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Cost and returns to producers of milk for manufacturing as affected by volume of production, management, and price

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Cost And Returns To Producers Of Milk For Manufacturing

As Affected by Volume of Production, Management, and Price

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COSTS AND RETURNS TO PRODUCERS OF MILK FOR MANUFACTURING AS AFFECTED BY VOLUME OF PRODUCTION, MANAGEMENT, AND PRICE

By JAMES G. HAMILL

Supplies of milk for manufacturing have declined sharply in Mississippi in recent years. Producers furnished a peak supply of over 368 million pounds in 1957. From this peak, producer supplies had decreased 26.6 percent to 270 million pounds by the end of 1962. This rapid decline in supplies has created a problem of much concern to the manufactured milk indutry. Some plants have been closed and other plants are operating at much below capacity.

The decrease in producer supplies is a result of producers leaving the industry. In 1957 there were 15,743 producers in the state. By the end of 1962, the number had decreased 46.0 percent to 8,499. Production per farm has been increasing, but at a rate too slow to maintain supplies. Some of the reasons producers have been leaving the industry are: increased production costs, high beef cattle prices, and retirement or the acceptance by dairy farmers of newly created industrial jobs.

The Problem

The hesitancy in adopting improved management practices to meet changing cost-price relationships has forced many farmers to discontinue their dairy operations. Future supplies of milk for manufacturing depends upon the relative profitability of this enterprise compared to alternative enterprises and alternative employment opportunities. Producer prices will play an important role in enabling producers to combat the "price-cost squeeze" confronting them, but cost problems can be attacked more directly by farmers than can price problems.

Objectives

The objectives of the study were:

1. To describe the present patterns of enterprise combination and resource use found on farms supplying milk for manufacturing.

2. To describe a combination of enterprises giving the most profitable resource use under improved management.

3. To compare net returns to the farm operation under the two situations described above.

4. To estimate the combination of enterprises and resources necessary to achieve specified levels of income with specified milk prices.

Scope and Method

In a 1959 farm survey, the Department of Agricultural Economics, Mississippi Agricultural Experiment Station, obtained estimates of the complete 1958 farm operation from a sample of producers of milk for manufacturing. The sample was drawn from lists of 12,154 producers provided through the courtesy of 17 milk plants and receiving stations. Names on these lists were divided into five groups based on the amount of milk sold during a two-week period in December of 1958. Ranges in pounds sold during the specified period and the number of producers in each group were:

Pounds sold	Number of producers	Group
0	3,398	I
1- 199	7,264	II
1,000-1,999	1,114	III
2,000-2,999	227	IV
3,000 or more	151	V

Groups were numbered I—V in ascending order according to volume sold and a sample of 25 producers was randomly drawn from each group.

Estimates of inputs and outputs for crop, livestock and pasture enterprises were obtained from each producer. Other data collected from each producer consisted of building and equipment inventories, available labor, and management practices. The information collected from this survey was used to construct a typical farm operation for each group.

Two levels of management were consid-

ered in the analysis: (1) present management, that is, the level of management being exercised by the farmers at the time of the interview and (2) improved management, a level of management which makes fuller use of known technology. Improved management represents a combination of estimates from professional agricultural workers, farmer experience, and experimental results.

Information from the farm survey was used in constructing enterprise budgets for the present management situation. Enterprise budgets under improved management situations specify the use of production techniques and yield expectations as estimated by the sources indicated above. Average prices for 1958 were used in all the budgets, Appendix Tables 1—9. Linear programming was used to determine the most profitable enterprise combination and resource use for each management-size situation. Production requirements, yields, costs, and returns for the typical farm under both levels of management were taken from the enterprise budgets.

An analysis was made of the effect of price changes on resource requirements for specified levels of income. Price levels used in this analysis were 10 percent below, and 10 and 20 percent above average prices of milk for manufacturing received by Mississippi farmers in 1958.

PRESENT MANAGEMENT

"Typical dairy farms" constructed for each producer group reflects the average size of dairy herd and herd management practices; land utilization and cropping practices; labor availability and utilization; capital investment; and off-farm income reported by producers. This information was used in budget analysis to estimate costs and returns to the farm business as operated in 1958 by the average farmer in each group of producers.

The Dairy Herd

The typical herd varied in size from 9 animal units in Group I with 7 cows being milked during the year to 31.75 animal units in Group V with 26 cows being milked during the year, Table 1.

None of the farms studies kept individual-cow production records, although most producers stated they culled cows from the herd for low production. Other reasons stated for culling cows from the herd were old age and mastitis.

Most of the farmers kept a bull. Little emphasis was placed on the quality of bull. Twenty-two of the 125 farmers interviewed used artificial insemination, some borrowed their neighbors's bull, but the scrub bull predominated. When asked the question "why did you buy that particular bull," the answers ranged from "I wanted to improve my herd and the bull was registered" to "I needed a bull so the cows would drop a calf." None of the farmers kept a breeding record except

Table 1.—Average composition of herd, by size group, 125 dairy farms, Mississippi, 1958.

Animals	Group I	Group II	Group III	Group IV	Group V
			Number		
Cows	7	7	12	18	26
Heifers (1-2 years)	1	2	4	4	6
Heifers (under 1 year)	2	2	4	5	7
Bull	1	1	1	1	1
Total	11	12	21	28	40
Animal units[1]	9.00	9.50	16.00	22.25	31.75

[1]One mature cow or bull; 2 heifers 1-2 years, or 4 heifers under one year.

those who used artificial insemination.

Replacement heifers were raised at the rate of one heifer for each three to four cows. This number would be adequate, but with the general quality of breeding it is doubtful if the replacement animal's capacity for milk production would be any better than, if as good as, that of the dam. Facilities for raising replacements—sheds and stables that had been in use for many years—made sanitation quite a problem and increased the disease hazards.

Annual volume of milk sold per cow, determined by the number of cows reported by producers and milks sales as obtained from manufacturing plant records, varied from less than 1,900 to 4,100 pounds, Table 2.

