Progress Report Series* No. 21 August 1946

AGRICULTURAL EXPERIMENT STATION
of The Alabama Polytechnic Institute, Auburn, Ala.
M. J. Funchess, Director

A SYSTEM FOR PROCESS MILK PRODUCTION IN THE BLACK BELT 1/

K. G. BAKER, Superintendent
Black Belt Substation

A farm-size experimental dairy producing milk for processing located on 80 acres of land of relatively low fertility at the Black Belt Substation near Marion Junction, Ala., has produced an average yearly net income to labor and total invested capital, not including government subsidy payments, of $14.58 per acre after taking out all cash expenses.

Purpose. There are thousands of acres in the Alabama Black Belt that are producing little income or are lying idle because productivity has been greatly reduced and row-cropping is no longer profitable.

The purpose of establishing the 80-acre experiment, begun in the spring of 1941, was to determine the possibilities of using and at the same time improving worn out soil by combining crops and dairy cattle in a farm-scale operation with a minimum of capital outlay.

It was planned to produce low-cost milk for manufacturing purposes by growing as much of the feed as possible and by managing the herd, so that the cows would freshen in the spring when the pastures are best.

History. The Substation for a number of years has been conducting experiments to determine the crops that are best adapted to the Black Belt, and the fertilizer requirements for economic production. These results were drawn upon in establishing the cropping system that would support the dairy.

The 80 acres are largely lime land, ranging from eroded hill tops of Sumter soil to the darker bottom soils. Included also, is a small acreage of acid land.

At the start of the experiment, there was only one building on the 80-acre tract. This was a tenant house, a relic of the by-gone days of cotton farming, which was reconditioned at a small expenditure. Since the hay was to be stacked in the fields, the only other building needed was a milking shed. To keep capital outlay for buildings to a minimum, the milking shed was designed to accommodate 12 animals, with the herd to be milked in relays. This shed was built at a cost of $122.73.

A herd of 25 heavy springer heifers was purchased from farmers in Elmore County, Alabama, at a cost of $971. While these heifers showed a predominance of Jersey breeding, little was known of the production records of their ancestors.

* Formerly Mimeograph Series.
1/ Four-year progress report, 1941-45

Other capital outlay at the start of the experiment included $232.20 for border and cross fencing, $60.95 for water system, and $75.25 for milk utensils. The land was valued at $2,250 and the tenant dwelling at $150.

The operations of the experimental dairy were supervised from the Substation, and the regular labor of operating the farm was supplied by a Negro and his wife. However, the supervision or management, was purposely limited, in order that it be comparable to that which a land owner might give such an enterprise as a part of his total farm operation. The regular labor for operation of the dairy required only one-half of the man's time during the period of milk production, from April to December. During the period when the cows were dry, very little of his time was needed. The remainder of the man's time was used on the Substation.

At certain periods, necessary extra labor and power machinery were hired from the Substation and charged to the dairy's operation expenses at local prevailing rates. These rates varied for different types of work and for the period reported. For instance, the charge for land breaking varied from $2.00 in 1941 to $2.50 per acre in 1944 and for planting from 50 cents to $1.00 per acre.

CROPPING SYSTEM

Based on the Substation's results and experiences, a cropping system was planned to provide grain, hay, and grazing. Seventy-two acres of the farm's acreage were divided into three separate fields and fenced in order that the area might be managed to obtain a maximum amount of feed the year around. The cropping system developed requires about 3 acres per mature animal, divided as shown below.

In any one season, only one-fourth of the land in the cropping system is plowed.

Field No. 1. In this system Field No. 1 was planted to small grains -- barley the first year, and oats the second and third years.[1/] The shift from barley was made because oats were better suited to the system. The best drained soils (preferably Sumter) were used for small grain production. In combination with the oats, were volunteer stands of black medic. In addition to providing grazing and grain, this field of oats produced Johnson grass, which was managed as a perennial crop. When stands of Johnson grass became thin, it was necessary to reseed the Johnson grass.

Time and method of breaking land for oats in the Black Belt are very important. The land was turned 4 to 6 inches deep with a disk plow as soon after oat harvest as possible, and was disked the same day. If the stand of Johnson grass became thin, 20 to 30 pounds of seed per acre were sown and harrowed in on the freshly broken land. In either case, with good seasons about one ton of Johnson grass hay was harvested per acre on this area within 6 to 8 weeks. A second growth of Johnson grass was then produced.

In mid-September, the oats were planted with a disk drill in the young second-growth Johnson grass at the rate of 2½ bushels per acre. The oats were fertilized at planting time with 200 pounds of superphosphate per acre. About March 1, when the cattle were removed, the oats were top-dressed with 100 pounds per acre of nitrate of soda.

