Charge for labor.....	27,210.20
Return to land and management.....	28,108.56
Average investment ¹	219,221.80
Returns to investment.....	41,261.87
Per cent return to investment.....	18.8

¹ Average investment does not include land value.

SUMMARY AND CONCLUSIONS

Summary

The purpose of this study was to determine costs, returns, and investments required for producing Grade A milk. Also, to analyze the effect of size of enterprise and efficiency on costs, returns, and investments.

Data used in this study were collected by personal interviews with 75 dairymen who were members of the DHI Program. The farmers taking part in the study were selected by stratified random sampling of all DHI Program members with the stratification being five different size groups in northern and southern Alabama.

The average total cost per hundredweight of milk sold was \$6.73. Feed cost (excluding pasture cost) averaged \$2.82 per hundredweight of milk sold and accounted for 42 per cent of total cost.

Average gross receipts per 100 pounds of milk sold were \$7.51 with the average price of milk per hundredweight being \$6.59. Gross receipts included change in inventory and the sale of cull cows, heifers, bulls, and calves. Average net return to land, labor, and management was \$1.99 per hundredweight of milk sold. Average net return to land and management was \$.71 per hundredweight. Total labor utilized per hundredweight was .90 hour with hired labor accounting for .55 hour. Average investment

was \$9.00 per hundredweight with an average per cent return to investment (excluding land) of 14.7 per cent.

To determine if economies of size were present, the data were divided into five size groups. The average total cost decreased at a decreasing rate as herd size increased. The average total cost was \$7.42 for the smallest size group and \$6.47 for the largest size group.

Non-feed variable, fixed, and labor cost decreased some degree as herd size increased, but labor cost was the major factor that decreased as herd size increased. Feed cost was the largest single cost item for all size groups and accounted for a larger percentage of total cost as herd size increased.

Gross sales per hundredweight of milk sold ranged from \$7.37 for the smallest group to \$7.64 for the size group of 101 to 151 cows. The size group 101 to 151 cows had the highest net returns to land and management with an average of \$1.07 per hundredweight of milk sold. The smallest group was the only group with negative returns to land and management.

The relationship between size of enterprise and cost of producing Grade A milk was estimated by least-squares regression technique. Cost per hundredweight decreased as size increased from 26 to 284 cows. Beyond this herd size total cost indicated diseconomies to size.

To determine why some producers were more efficient than others, the data were divided into three producer groups based on cost of production. The average total costs for the low, middle, and high cost groups were \$5.38, \$6.76, and \$7.90 per hundredweight of milk sold, respectively.

The largest difference in cost among the three producer groups was the difference in feed cost. This was an indication that the low cost group had a better feed efficiency. Feed costs averaged \$2.34, \$2.91, and \$3.20 per hundredweight of milk sold for the low, middle, and high cost producer groups, respectively.

The low, middle, and high cost groups had gross receipts of \$7.10, \$7.59, and \$7.80 per hundredweight of milk sold, respectively. Net returns to land, labor, and management ranged from \$2.62 to \$1.44 per hundredweight of milk sold for the low and high cost groups, respectively. The high cost group was the only group with a negative return to land and management.

To determine if there was any difference in costs and returns of producing Grade A milk in northern and southern Alabama the data collected were grouped by geographic area.

Average total costs were \$6.64 and \$6.81 per hundredweight of milk sold for northern and southern Alabama, respectively. The difference in feed cost was the major cause for the difference in total cost.

Gross receipts averaged \$7.57 per hundredweight of milk sold for producers in northern Alabama and \$7.47 for producers in southern Alabama. Net returns to land, labor, and management were \$2.09 and \$1.73 per hundredweight of milk sold for producers in northern Alabama and southern Alabama, respectively.

Three enterprise budgets were developed; 60-cow, 125-cow, and 250-cow, by using the average costs and returns from the economies to size section.

The 125-cow enterprise budget indicated a significant increase in efficiency over the 60-cow herd. One reason for the increased efficiency was the average production per cow with the 125-cow herd having the advantage. Average production per cow for the 125-cow herd was 10,474 pounds of milk compared to 10,255 for the 60-cow herd.

Most of the efficiency gained in increase of herd size resulted between 60-cow herd to 125-cow herd. The 250-cow herd showed very little increase in efficiency over the 125-cow herd.

Conclusions

As herd size increased, average total cost decreased at a decreasing rate. Therefore, in general producers with the largest enterprises were the most efficient. The data indicated that dairy farmers in Alabama should strive toward a minimum herd size of 284 cows since this was the size with the lowest cost per hundredweight of milk sold. The extent of diseconomies beyond a herd size of 284 cows could not be determined because of the limited number of observations above this herd size. Thus, more detailed research dealing with larger herds would be useful in determining the optimum level of output.