The amount of concentrates fed per cow varied from 1.09 pounds per pound of milk sold (Group I) to .52 pounds per pound of milk sold (Group V). The typical ration for each group consisted of a mixture of oil seed meal, corn, molasses and salt. The protein content varied from 12.5 percent crude protein for Group IV to 13.1 percent crude protein for Groups II and III.

The amount of stored roughage fed per cow varied from 2,063 pounds for Group II to 3,340 pounds for Group IV. Two major factors probably contributed to the low feeding-rate of hay. Either the hay was rationed, or if fed free choice, it was of such poor quality that low consumption resulted. A majority of the farmers practiced rationed feeding of stored roughage. Only 9 farms in the survey had silage as a part of their stored roughage program. This silage was converted to hay equivalent and included in Table 2 as stored roughage.

The pasture improvement program consisted of some seeding and fertilizing in each group. Producers in each group practiced weed control by clipping. The extent of pasture improvement is shown by comparing the average annual expense per acre of open pasture, which varied from $1.30 per acre for Group I to $3.49 per acre for Group IV.

Resource Use

In 1958, the average producer of milk for manufacturing had a capital investment highly disproportionate to his income earned from farming. Investment in land accounted for approximately 50 percent of total investment for each group, Table 3. Investment in cropping and dairy equipment was next in importance. Building investment per animal unit averaged

Table 2.—Concentrates, stored roughage, pasture, and milk sales per cow, by size group, 125 dairy farms, Mississippi, 1958.

Item	Unit	Group I	Group II	Group III	Group IV	Group V
Concentrates	cwt.	20.58	23.22	32.42	20.81	20.68
Roughage	cwt.	25.69	20.63	25.62	33.40	30.64
Pasture	acre	7.29	3.29	3.78	2.67	4.59
Milk sales	cwt.	18.81	30.40	40.78	41.05	39.44

Table 3.—Average capital investment, by size group, 125 dairy farms, Mississippi, 1958.

Item	Group I	Group II	Group III	Group IV	Group V
			Dollars		
Equipment	4,531	3,936	5,041	5,522	7,838
Buildings	2,429	2,577	3,282	5,154	5,006
Land[1]	10,800	7,850	11,550	15,600	22,650
Fences	462	273	447	582	722
Cows[2]	1,475	1,565	2,650	3,680	5,260
Total	19,697	16,201	22,970	30,538	41,476

[1]Land valued at $100 per acre of open land and $50 per acre of other land.
[2]Cows valued at $165, heifers 1-2 at $90, heifers under 1 at $40 and bull at $150.

Table 4.—Land utilization and crop yields, by size groups, 125 dairy farms, Mississippi, 1958.

Land utilization and yield per acre	Group I	Group II	Group III	Group IV	Group V
			Acres		
Land utiliation					
Cotton	4.8	4.9	5.2	5.5	5.2
Corn, grain	15.6	11.3	21.4	25.9	25.0
Temporary winter grazing	4.0	---	---	7.4	---
Pasture	46.3	23.0	35.7	43.3	105.6
Pasture and hay	4.7	---	9.7	4.7	13.7
Hay crops	13.6	6.8	8.0	15.2	27.5
Idle land	5.0	7.0	6.0	11.0	5.0
Woodland	24.0	48.0	53.0	79.0	81.0
Wasteland	4.0	3.0	6.0	7.0	8.0
Total	122.0	104.0	145.0	199.0	271.0
			Yield per acre		
Cotton (lbs. of lint)	431.3	413.8	544.2	487.0	481.0
Corn, grain (bu.)	36.8	37.8	37.1	40.2	42.3
Pasture and hay (tons)	1.0	---	1.0	1.8	1.2
Hay crops (tons)	1.1	1.3	1.5	2.1	1.6

about $270 on farms with the smallest herds, but dropped to an average of $158 for the largest dairies.

The average farm ranged from 104 acres Group II) to 271 acres (Group V), Table 4. The cropping program for farms in all groups included cotton, corn, and hay. An average of about 5 acres of cotton was grown on farms of all sizes. Most of the producers surveyed did not provide a temporary winter grazing crop for the dairy herd.

The average family in each group included two adults and one fourteen-year old child. Data presented in Table 5 shows the average amount of family labor available and the pattern of labor utilization for each group in the study. The large amounts of unused family labor — ranging from 1,222 hours in Group V to 3,068 hours in Group I — illustrate the low level of utilization of this resource, particularly in the smaller farm operations. The family labor supply was more than sufficient for the farm operation except during the crop harvesting season when farmers in each group hired labor as needed.

Returns to the Farm Business

The farmer is mainly interested in how much net return he can get from the things he has to earn a living with. . his labor and that of his family, his land, and his other investment capital. The manner in which he manages the resources he has determines the size of this net return.

For the five groups of dairies analyzed, 1958 average annual receipts from farming ranged from $1,990 (Group II) to $6,378 (Group V), Table 6. While average receipts for the largest dairies averaged about 16 percent higher than those for any of the other four groups, expenses on these large farms averaged 51 percent more than on other farms. Operators of the larger dairies, therefore fared worse financially than did those in Group IV, who showed an average net return of $2,206, or those in Group III, with a net return of $1,450. Average net returns for dairies with fewer than eight cows was less than $800 in 1958.

Since the farms did not afford full-time employment for all members of the family, the typical family earned some income through off-farm work. Income from all sources averaged less than $2,650 for the highest income group, and for one group, incomes averaged less than $1,000 for the year.