1/ Because of continuous cropping of Field No. 1 to small grain, oats were planted on Field No. 2 the fourth year. However, Field No. 2 is low wet land and it was found to be less suited to oats than Field No. 1, and the oats had to be handled as a hay crop.

Field No. 1	Field No. 2	Field No. 3 Permanent Pasture
Oats Black Medic followed by Johnson Grass	Caley Peas followed by Johnson Grass	Black Medic White Clover Dallis Grass
18 acres or 3/4 acre per mature animal	18 acres or 3/4 acre per mature animal	36 acres or 1-1/2 acres per mature animal

The acreage in Field No. 1 is one-fourth of the total acreage of the three fields, Field No. 2 one-fourth, and Field No. 3 one-half.

The oats were cut and threshed (combined) after they were fully matured. In one instance, the stand of oats was thin, with a proportionately heavier volunteer stand of medic. This mixture was cut and stacked for hay.

Field No. 2. In the first year of operations, Field No. 2 was seeded in September, to Caley peas at the rate of 40 pounds per acre, and they were followed by Johnson grass. The peas reseeded themselves each year.

The fertilizer treatment for the Caley peas was an annual application of 400 pounds per acre of superphosphate.

The Johnson grass was handled the same as on Field No. 1.

Field No. 3. Field No. 3 is the permanent pasture area in the system. It consists of white clover, black medic, and followed by Dallis grass.

The white clover was sown in October, 1941, at the rate of 3 pounds of seed per acre on a lightly disked seedbed. Mature Dallis grass was then hauled from adjoining areas and scattered (in the straw) on the pasture area. The black medic came into the pasture as a volunteer crop.

The fertilizer treatment used was an annual application of 400 pounds per acre of superphosphate.

USE of CROPS and MANAGEMENT of HERD

Breeding. After the first crop of calves was dropped by the 25 purchased heavy springers, a purebred Jersey bull was put with the herd each June in order to obtain spring crops of calves.

It was planned to take full advantage of the grazing seasons, in order to produce cheap milk and to give the cows their rest period during the winter, when the cost of milk production is relatively higher.

Use of crops. The dry cows were wintered on fall-seeded oats (Field No. 1) and stacked Johnson grass hay until about March 1. At this time the

cows were removed to allow the oats to mature grain, and were turned in on Caley peas (Field No. 2).

The Caley peas were grazed until the plants began to bloom and produce seed, at which time the crop is toxic to animals. The cows were removed to the permanent pasture (Field No. 3). Under favorable moisture conditions, Caley peas have given 6 to 8 weeks of heavy grazing.

The pasture (white clover and black medic followed by Dallis grass) was grazed in the spring and summer as long as it supplied nutritious green feed. When grazing on this field was reduced by drought or frost, the Johnson grass in Fields No. 1 and 2 was relied upon for supplementary grazing.

Following the harvest of oats (Field No. 1) and seed maturity of the Caley peas (Field No. 2), the Johnson grass was cut and stacked in the two fields for winter feeding. With good rainfall, the Johnson grass produced a second crop, which was left standing for grazing after frost. However, in one instance, dry summer weather eliminated the possibility of a second crop of Johnson grass, and stacked hay and fall-seeded oats were depended upon for winter roughage.

In the fall the herd was turned in on the second-growth standing Johnson grass (Fields No. 1 and 2), and the Johnson grass was grazed off, with the oats coming on later in Field No. 1 to furnish winter grazing.

Feeding. In the 4 years all required roughage has been raised on the dairy farm. However, cottonseed meal or peanut meal (protein concentrates) was used as a supplement when the pasture was short or when Johnson grass or Dallis grass was the only available grazing. About 8-3/4 tons were used per year during the 4-year period. With improvement in the level of soil fertility, purchase of less meal is anticipated in the future, because more protein will then be supplied by increased yields of legumes in the cropping system.

As weather conditions varied, it was necessary to shift the herd on the roughage-producing areas and to adjust the amounts of concentrate fed. For instance, when drought or frost occurred and grazing became short on the permanent pasture, the herd was moved to the fields provided in the cropping system for supplementary grazing and one of the meal supplements was fed. Under favorable spring weather conditions, clovers were available; therefore, no cottonseed meal was used.

Culling and replacements. It was the general plan to maintain a mature herd of 25 cows, although this number varied within reasonable limits because of the need to cull and the time required to raise replacements.

It was necessary to cull one or more animals each year because of defective udders, low milk production, or shy breeding.