Reducing the cost of feed per hundredweight of milk was an important factor determining the profitability of the dairy enterprise. Production per cow was also an influence on profit with the low-cost producers having the highest production per cow and

the highest profit per hundredweight of milk. Dairy farmers should work toward improving feed efficiency and higher production per cow for higher net returns.

Three enterprise budgets indicated that the increase from a 60-cow herd to a 125-cow herd resulted in the greatest improvement in efficiency. This was primarily the result of lower feed cost and spreading of fixed cost over larger output.

To increase profits in milk production a dairyman needs a sound management program that would ensure a high level feed and labor efficiency. Also, an aim of a sound management program should be improving the quality of cows and feed program to ensure a high level of milk production. Sound financial management also has rapidly become an important aspect of a management program because of the high capital investment required for an efficient size dairy operation. More detailed research is needed to determine what factors are the most important in different production situations.

APPENDIX

APPENDIX TABLE 1. VARIABLE EXPENSES PER ACRE FOR COASTAL BERMUDAGRASS HAY PRODUCTION, SEVEN DAIRY ENTERPRISES, ALABAMA, 1969

Item	Variable expenses per acre
	<i>Dollars</i>
Fertilizer and nitrogen	26.82
Lime	2.57
Tractor and equipment operating expense	21.25
Total	50.64

APPENDIX TABLE 2. VARIABLE EXPENSES PER ACRE FOR HAY PRODUCTION, 34 DAIRY ENTERPRISES, ALABAMA, 1969

Item	Variable expenses per acre
	<i>Dollars</i>
Seed, fertilizer, and nitrogen	14.24
Lime	2.57
Tractor and equipment operating expense	14.25
Total	31.06

APPENDIX TABLE 3. VARIABLE EXPENSES PER ACRE FOR GRAIN PRODUCTION, 27 DAIRY ENTERPRISES, ALABAMA, 1969

Item	Variable expenses per acre
	<i>Dollars</i>
Seed, fertilizer, and nitrogen	19.14
Lime	2.57
Tractor and equipment operating expense	10.15
Total	31.86

APPENDIX TABLE 4. VARIABLE EXPENSES PER ACRE FOR SORGHUM SILAGE PRODUCTION, 26 DAIRY ENTERPRISES, ALABAMA, 1969

Item	Variable expenses per acre
	<i>Dollars</i>
Seed, fertilizer, and nitrogen	17.69
Lime	2.57
Tractor and equipment operating expense	13.19
Total	33.45

APPENDIX TABLE 5. VARIABLE EXPENSES PER ACRE FOR CORN SILAGE, 37 DAIRY ENTERPRISES, ALABAMA, 1969

Item	Variable expenses per acre
	<i>Dollars</i>
Seed, fertilizer, and nitrogen	23.72
Lime	2.57
Tractor and equipment operating expense	20.50
Total	46.79

APPENDIX TABLE 6. VARIABLE EXPENSES PER ACRE FOR WINTER
TEMPORARY PASTURE, DAIRY ENTERPRISES, ALABAMA, 1969

Item	Variable expenses per acre
	<i>Dollars</i>
Seed, fertilizer, and nitrogen.....	22.22
Lime.....	1.28
Tractor and equipment operating expense.....	7.25
Total.....	30.75

APPENDIX TABLE 7. VARIABLE EXPENSES PER ACRE FOR SUMMER
TEMPORARY PASTURE, DAIRY ENTERPRISES, ALABAMA, 1969

Item	Variable expenses per acre
	<i>Dollars</i>
Seed, fertilizer, and nitrogen.....	22.58
Lime.....	1.28
Tractor and equipment operating expense.....	6.45
Total.....	30.31

APPENDIX TABLE 8. VARIABLE EXPENSES FOR IMPROVED PERMANENT
PASTURE, DAIRY ENTERPRISES, ALABAMA, 1969

Item	Variable expenses per acre
	<i>Dollars</i>
Fertilizer and nitrogen.....	13.54
Lime.....	2.57
Tractor and equipment operating expense.....	2.96
Total.....	19.07

APPENDIX TABLE 9. NUMBER AND PER CENT OF FARMERS GROWING
CERTAIN CROPS, 75 DAIRY FARMS, ALABAMA, 1969

Item	Farmers	
	<i>No.</i>	<i>Pct.</i>
Crops grown for dairy		
Corn silage.....	37	49.3
Hay.....	34	45.3
Grain.....	27	36.0
Other silage.....	26	34.7
Coastal bermudagrass (hay).....	7	9.3
Non-dairy crops		
Soybeans.....	8	10.7
Cotton.....	7	9.3
Corn.....	3	4.0
Hay.....	3	4.0
Wheat.....	3	4.0
Other ¹	4	5.3

¹ Grain sorghum, pecans, and watermelons.