Table 5.—Labor: Hours available and utilized, by size groups, 125 dairy farms, Mississippi, 1958.[1]

Item	Family labor available	Labor utilized				
		Group I	Group II	Group III	Group IV	Group V
		— — — — — Hours — — — — —				
1st. puarter:						
Family labor	992					
Field	(272)	29	24	38	48	48
Livestock	(720)	319	359	530	842[2]	790[3]
Total	992	348	383	568	890	838
2nd. quarter:						
Family labor	1,144					
Field	(408)	240	198	283	329	388
Livestock	(736)	235	269	419	538	626
Total	1,144	475	467	702	867	1,014
3rd. quarter:						
Family labor	1,712					
Field	(976)	212	156	231	280	371
Livestock	(736)	230	263	412	508	613
Total	1,712	442	419	643	788	984
4th. quarter:						
Family labor	1,176					
Field	(448)	419	422	569[4]	571[5]	288
Livestock	(728)	272	306	465	583	678
Hired labor	—	130	80	186	230	500
Total	1,176	821	808	1,220	1,384	1,466
Yearly total:						
Family labor	5,024	1,956	1,997	2,947	3,699	3,802
Hired labor	—	130	80	186	230	500
Grand total	5,024	2,806	2,077	3,133	3,929	4,302

[1]Method of estimating available field labor: Man — eight hours per day on days fit for field labor. Child — eight hours per day on days fit for field labor during June, July, and August.

Method of estimating available livestock labor: Man — two hours per day every day of the year. Woman — four hours per day every day of the year. Child — two hours per day every day of the year.

[2]122 hours of field labor utilized as livestock labor.

[3]70 hours of field labor utilized as livestock labor.

[4]121 hours of field labor derived from more hours per family worker than was generally allowed for available family field labor.

[5]123 hours of field labor derived from more hours per family worker than was generally allowed for available family field labor.

IMPROVED MANAGEMENT

The manager of a farm business must make decisions in two general areas: (1) enterprise selection and combination, determining the kinds and quantities of enterprises to produce; and (2 determining those production practices which will best use his limited resources in producing that enterprise combination. This phase of the study deals primarily with selection of the most profitable enterprise combination for the typical farm in each group, incorporating those production practices that reflect a level of improved management.[1]

The practices evaluated under improved management compose an overall pro-

[1]See Hamill, J. G. and Simpson, J. H., Jr., An Economic Evaluation of Production of Milk for Manufacturing in Mississippi, (Mississippi Agricultural Experiment Station Bulletin Number 613); State College, Miss., February, 1961, for a description of these practices.

Table 6.—Average income from farm and non-farm sources by size groups, 125 dairy farms, Mississippi, 1958[1].

Item	Group I	Group II	Group III	Group IV	Group V
	— — — — — Dollars — — — — —				
Receipts:					
Cotton	793	777	1,084	1,026	958
Corn	502	299	466	1,151	630
Hay	247	38	144	238	479
Milk	438	694	1,639	2,483	3,425
Cattle	258	182	476	622	886
Total	2,238	1,990	3,809	5,520	6,378
Expenses:					
Cotton	272	256	355	391	455
Corn	354	235	462	563	548
Hay crops	190	93	125	330	556
Pasture	60	41	99	151	303
Pasture and hay	70		145	69	224
Temporary grazing	53			173	235
Feed purchased	168	139	362	489	546
Cattle purchased				166	652
Depreciation	96	96	122	144	144
Hauling milk and ADA	58	94	215	325	451
Hired labor	47	29	67	83	180
Miscellaneous[2]	250	244	471	430	721
Total	1,523	1,190	2,359	3,314	5,015
Net farm returns:	715	800	1,450	2,206	1,363
Off-farm income:	917	107	1,038	431	342
Total family income	1,632	907	2,488	2,637	1,705

[1]Interest on investment has not been deducted from farm income.
[2]Includes cleaning materials, milking supplies, veterinary costs, electricity, repairs, etc.

Table 7.—Land utilization and crop yields, optimum combination of resources, improved management, by size groups, 125 dairy farms, Mississippi, 1958.

Land utilization and yield per acre	Yield per acre	Group I	Group II	Group III	Group IV	Group V
		— — — — — Acres — — — — —				
Land utiliation						
Cotton (lbs. of lint)	550.0	4.8	4.9	5.2	5.5	5.2
Corn, grain (bu.)	50.0	15.2	8.7	14.6	19.3	24.2
Millet	—	15.6	8.8	15.0	19.8	24.8
Pasture	—	24.0	13.6	23.0	30.3	38.0
Pasture and hay (tons)	2.5	20.8	11.8	20.0	26.3	33.1
Corn silage (tons)	9.0	9.4	5.3	9.0	11.9	14.9
Idleland	—	4.2	—	—	—	41.8
Woodland	—	24.0	48.0	53.0	79.0	81.0
Wasteland	—	4.0	2.9	5.2	6.9	8.0
Total		122.0	104.0	145.0	199.0	271.0

duction program. Omission of any part of the management program from the farm operation could prevent achieving the level of production and the returns associated with improved management. However, practices other than those considered could be used provided they resulted in comparable returns.

Land

In programming optimum farm organizations, land acreages were held constant to reflect improvements that can be made on existing farms, Table 7. No attempt was made to utilize woodland and wasteland, and pasture land was restricted from being utilized for crops.

Cotton acreages were assumed to represent current allotments, and thus were not changed. The remaining crops were grown in support of the dairy enterprise. The size of the dairy enterprise was limited by the number of acres of cropland or total open land. In Groups I and V some pasture land was left idle for lack of sufficient acres of cropland to support a larger dairy enterprise.

The Dairy Herd

Under improved management, herd size would vary from 23 to over 63 animal units, Table 8. Annual production per cow was estimated at 6,327 pounds, the average of 74 dairy herds on test in the Dairy Herd Improvement Association in Mississippi for 1958. By following the dairy management practices outlined in this study, dairy farmers can readily achieve this production per cow.

Culling and Breeding

A high-producing herd can be developed only by an intensive program of culling and breeding. With an intensive program of culling, those cows which do not have the inherited characteristics for high milk production can be sold from the herd. Then with a well-managed breeding program and/or purchase of high producing animals, replacements will have an increased genetic capability for milk production.

Under improved management, mature cows would not be bred until the third heat period after calving, nor heifers until they attain the proper age and size, which may vary with breed. All breeding would be done by artificial insemination which, at an average fee of five dollars per cow, not only is generally more economical than using a herd bull, but also has other advantages. Artificial insemination facilitates controlled breeding and the keeping of breeding records, both very important in an efficient dairy operation.