Calves from the best cows have been used for all replacements in the herd.

Shelter. About 8 acres of natural hardwoods provided all of the shelter in the winter, and this area in addition to trees along fence lines provided shade in the summer.

FOUR-YEARS' RESULTS of OPERATIONS

Production. The average amount of milk sold for processing per year in the 4-year period totaled 77,704 pounds or 3,108 pounds per cow. This, however, is not the total production of the herd. Since the cows freshened over a period of a number of weeks, it was not practical to haul milk to market until total production reached a volume to justify delivery. During this period, the calves suckled the cows. Also, the tenant and his family were supplied milk from the herd throughout production.

Returns from operations. Under the described system of cropping, the 80 acres of relatively low fertility were made to produce an average yearly income to labor and capital (total money invested) of $1,166.43, or $14.58 per acre. The average annual income to labor alone amounted to $931.66, or $11.65 per acre, and income (6 per cent) to capital invested in land, buildings, fencing, livestock, and equipment averaged $234.77 per year.

Cash sales. Returns from milk made up a large portion of the cash sales of the 80-acre farm experiment, although in the last year of operation, 1944-45 nearly $1,000 worth of surplus seed, grain, and cull animals were marketed. The 4-year average annual cash sales amounted to $2,334.57, of which $1,772.80 was from the sale of milk to a cheese plant. These amounts do not include government subsidies paid to dairymen beginning the fall of 1943 to help offset the diminishing margin of profit caused by rising mixed feed prices as against milk prices fixed by ceilings.

Expenses. Average annual cash expenses for the 4-year period amounted to $1,174.64. These expenses were for fertilizer, cottonseed and peanut meal, extra labor and power machinery, hauling milk to the cheese plant, taxes, and miscellaneous items.

Extra labor and machinery required for land breaking, planting, and harvesting by this farm-size experiment were supplied by the Substation and charged at standard local rates. While it is not probable that such a practice could be followed in a community of small farms, owners of large acreages could put to work similar nonproducing land in their holdings by the use of such a system of operation. Extra labor and power machinery when needed could be supplied from the farm as a whole.

CHANGES for IMPROVING the SYSTEM

Certain changes were made from time to time to improve the system of operation and cropping.

Barley was grown as the grain crop the first year on Field No. 1. Because it was necessary to seed barley late to avoid root rot, low yields of grain resulted and winter grazing was late. For these reasons the crop was replaced by early, fall-seeded oats.

The rate of top-dressing oats with nitrogen in the spring has been changed from 100 to 200 pounds per acre, because larger and more economical yields of grain could be harvested per acre.

Results from pasture plot experiments on the Substation showed definite need for potash after several years' trials. Therefore, both phosphate and potash will be used on legume grazing crops in the future.

SUMMARY and CONCLUSION

In the spring of 1941 an 80-acre experimental dairy for process milk production was established at the Black Belt Substation for the purpose of determining the possibilities of (1) using nonproducing land, and (2) producing low-cost milk with a minimum of capital outlay.

The cropping system, based on results and experiences at the Substation, was planned to produce as much of the feed requirements as possible. This system required about 3 acres per cow, divided as follows: 3/4 acre of fall-seeded oats and volunteer black medic followed by Johnson grass, which was managed as a perennial; 3/4 acre of Caley peas, which reseeded themselves, followed by Johnson grass; and 1½ acres of permanent pasture consisting of white clover, black medic, and Dallis grass. Elsewhere, such a system of feed and forage production might require more acres or less acres per cow, the number depending upon the level of productivity of the land and the amounts of fertilizers used.

A herd of 25 heavy springer heifers was bought and about this number was maintained during the 4-year period. Although the purchased animals were predominantly of Jersey breeding, no production records of their ancestors were available.

The cropping system produced all of the required roughage; however, to take full advantage of the grazing seasons in order to produce cheap milk, the cows were bred to drop spring calves and to have their rest period during the winter when milk production costs are higher.

The average total amount of process milk sold in the 4-year period, 1941-1945, amounted to 77,704 pounds per year.

The total capital outlay, which was purposely held to the minimum, amounted to $3,862.63 at the start of the experiment. Four years later this outlay had increased about $50.

By this cropping system, the 80 acres of relatively low fertility were made to produce $931.66, or $11.65 per acre, as yearly income to regular labor during the 4-year period. Returns to capital invested in land, stock, buildings, and equipment totaled $939.08 for the 4 years, or an average of $234.77 per year. Combined labor and capital income averaged $14.58 per acre per year. These returns do not in clude government subsidy payments paid dairymen for milk produced in 1943 and 1944, but they do include returns from the sale of surplus grain, seed, and cull animals.