APPENDIX TABLE 10. ANALYSIS OF VARIANCE AMONG MILK PRODUCER GROUPS BY SIZE OF ENTERPRISE, 75 DAIRY ENTERPRISES, ALABAMA, 1969

Type of costs	Source of variation	D.F.	Estimated variance	F	P
Feed.....	Treatment	4	.62	1.26	N.S.
	Error	70	.49		
Non-feed variable.....	Treatment	4	.30	1.36	N.S.
	Error	70	.22		
Fixed.....	Treatment	4	.15	1.36	N.S.
	Error	70	.11		
Labor.....	Treatment	4	.52	2.48	.10
	Error	70	.21		
Total.....	Treatment	4	2.14	1.68	N.S.
	Error	70	1.27		

APPENDIX TABLE 11. RELATIONSHIP BETWEEN MAJOR COST ITEMS WITH SIZE OF ENTERPRISE, 75 DAIRY ENTERPRISES, ALABAMA, 1969

Relationship between variables	Correlation coefficients	Comments
A. Unit cost of feed and size of enterprise $Y = 2.89 - .00268X + .00001X^2$ S.E. ¹ = ± \$.68	.312	Not sig. at .05 level
B. Unit cost of non-feed variable expenses and size of enterprise $Y = 1.75 - .01167X + .000002X^2$ S.E. = ± \$.46	.189	Not sig. at .05 level
C. Unit cost of fixed inputs and size of enterprise $Y = 1.26 - .0008X + .000000064X^2$ S.E. = ± 0.33	.264	Not sig. at .05 level
D. Unit cost of labor and size of enterprise $Y = 1.64 - .0044X + .00001X^2$ S.E. = ± \$.44	.442	Sig. at the .001 level
E. Total cost and size of enterprise $Y = 7.68 - .012X + .00003X^2$ S.E. = ± \$1.09	.370	Sig. at the .001 level

¹ Standard error .05 estimate.

APPENDIX TABLE 12. ANALYSIS OF VARIANCE AMONG MILK PRODUCER GROUPS, BY COST OF PRODUCTION, 75 DAIRY ENTERPRISES, ALABAMA, 1969

Type of costs	Source of variation	D.F.	Estimated variance	F	P
Feed.....	Treatment	2	4.69	12.34	.001
	Error	72	.38		
Non-feed variable.....	Treatment	2	2.52	14.82	.001
	Error	72	.17		
Fixed cost.....	Treatment	2	1.35	16.88	.001
	Error	72	.08		
Labor.....	Treatment	2	2.37	15.80	.001
	Error	72	.15		
Total.....	Treatment	2	40.74	177.13	.001
	Error	72			

APPENDIX TABLE 13. ESTIMATED INVESTMENT AND ANNUAL FIXED COSTS FOR
PRODUCING GRADE A MILK, 60-COW HERD, ALABAMA, 1969

Item	Value		Annual fixed costs		
	New	Average	Interest, taxes, and insurance	Depreciation	Total
	<i>Dol.</i>	<i>Dol.</i>	<i>Dol.</i>	<i>Dol.</i>	<i>Dol.</i>
Cows.....	25,534.95	25,534.95	1,802.43	.....	1,802.43
Heifers.....	5,968.41	5,968.41	419.74	.....	419.74
Calves.....	2,153.55	2,153.41	148.14	.....	148.14
Bulls.....	473.78	473.78	34.57	.....	34.57
Dairy barn.....	8,614.20	4,355.96	307.84	609.15	916.99
Hay barn.....	4,491.69	2,177.98	153.92	304.57	458.49
Silo.....	4,510.15	2,250.58	159.05	314.72	473.77
Other buildings.....	4,184.04	2,105.52	148.79	294.42	443.21
Machinery and equipment.....	26,273.31	13,309.85	940.65	1,861.29	2,801.94
Total.....	82,204.08	58,330.44	4,115.13	3,384.15	7,499.28