A record of production is a prerequisite for determining which cows to keep in the herd. A records program involves not only obtaining scales, weighing the milk and keeping a record, but also using the record as a basis for culling.

Raising Replacement

All heifers would be raised and at least one heifer for each three cows would be retained as a replacement. Sterilizing all utensils used in feeding the calves and using portable pens for shelter would improve sanitation. Results of the calf management program followed at the Pontotoc Ridge-Flatwoods Branch Experiment Station, where 70 calves have been raised with no deaths or serious trouble from disease, evidence the value of these practices.[2]

Stored Roughage Program

Two and one-half tons of hay or hay-equivalent per animal unit would be needed each year and would be fed during those periods when grazing would not provide for nutritional needs. Silage is considered to be an important factor in achieving the milk production set forth for improved management. Three tons of

[2]Hurt, B. C., Jr., Graham, E. N., and Hamill, J. G., Producing Milk for Manufacturing, (Mississippi Agri. Exp. Station Bulletin 590); State College, Mississippi, February, 1960, pp. 5-7.

Table 8.—Size and composition of herd, optimum combination of resources, improved management by size group, 125 dairy farms, Mississippi, 1958.

Animals	Group I	Group II	Group III	Group IV	Group V
			Number		
Cows	31	18	30	40	50
Heifers (1-2 years)	10	6	10	13	17
Heifers (under 1 year)	12	7	12	16	20
Total	53	31	53	69	87
Animal units[1]	39.00	22.75	38.00	50.50	63.50

[1]One mature cow; 2 heifers 1-2 years, or 4 heifers under 1 year.

good quality silage were considered equivalent to one ton of good quality hay. Silage feeding would be limited to cows in production and fed at the rate of approximately 25 pounds per day when grazing was not available. Corn was the only silage crop considered in this study.[3]

Since coastal bermuda is considered adaptable for most areas of Mississippi, it was the hay crop selected for use on the typical farm under improved management. Its use, of course, would depend on its adaptability in comparison with other crops for any particular farm situation. High-quality hay is a necessity under improved management, and coastal bermuda will produce a high-quality hay if managed properly. Hay would be fed free-choice to the entire herd, preferably through some type of self-feeder, during those periods when grazing is inadequate.

Pasture Program

An intensive pasture program was considered necessary to achieve the production goal of 6,327 pounds of milk per cow. The most important crops in this program are coastal bermuda and crimson clover. This combination will produce the most grazing per acre of all permanent pasture crops considered. The crimson clover will furnish early spring grazing, and when the crimson clover is gone, two cuttings of hay from the coastal bermuda will furnish the necessary hay for the dairy operation, with much additional grazing later. Cutting the coastal bermuda for hay twice would give adequate weed control. The other permanent pasture crop included under improved management was a Dallis grass-white clover combination. For maximum grazing, the permanent pasture must be cross-fenced and a strict program of controlled grazing followed. Weeds should be controlled by spray with 2, 4-D in June. Millet would be used in the summer as a temporary grazing crop, with half of the acreage being planted the first of May and the other half the first of June. This grazing would be utilized only by cows in production, and grazing would be controlled.

Since land capabilities vary, the combination of pasture and forage crops used in the study will not be suitable for every farm situation. Soil-testing and other specialists of the Extension Service can assist the farmer in adjusting to his individual farm conditions.

Concentrate Feeding

The mix suggested for cows in production, under the improved level of management, is 530 pounds of oilseed meal, 1,440 pounds of corn-and-cob meal, and 30 pounds of salt. This mixture provides a 16 percent crude protein ration, which would be fed at the rate of about one pound of feed for each 3 pounds of milk during the winter months and 1 pound of feed for each 4 pounds of milk during the summer months. For winter feeding of dry cows and heifers, a mixture of 280 pounds of oilseed meal, 1,700 pounds of corn-and-cob meal and 20 pounds of salt provides an 11-percent crude protein ration. Dry cows would be fed approximately 5½ pounds of this mixture per day, large heifers about 4 pounds and small heifers about 5 pounds. This ration was developed primarily to utilize homegrown feeds in meeting the nutritional requirements of the dairy herd. The above feeding rates depend upon the availability of good quality roughage.

Capital Requirements

The shift to optimum farm organizations would, of course, require additional capital investment on the part of the operators. Additional investment amounts would range from about $10,000 to $13,000, Tables 3 and 9. Most of this capital increase would be in the form of larger numbers of higher-quality animals,

[3]Research being conducted by the Departments of Agronomy and Dairying, Mississippi Agri. Exp. Station, shows promise for grain sorghum as a silage crop for dairy cattle.

and the forage-handling equipment necessary to maintain these animals. It is estimated that essentially the same amount of equipment would be necessary to maintain herds of all sizes. The use of this equipment plays an important part in achieving the overall management program set forth in this study.

Since the suggested changes require no additional land, investment in that asset would not be changed. Building investment, on the average would be increased by about $700.

Table 9.—Investment capital requirements, optimum combination of resources, improved management, by size groups, 125 dairy farms, Mississippi, 1958.

Investment	Group I	Group II	Group III	Group IV	Group V
	— — — — — Dollars — — — — —				
Equipment	9,193	9,047	9,184	9,262	9,600
Buildings	3,157	3,277	4,004	5,898	5,773
Land[1]	10,800	7,850	11,550	15,600	22,650
Fences	462	273	447	582	722
Cows[2]	8,900	5,200	8,700	11,550	14,550
Total	32,620	25,929	34,008	42,915	52,957

[1]Land valued at $100 per acre of open land and $50 per acre of other land.
[2]Cows valued at $200, heifers 1-2 at $150 and heifers under 1 at $100.

Table 10.—Labor: Hours available and utilized, optimum combination of resources, improved management, by size groups, 125 dairy farms, Mississippi, 1958[1].