Yearly cash expenses averaged $1,174.64 during the period. The greatest single cash cost item was for cottonseed and peanut meals, which were used as supplement during periods of the year when no legumes were available in the grazing areas or pasture was short. As soil fertility levels improve, increased yields of legumes are expected. Therefore, it is believed that this relatively large cash expense item may be reduced to some extent as the home production of protein in the form of legumes is increased.

Four years' results of the experiment show: (1) That land of relatively low fertility in the Black Belt can be brought back into productive use by such a system of operation and cropping; (2) that the production of milk for processing lends itself to the use of nonproducing areas within farms where most of the labor can be supplied by the operator; and (3) that such areas, if not over-stocked, can be made to supply all of the roughage requirements by an improved program, which includes the use of proper kinds and amounts of fertilizers.

FACTORS RELATING to PROFITABLE OPERATIONS of 80-ACRE GRADE-B DAIRY UNIT

Items	First year 1941-42	Last year 1944-45
Capital Investment, dollars	3,862.13	3,915.09
Total Investment per acre, dollars	48.27	48.94
Relationship of items to total investment		
Land, 80 acres per cent	58	57
Buildings, per cent	8	7
Fencing, per cent	6	7
Dairy animals, per cent	27	29
Miscellaneous, per cent	2	2
Fertilizer cost per acre, dollars	4.30	5.73
Per cent of all cash receipts from livestock	77	76
Cash receipts from livestock per productive animal unit, dollars	62.29	80.89
Milk prices received per hundred, dollars	2.02	2.39
All receipts per farm acre, dollars	26.02	41.70
Labor and hired machinery cost per farm acre, dollars	6.46	12.20

SUMMARY of BUSINESS of 80-ACRE GRADE B DAIRY UNIT, 1941-45 AVERAGE

Items	4-year average
Cash receipts	
Milk (77,704 pounds)	$ 1,772.80
Bonus paid by cheese plant	30.88
Cows	79.10
Calves	54.45
Miscellaneous (seed and grain)	397.34
Total	2,334.57
Cash Expenses	
Fertilizer	187.01
Feed	374.08
Extra labor	188.30
Hauling milk to cheese plant	219.36
Seed, planting	22.05
Taxes	41.03
Miscellaneous	142.81
Total	1,174.64
Financial summary	
Cash receipts	2,334.57
Cash expenses	-1,174.64
Net cash income	1,159.93
Inventory (increase or decrease)	✓ 6.50
Income to capital and labor	1,166.43
Capital investment (Average)	3,912.81
Return to capital (6 per cent)	234.77
Return to labor	931.66
Per acre return to capital and labor	14.58
Per acre return to labor	11.65
Per acre return on net cash return	14.50
Milk subsidies paid in 1943-44 and 1944-45 years (2-year average)	$600.16

* AGRICULTURAL EXPERIMENT STATION *
of the Alabama Polytechnic Institute, Auburn, Alabama
M. J. Funchess, Director

REPORT of GRADE B DAIRY UNIT, BLACK BELT SUBSTATION, 1941-48*

(Supplement to Progress Report Series No. 21)

K. G. BAKER, Superintendent

In 1945 a progress report was issued covering 4 years' operations at the Black Belt Substation of an experimental 80-acre dairy for process milk production. A supplementary report of the operation of the dairy for the succeeding years (1945-48) is now added.

In this summary discussion, Period I and Period II are used to designate the 4-year and 3-year periods, respectively.

During Period II, the management system for the crops and herd was practically unchanged from that of the earlier period, except in the kind and amount of fertilizers used. In the main, 0-14-10 was used on all pastures and hay crops, while some 6-8-4 was used on oats.

Period I and Period II

Results. Results given in the accompanying table show the production, cost, and income for the two periods. Because of wide variations in prices for all items bought and sold, a comparison between periods as a whole would be misleading. However, since the purpose of this project is to bring worn out soil into production and to produce low-cost milk, a comparison of some of the data shows significant trends -- upward in production and downward in cost of production.

The area comprising the unit in 1941 was largely worn out cotton land. The plan was to produce all possible feed for the dairy animals and to buy supplementary feed when necessary. A comparison of the two periods show the following significant changes:

	Period I	Period II
In Period II -- 26% more fertilizer was used (per acre)	291 lb.	367 lb.
-- 85% less feed was bought (per acre)	222 lb.	33 lb.
-- 25% more milk was produced (per acre)	971 lb.	1,215 lb.
-- 25% lower cost of milk production (per acre)	$1.81*	$1.36*

*Includes labor

Observations. Fertility of the soil has been gradually increased by the application of mineral fertilizers and by the growth of legumes. This improvement has been particularly noticeable during Period II, when heavier applications were made.