APPENDIX TABLE 14. ESTIMATED INVESTMENT AND ANNUAL FIXED COSTS FOR
PRODUCING GRADE A MILK, 125-COW HERD, ALABAMA, 1969

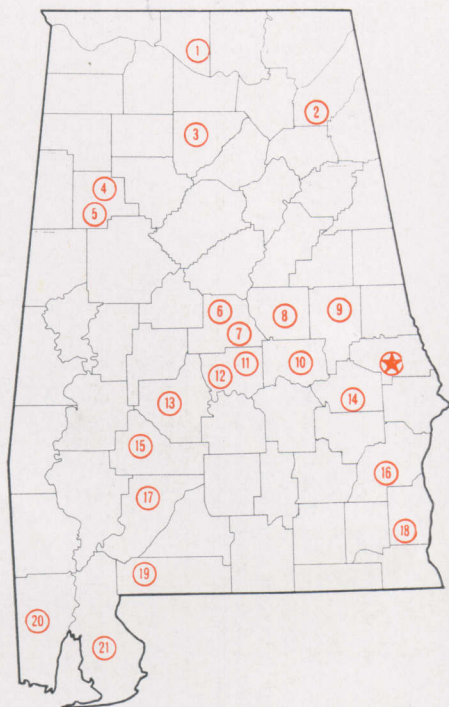
Item	Value		Annual fixed costs		
	New	Average	Interest, taxes, and insurance	Depreciation	Total
	<i>Dol.</i>	<i>Dol.</i>	<i>Dol.</i>	<i>Dol.</i>	<i>Dol.</i>
Cows	49,749.60	49,749.60	3,489.60	.....	3,489.68
Heifers	9,688.08	9,688.08	679.36	.....	679.36
Calves	4,189.44	4,189.44	294.06	.....	294.06
Bulls	785.52	785.52	55.39	.....	55.39
Dairy barn	15,579.48	8,051.78	564.78	1,039.60	1,604.38
Hay barn	11,390.04	5,890.16	413.15	760.50	1,173.65
Silo	8,509.80	4,405.98	309.05	568.87	877.92
Other buildings	9,819.00	5,073.08	355.84	655.01	1,010.85
Machinery and equipment	54,724.56	28,292.40	1,984.53	3,652.94	5,637.47
Total	164,435.52	116,126.04	8,145.83	6,676.92	14,822.76

APPENDIX TABLE 15. ESTIMATED INVESTMENT AND ANNUAL FIXED COSTS FOR
PRODUCING GRADE A MILK, 250-COW HERD, ALABAMA, 1969

Item	Value		Annual fixed costs		
	New	Average	Interest, taxes, and insurance	Depreciation	Total
	<i>Dol.</i>	<i>Dol.</i>	<i>Dol.</i>	<i>Dol.</i>	<i>Dol.</i>
Cows.....	105,760.40	105,760.40	7,422.53	.....	7,422.53
Heifers.....	27,210.20	27,210.20	1,855.63	.....	1,855.63
Calves.....	8,471.10	8,471.10	618.54	.....	618.54
Bulls.....	2,310.30	2,310.30	154.64	.....	154.64
Dairy barn.....	21,562.80	11,320.47	811.84	1,617.21	2,429.05
Hay barn.....	10,524.70	5,282.89	378.86	754.70	1,133.56
Silo.....	13,348.40	6,792.28	487.10	970.33	1,457.43
Other buildings.....	15,402.00	8,301.67	595.35	1,185.95	1,781.30
Machinery and equipment.....	85,481.10	43,772.49	3,139.12	6,253.21	9,392.33
Total.....	290,071.00	219,221.80	15,463.61	10,781.40	26,245.01

AGRICULTURAL EXPERIMENT STATION SYSTEM OF ALABAMA'S LAND-GRANT UNIVERSITY

With an agricultural research unit in every major soil area, Auburn University serves the needs of field crop, live-stock, forestry, and horticultural producers in each region in Alabama. Every citizen of the State has a stake in this research program, since any advantage from new and more economical ways of producing and handling farm products directly benefits the consuming public.



Research Unit Identification

★ Main Agricultural Experiment Station, Auburn

1. Tennessee Valley Substation, Belle Mina.
2. Sand Mountain Substation, Crossville.
3. North Alabama Horticulture Substation, Cullman
4. Upper Coastal Plain Substation, Winfield.
5. Forestry Unit, Fayette County.
6. Thorsby Foundation Seed Stocks Farm, Thorsby.
7. Chilton Area Horticulture Substation, Clanton.
8. Forestry Unit, Coosa County.
9. Piedmont Substation, Camp Hill.
10. Plant Breeding Unit, Tallassee.
11. Forestry Unit, Autauga County.
12. Prattville Experiment Field, Prattville.
13. Black Belt Substation, Marion Junction.
14. Tuskegee Experiment Field, Tuskegee.
15. Lower Coastal Plain Substation, Camden.
16. Forestry Unit, Barbour County.
17. Monroeville Experiment Field, Monroeville.
18. Wiregrass Substation, Headland.
19. Brewton Experiment Field, Brewton.
20. Ornamental Horticulture Field Station, Spring Hill.
21. Gulf Coast Substation, Fairhope.