Item	Family labor available	Labor utilized				
		Group I	Group II	Group III	Group IV	Group V
		— — — — — Hours — — — — —				
1st. quarter:						
Family labor	992					
Field	(272)	79	47	76	98	122
Livestock	(720)	728	423	705	894	870
Hired labor					46	304
Total	992	807	470	781	1,038	1,296
2nd. quarter:						
Family labor	1,144					
Field	(408)	384	271	384	408	408
Livestock	(736)	605	351	585	736	736
Hired labor					111	385
Total	1,144	989	622	969	1,255	1,529
3rd. quarter:						
Family labor	1,712					
Field	(976)	403	282	399	494	577
Livestock	(736)	455	264	441	588	734
Total	1,712	858	546	840	1,082	1,311
4th. quarter:						
Family labor	1,176					
Field	(448)	448	448	448	448	448
Livestock	(728)	518	301	501	668	728
Hired labor		283	190	315	420	574
Total	1,176	1,249	939	1,264	1,536	1,750
Yearly total:						
Family labor	5,024	2,620	2,387	3,539	4,334	4,623
Hired labor		283	190	315	577	1,263
Grand total		3,903	2,577	3,854	4,911	5,886

[1]Method of estimating available field labor: Man —eight hours per day on days fit for field labor. Child — eight hours per day on days fit for field labor during June, July and August.
Method of estimating available livestock labor: Man — two hours per day every day of the year. Woman — four hours per day every day of the year. Child — two hours per day every day of the year.

Labor

The optimum combinations of resources make for more efficient use of family labor than formerly, Table 10. While on the smaller farms only about half or less of the available family labor supply would be used because of land limitations, even this is an improvement over the extremely low utilization found in the survey. Besides permitting fuller use of family labor, the revised plans call for greater use of hired labor.

In estimating labor utilization, it was assumed that, within a given quarter, labor available for field work could be shifted to livestock but that livestock labor was not transferable to field labor. In a situation where hired labor was not available, the optimum combination of enterprises would change to a combination which would use family labor most efficiently.

Returns to the Farm Business

The adoption of improved management practices would necessitate sharp increases in annual expenditures, but would result in even greater gain in farm returns, Table 11. On the average, for all farms analyzed, current expenditures would rise by about 117 percent, but a 150 percent increase in farm receipts would mean a 214 percent increase over present levels in net returns.

For particular groups of farms, results of the change would be even more striking. For large farms (Group V), it is estimated that the improvements would increase returns from the former level of $1,363 to $5,622 — a 312 percent jump — while current expenses would rise by only 72 percent. Operators of small farms (Group I), who netted an average of only $715 from farming by the old methods, could increase their returns by 441 percent to $3,866.

None of the estimated returns shown in Table 11 includes non-farm income as did the totals in Table 6. Yet in each instance farm returns resulting from improved management are much higher than the combined farm and non-farm income from previous methods. Neither table shows the value of farm perquisites, which, of course, are important components of the farmer's realized net income.

Table 11.—Estimated net farm returns resulting from optimum combination of resources and improved management, by size groups, 125 dairy farms, Mississippi, 1958.

Item	Group I	Group II	Group III	Group IV	Group V
Receipts:			Dollars		
Cotton	1,011	1,032	1,096	1,159	1,096
Milk	6,649	3,861	6,435	8,580	10,724
Cattle	1,509	876	1,460	1,947	2,434
Total	9,169	5,769	8,991	11,686	14,254
Expenses:[1]					
Cotton	306	312	331	350	331
Corn	427	245	411	543	681
Pasture	390	221	374	493	618
Pasture and hay	645	366	620	815	1,026
Temporary grazing	200	113	192	254	318
Corn for silage	344	194	330	436	546
Feed purchases	1,229	714	1,190	1,586	1,982
Depreciation	184	107	178	238	297
Hauling milk and ADA	824	478	797	1,063	1,328
Hired labor	102	68	113	207	453
Breeding	207	120	200	267	334
Miscellaneous[2]	445	258	431	574	718
Total	5,303	3,196	5,167	6,826	8,632
Net farm returns	3,866	2,573	3,824	4,860	5,622

[1]Expense items do not include a charge for investment .

[2]Includes cleaning materials, milking supplies, veterinary costs, electricity, repairs, etc.

RESOURCE REQUIREMENTS FOR SPECIFIED INCOME LEVELS AT SPECIFIED MILK PRICES

To estimate the effect changes in the price of milk would have on the milk producer, a linear programming technique was used to determine the resource requirements necessary to attain income levels of $2,000, $4,000 and $6,000 net returns to land, labor, capital and management with a price for milk of $3.05, $3.73 and $4.07 per hundredweight. These prices are 10 percent below, and 10 and 20 percent above the 1958 average price received by Mississippi farmers for milk for manufacturing. Prices other than those for milk were held at 1958 levels.

The input coefficients were based on improved management. The available family labor for a family of three was utilized with hired labor available when needed. Each acre of land was brought into the farm organization at fixed proportions of .247 acres of cropland (including .03 acre of cotton allotment), .341 acres of pasture-land and .412 acres of woodland, idleland and wasteland. Land use was restricted to those crops found on the sample farms.

Even at prices for milk 20 percent above those for 1958, the farmer would have to milk 12 cows and produce 2.2 acres of cotton to earn $2,000 annually, Tables 12 and 13. Production yielding this income would require, on the average for Mississippi conditions, a 75-acre farm. To earn a $6,000 net return he would need a 234-acre farm on which he had 39 cows and 7 acres of cotton. For the average family of three, operation of such farm would require about 72 10-hour days of hired labor, Table 14.

Should milk prices drop to $3.05 per hundredweight, or 10 percent below 1958 levels, 21 milk cows and 3.8 acres of cot-

Table 12.—Size and composition of herd necessary to earn specified levels of income at specified levels of milk prices below and above 1958 price, optimum resource combination, improved management, typical dairy farm, Mississippi.