The cost of producing milk decreased even though higher prices prevailed for all items purchased during Period II.

It should be noted that this dairy is not a self-contained unit, since it owns none of the equipment necessary for cultivation and harvesting. The equipment is supplied by the Substation and a customary charge on a per acre or per ton basis is assessed against the unit.

* Prepared for Field Day for Agricultural Workers, February 24, 1948.

Production, Sales, Costs, and Income, Grade B Dairy Unit
Black Belt Substation, 1941-48

80 acres - 25 cows

Items	1941 - 45 average	1945 - 47 average
Cash receipts		
Milk	$ 1,772.80	$ 3,027.54
Bonus paid by cheese plant	$ 30.88	$ 30.00
Cows	$ 79.10	$ 230.20
Calves	$ 54.45	$ 49.85
Miscellaneous (seed and grain)	$ 397.34	$ 210.13
Total	$ 2,334.57	$ 3,547.72
Cash Expenses		
Fertilizer	$ 187.01	$ 332.98
Feed	$ 374.08	$ 95.86
Cultivating and harvesting	$ 188.30	$ 244.00
Hauling milk to cheese plant	$ 219.36	$ 352.53
Seed for planting	$ 22.05	$ 62.25
Taxes	$ 41.03	$ 39.71
Miscellaneous	$ 142.81	$ 85.70
Total	$ 1,174.64	$ 1,213.03
Financial summary		
Cash receipts	$ 2,334.57	$ 3,547.72
Cash expenses	$ 1,174.64	$ 1,213.03
Net cash income	$ 1,159.93	$ 2,334.69
Inventory (increases or decreases)	$ + 6.50	$ + 251.01
Income to capital and labor	$ 1,166.43	$ 2,585.70
Capital investment (average)	$ 3,912.81	$ 3,999.45
Return to capital (6%)	$ 234.77	$ 239.97
Return to labor and management	$ 931.66	$ 2,345.73
Labor cost	$ 532.40	$ 611.25
Return to management	$ 399.26	$ 1,734.48
Return to capital and management	$ 634.03	$ 1,974.45
Milk subsidies received (not used in figures above)	$ 300.08	$ 296.77
Milk production per 80 acre unit (actual sales)	77,704 lbs.	97,176 lbs.

Per Acre Production, Sales, Costs, and Income, Grade B Dairy Unit Black Belt Substation, 1941-48

Item	1941 - 45 average	1945 - 47 average
Milk produced per acre	971 lb.	1,215 lb.
Sales of milk per acre	$ 22.55	$ 38.22
Other sales per acre*	$ 6.64	$ 6.13
Change in inventory per acre	$ .08	$ 3.14
Total income per acre	$ 29.27	$ 47.49
Fertilizer cost per acre	$ 2.34	$ 4.16
Feed cost per acre	$ 4.68	$ 1.20
Other costs per acre**	$ 10.60	$ 12,80
Total costs per acre	$ 17.62	$ 18.16
Gross cost of milk per 100 lb. exclusive of labor	$ 1.81	$ 1.49
Other income per 100 lb. of milk***	$ .69	$ .76
Net cost of milk per 100 lb. exclusive of labor	$ 1.12	$ .73
Gross cost of milk per 100 lb. including labor	$ 2.50	$ 2.12
Other income per 100 lb. milk***	$ .69	$ .76
Net cost of milk per 100 lb. including labor	$ 1.81	$ 1.36
Income to labor and management per acre	$ 11.65	$ 29.33
Income to management per acre	$ 5.00	$ 21.69
Average amount of fertilizer applied per acre	291 lb.	367 lb.
Average amount of feed fed per acre	222 lb.	33 lb.
Average price of milk per 100 lb.	$ 2.32	$ 3.15

* Includes sale of cattle, Dallis grass seed, and grain.

** Includes planting and harvesting, hauling milk to cheese plant, seed for planting, taxes, interest on investment, and miscellaneous items. Labor cost not included.

*** Other income includes sale of cattle, seed, and grain plus change in inventory, which is an income that must be deducted from cost of production.

Note: Figures above do not include payment of Federal subsidies to the unit.

The average amount of milk sold per cow per year was 3,108 lb. for the first period and 3,887 lb. for the last period. These figures do not include home use of milk and milk consumed by heifer calves grown out for replacement. Considering entire production of the herd, the per cow production for the last 3-year period ran between 4,100 lb. and 4,200 lb.