	$2,000			$4,000			$6,000		
Herd size	10% below	10% above	20% above	10% below	10% above	20% above	10% below	10% above	20% above
	— — — — — Number — — — — —								
Cows	21	14	12	47	30	25	84	47	39
Heifers (1-2 years)	7	5	4	16	10	9	29	16	13
Heifers (under 1 year)	8	6	5	18	12	10	33	18	15
Total number	36	25	21	81	52	44	146	81	67
Animal units*	26.50	18.00	15.25	59.50	38.00	32.00	106.75	59.50	49.25

*One mature cow; 2 heifers, 1-2 years; or 4 heifers under 1 year.

Table 13.—Land utilization to earn specified levels of income, optimum combination of resources, improved management, specified prices for milk below and above 1958 price, typical dairy farm, Mississippi.

	$2,000			$4,000			$6,000		
Item	10% below	10% above	20% above	10% below	10% above	20% above	10% below	10% above	20% above
	— — — — — Acres — — — — —								
Cotton	3.6	2.6	2.2	8.5	5.3	4.6	15.2	8.4	7.0
Corn for grain	10.4	7.1	6.1	23.1	14.6	12.5	41.6	23.1	19.2
Millet	10.7	7.3	6.3	23.8	15.0	12.9	42.7	23.7	19.7
Pasture	16.4	11.1	9.6	36.3	22.9	19.6	65.3	36.2	30.1
Pasture and hay	14.3	9.7	8.4	31.6	19.9	17.1	56.9	31.6	26.3
Corn and silage	6.4	4.4	3.8	14.3	9.0	7.7	25.7	14.2	11.9
Other land[1]	65.2	45.3	38.7	144.3	91.1	78.8	259.3	144.0	119.8
Total	127.2	87.5	75.1	281.9	177.8	153.2	506.7	281.2	234.0

[1]Includes idleland, woodland, and wasteland.

Table 14.—Labor, available and utilized, optimum combination of resources, improved management specified income levels, specified prices for milk below and above 1958 price, typical dairy farm, Mississippi.

	Family	$2,000			$4,000			$6,000		
	labor available	10% below	10% above	20% above	10% below	10% above	20% above	10% below	10% above	20% above
1st. quarter:		— — — — — Hours — — — — —								
Family labor	992									
Field	(272)	55	37	32	121	76	66	217	121	101
Livestock	(720)	496	336	291	871	693	594	775	871	891
Hired labor					228			1,200	225	21
Total	992	551	373	323	1,220	769	660	2,192	1,217	1,013
2nd. quarter:										
Family labor	1,144									
Field	(408)	277	188	163	408	387	332	408	408	408
Livestock	(736)	411	279	241	736	575	493	736	736	736
Hired labor					382			1,599	379	123
Total	1,144	688	467	404	1,526	962	825	2,743	1,523	1,267
3rd. quarter:										
Family labor	1,712									
Field	(976)	288	196	169	639	403	346	976	637	530
Livestock	(736)	310	210	182	687	433	372	736	685	570
Hired labor								671		
Total	1,712	598	406	351	1,326	836	718	2,383	1,322	1,100
4th. quarter:										
Family labor	1,176									
Field	(448)	448	377	327	448	448	448	448	448	448
Livestock	(728)	352	239	207	728	492	423	728	728	649
Hired labor		107			837	328	218	2,441	831	574
Total	1,176	907	616	534	2,013	1,268	1,089	3,617	2,007	1,671
Yearly total:										
family labor	5,024	2,637	1,862	1,612	4,638	3,507	3,074	5,024	4,634	4,333
Hired labor		107			1,447	328	218	5,911	1,435	718
Grand total		2,744	1,862	1,612	6,085	3,835	3,292	10,935	6,069	5,051

Table 15.—Investment capital necessary to earn specified levels of income when milk prices are at specified levels below and above 1958 price, optimum combination of resources, improved management, typical dairy farm, Mississippi.

	$2,000			$4,000			$6,000		
Investment	10% below	10% above	20% above	10% below	10% above	20% above	10% below	10% above	20% above
Equipment	8,881	8,725	8,680	9,464	9,083	8,971	10,293	9,464	9,285
Buildings	2,156	1,437	1,232	4,825	3,080	2,567	8,623	4,825	4,004
Land	9,540	6,562	5,632	21,142	13,335	11,490	38,002	21,090	17,550
Fences	655	451	387	1,452	916	789	2,610	1,448	1,205
Cows	6,050	4,150	3,500	13,600	8,700	7,350	24,450	13,600	11,250
Pasture	78	52	45	174	111	93	312	174	145
Total	27,360	21,377	19,476	50,657	35,225	31,260	84,290	50,601	43,439

ton would be needed to earn $2,000 above current operating expenses. At these low prices for milk it would take a minimum of 84 milking cows and 15.2 acres of cotton for the farmer to earn a $6,000 return to his labor, management and capital investment. An operation of that size would require more than 500 acres of land.

From none of these income figures has a deduction been made for interest on capital invested. Farm investments for each of the nine price-income level situations analyzed range from $19,500 to $84,000, Table 15. Deducting a 5 percent charge for interest on investment would leave the operator's family very little cash for living

expenses. The $2,000 earnings could be cut to as low as 926, Table 16. Even under the best price situation considered, the man who cleared $6,000 above current operating costs would have less than $4,200 left after deducting the charge for use of the capital invested.

Table 16.—Returns to labor and management, optimum combination of resources, improved management, specified income level, specified prices for milk below and above 1958 price, typical dairy farm, Mississippi.

Item	$2,000			$4,000			$6,000		
	10% below	10% above	20% above	10% below	10% above	20% above	10% below	10% above	20% above
Receipts:									
Cotton	804	546	473	1,782	1,123	964	3,203	1,777	1,479
Milk	4,072	3,379	3,196	9,026	6,959	6,517	16,222	11,010	9,999
Cattle	1,027	697	604	2,277	1,435	1,232	4,091	2,271	1,890
Total	5,903	4,622	4,273	13,085	9,517	8,713	23,516	15,058	13,368
Expenses:									
Cotton	243	165	143	539	340	291	968	537	447
Concentrate	1,020	692	600	2,261	1,425	1,223	4,064	2,255	1,877
Calf starter	240	163	141	532	335	288	956	530	441
Milk for calves	162	110	95	358	226	194	644	357	297
Pasture	264	179	155	586	369	317	1,053	585	486
Pasture and hay	438	297	258	971	612	525	1,745	969	806
Temporary grazing	135	92	80	300	189	162	539	299	249
Corn for silage	232	157	136	514	324	278	924	513	427
Breeding	141	96	83	312	197	169	561	311	259
Depreciation on fences, bldgs., and equip.	125	85	74	278	175	151	499	277	231
Hauling milk and ADA	561	380	330	1,243	784	673	2,234	1,240	1,032
Miscellaneous	303	206	178	672	423	364	1,207	670	558
Hired labor	39			519	118	78	2,122	515	258
Total	3,903	2,622	2,273	9,085	5,517	4,713	17,516	9,058	7,368
Total net returns to land, family labor, investment, capital & management	2,000	2,000	2,000	4,000	4,000	4,000	6,000	6,000	6,000
Interest on average investment (5%)	1,074	802	715	2,135	1,431	1,252	3,669	2,132	1,806
Net returns to family labor and management	926	1,198	1,285	1,865	2,569	2,748	2,331	3,868	4,194

SUMMARY AND CONCLUSIONS

The sharp decline in the supply of milk for manufacturing has caused much concern within the industry. Increases in the volume of "Grade A" surplus milk have failed to offset the decline in volume supplied by producers of manufacturing milk. Some of the more important factors leading to the decline in production by producers of manufacturing milk have been: increased production costs, high beef cattle prices, the low price of milk for manufacturing relative to the price of "Grade A" milk, and retirement of the acceptance of off-farm employment by dairy farmers.

Present management practices and enterprise combinations on manufacturing milk farms yield low returns. Even before allowing for interest on investment, the typical farm in two of the five size-groups studied showed returns of $800 or less in

1958. Average earning of capital, labor and management for the remaining size-groups ranged from $1,450 to $2,200.

Linear programming techniques were used to evaluate the effect of milk prices, improved management practices and resource availability upon farm organization and income. At 1958 prices, optimum farm organizations with improved management practices would have increased returns to the factors of production on the typical farms by as much as 120 to 440 percent.

To achieve returns to capital, labor and management of $2,000, $4,000 and $6,000, it would be necessary to have an investment of $27,000, $51,000 and $84,000 if the 1958 milk price is allowed to decrease by 10 percent (from $3.39 to $3.05 per cwt). If the 1958 milk price is increased by 10 percent (from $3.39 to $3.73 per cwt). an investment of $21,000, $35,000 and $51,000 would be required to achieve the specified returns to capital, labor and management. With a 20 percent increase in the 1958 milk price (from $3.39 to $4.07 per cwt). an investment of $19,000, $31,000 and $43,000 would be necessary to achieve the specified income levels. With the highest price and income level an investment of $43,000 would be required to yield a return of $4,194 per year to labor and management.

Incomes higher than those presently received can be attained through better management, more efficient use of labor and land, and additional capital expenditures. The individual must compare his present or expected returns with alternative enterprises and alternative employment opportunities.

APPENDIX

Appendix Table 1.—Estimated costs and returns per cow, improved management, typical dairy farm, Mississippi, 1958

Item	Unit	Quantity	Price	Amount
	(38 cow milking herd)		Dollars	Dollars
Income:				
Milk	cwt.	63.27	3.39	214.49
Cattle sold				48.67
Total				263.16
Expenses:				
Concentrate	cwt.	23.58	2.05	48.34
Calf starter	cwt.	.98	11.60	11.37
Milk for calves	cwt.	2.26	3.39	7.66
Pasture	acre	.77	16.27	12.53
Pasture and hay	acre	.67	30.99	20.76
Temporary grazing	acre	.50	12.82	6.41
Corn for silage	acre	.30	36.63	10.99
Breeding				6.67
Depreciation on fences, bldgs., and equip.				5.94
Hauling milk and ADA				26.57
Miscellaneous[1]				14.36
Total				171.60
Net returns above specified expenses				91.56

[1]Miscellaneous includes cleaning and other dairy supplies, veterinary costs, electricity, repairs, etc.

Appendix Table 2.—Corn: Estimated costs and returns per acre, improved management, typical dairy farm, Mississippi, 1958

Item	Unit	Quantity	Price	Amount
			Dollars	Dollars
Income:				
Corn	bu.	50.0	1.14	57.00
Expenses:				
Seed	bu.	.2	10.38	2.08
Ammonium nitrate	cwt.	3.0	3.80	11.40
Superphosphate	cwt.	2.0	1.55	3.10
Muriate of potash	cwt.	.5	2.62	1.31
Tractor operation	hr.	8.75	.95	8.31
Equipment operation	acre	1.0	----	1.92
Total expenses				28.12
Returns above specified expenses				28:88

Appendix Table 3.—Cotton: Estimated costs and returns per acre, improved management, typical dairy farm, Mississippi, 1958.

Item	Unit	Quantity	Price	Amount
			Dollars	Dollars
Income:				
Cotton lint	lb.	550.0	.3410	187.55
Cottonseed[1]	lb.	971.1	.02385	23.16
Total				210.71
Expenses:				
Seed	cwt.	.75	11.50	8.62
Ammonium nitrate	cwt.	2.18	3.80	8.28
Superphosphate	cwt.	2.40	1.55	3.72
Muriate of potash	cwt.	.80	2.62	2.10
Insecticide	acres	1.0	----	11.05
Tractor operation	hours	9.35	.95	8.88
Equipment operation	acres	1.0	----	5.21
Ginning, bagging and ties	cwt.-lint	5.50	2.70	14.85
Miscellaneous	acres	1.0	----	1.00
Total expense				63.71
Returns above specified expenses[2]				147.00

[1]Trash per bale = 3.3 percent of the harvested seed cotton weight (1,573 pounds), or 51.9 pounds of trash.

[2]No charge made for hired labor.

Appendix Table 4.—White clover and Dallisgrass pasture: Estimated annual costs per acre, improved management, typical dairy farm, Mississippi, 1958.

Item	Unit	Quantity	Price	Amount
			Dollars	Dollars
Expenses:				
Dallisgrass seed[1]	lb.	1.0	.80	.80
White clover seed[2]	lb.	.2	.834	.17
Ammonium nitrate	cwt.	1.0	3.80	3.80
Superphosphate	cwt.	3.0	1.55	4.65
Muriate of potash	cwt.	1.0	2.62	2.62
Lime[3]	ton	.4	7.25	2.90
Tractor operation	hours	1.2	.95	1.14
Equipment operation	acres	1.0	----	.19
Total annual expense				16.27

[1]Prorated for 10 year life, 10 lbs. at $.80/lb.

[2]Prorated for 10 year life, 2 lbs. at $.834/lb.

[3]Two tone per acre every 5 years, custom application at $2/acre.

Appendix Table 5.—Coastal bermuda and Crimson clover for grazing and hay: Estimated annual costs per acre, improved management, typical dairy farm, Mississippi, 1958.

Item	Unit	Quantity	Price	Amount
			Dollars	Dollars
Expenses:				
Bermuda sprigs[1]	thous.	.25	.60	.15
Crimson clover[2]	lb.	6.0	.325	1.95
Ammonium nitrate	cwt.	2.0	3.80	7.60
Superphosphate	cwt.	3.0	1.55	4.65
Muriate of potash	cwt.	1.33	2.62	3.48
Lime[3]	ton	.4	7.25	2.90
Tractor operation	hours	7.04	.95	6.69
Equipment operation	acres	1.0	.....	3.57
Total annual expenses[4]				30.99

[1]Prorated over 20 year life, 5,000 sprigs at $.60/thousand.
[2]Prorated over 5 year life, 30 lbs. of seed at $32.50/cwt.
[3]Two tone per acre every 5 years, custom application at $2/acre.
[4]Includes cost of harvesting 2½ tons of hay per acre.

Appendix Table 6.—Millet: Estimated annual costs per acre, improved management, typical dairy farm, Mississippi, 1958.

Item	Unit	Quantity	Price	Amount
			Dollars	Dollars
Expenses:				
Seed	lb.	25.0	.09	2.25
Ammonium nitrate	cwt.	2.0	3.80	7.60
Tractor operation	hours	2.5	.95	2.38
Equipment operation		1.0	.....	.59
Total annual expense				12.82

Appendix Table 7.—Corn silage: Estimated annual costs per acre, improved management, typical dairy farm, Mississippi, 1958.

Item	Unit	Quantity	Price	Amount
			Dollars	Dollars
Expenses:				
Seed	bu.	.3	10.38	3.11
Ammonium nitrate	cwt.	3.0	3.80	11.40
Superphosphate	cwt.	2.0	1.55	3.10
Muriate of potash	cwt.	.5	2.62	1.31
Tractor operation	hours	11.35	.95	10.78
Equipment operation	acres	1.0	.....	6.93
Total annual expenses[1]				36.63

[1]Includes cost of harvesting 9 tons per acre.

Appendix Table 8.—Estimated quarterly labor requirements for farm operation, typical dairy farm, Mississippi, 1958

	1st quarter	2nd quarter	3rd quarter	4th quarter	Total
		— — — — — Hours — — — — —			
		(38 cow milking herd)			
Livestock labor (per cow):					
Feed hay	1.53	.26	....	.50	2.29
Milk	11.47	12.42	8.97	8.21	41.07
Clean	1.55	1.61	1.61	1.58	6.35
Feed grain	1.42	1.55	1.13	1.03	5.13
Other routine work	1.21	1.24	1.24	1.24	4.93
Calves in pens	1.74	.97	.21	.97	3.89
Rotate grazing	....	.24	.71	.	.95
Feed grinding	.61	.32	.21	.24	1.38
Fence repair	1.82	....	....	1.82	3.64
Feed silage	1.53	.26	....	.50	2.29
Miscellaneous	.61	.63	.61	.61	2.46
Total	23.49	19.50	14.69	16.70	74.38
Field labor (per acre):					
White clover and dallisgrass	.24	.58	.98	.10	1.90
Coastal bermuda and crimson clover	1.56	4.09	5.14	.19	10.98
Millet	....	1.76	2.23	.	3.99
Corn silage	1.38	5.86	7.93	.26	15.43
Corn	1.35	5.82	2.84	15.24	25.25
Cotton	1.41	24.06	24.69	102.34	152.50
Total	5.94	42.17	43.81	118.13	210.05

*Ist. quarter, December, January, and February; 2nd. quarter, March, April, and May; 3rd quarter, June, July, and August, 4th quarter, September, October, and November.

Appendix Table 9.—Investment capital, present and optimum combination resources, improved management, typical dairy farm, Mississippi, 1958.

Item	38 cow milking herd
	— — Dollars — —
Equipment:	
Tractor, 2-row	2,640
Breaking plow	-------
Stalk-cutter, 2-row	500
Disk, 6' - 8'	485
Middlebreaker, 2-row	200
Fertilizer distributor, 10'	325
Fertilizer distributor, 2-row	75
Section harrow, 2-section	45
Cultivator, 2-row	285
Planter, 2-row	230
Trailer	465
Rake, side-delivery	485
Baler, small-PTO	1,750
Cultipacker, 10'	365
Spraying equipment	121
Cotton duster, hand	45
Mower, 7'	395
2-unit milking machine	260
Milk cooler, 7 can	220
Milk cans	221
Miscellaneous	150
Total	9,262
Buildings:	
Barn, hay storage and feeding	2,986
Milking barn	500
Trench silo	267
Other buildings	148
Total	3,901
Cattle:	
Milk cows	7,600
Heifers, (1-2 years)	1,950
Heifers, (under 1 year)	1,500
Bull	-------
Total	11,050
Other:	
Land	13,388
Fences	920
Pasture	141
Total	14,449
Total investment	38,662