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# FEED and FORAGE CROPPING SYSTEM for PROCESS MILK PRODUCTION in the ALABAMA TENNESSSEE VALLEY

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Can the present number of Tennessee Valley dairy farmers remain in the business when lower milk prices return?

Four years' results from an 87-acre grade B dairy experiment at the Tennessee Valley Substation say they can, provided they establish a cropping system that yields large amounts of year around grazing and hay.

Results from this experimental dairy, on which forage crops, pasture, and hay are grown the year around, show:

1) That good grade cows on pasture, forage, and hay alone--without grain or concentrate--will produce around 2½ gallons of milk per day.

2) That concentrate fed to such cows having an abundance of grazing and hay did not increase milk production enough to pay for the concentrate.

3) And that dairy farmers of the Tennessee Valley using such a cropping system can produce milk cheaply enough to remain in business even in periods of low prices.

## FARM-SIZE DAIRY EXPERIMENT

In 1942 the Alabama Agricultural Experiment Station began operation of an 87-acre farm-size dairy experiment at its Tennessee Valley Substation near Belle Mina. The purpose was to find a logical combination of crops that would yield cheap milk for sale to process plants. In this experiment, the Station was looking ahead to the time when dairy farmers would be faced with low prices.

Previous to operation of the unit, the Substation bought 20 grade heifers. These were selected for breeding capacity and milk production. Also, a registered Jersey bull of good production breeding was purchased. The animals were bought in 1940 preliminary to the operation of the unit 2 years later.

After milk production of each cow was determined, the animals were placed in two groups of about nine cows each having as nearly as possible the same total milk production capacity. The groups were used to test different feeding schedules and rations aimed at determining methods of producing low-cost milk.

A dairy barn was designed and built to include space for storing hay, milking, caring for milk, and housing the cattle at night.

The crops grown to support the dairy unit include permanent pastures of adapted legumes and grasses; alfalfa; and a legume-grain rotation consisting of crimson clover, followed by grain sorghum, which is interplanted with oats about September 1. The crops and methods of production are described later in this publication.

In developing this system, the Substation drew upon its results and its experiences from crop production experiments.

## PAY-OFF from SYSTEM

The cows of the dairy are divided into two groups of about equal total milk pro-

*Formerly Mimeograph Series.

duction capacity. One group produced milk wholly on an abundance of good grazing or hay. The other group, in addition to having access to the same grazing and hay, was fed a concentrate consisting of 1 pound of cottonseed meal and 3 pounds of crushed grain. During the first 2 years of the experiment, this mixture was fed at the rate of 1 pound for each 3 pounds of milk produced. The rate was reduced during the last 2 years to 1 pound for each 4 pounds of milk.

The two groups of cows were switched every year so that total annual production from each feeding schedule would be equalized over a period of an even number of years.

Results from 1942-46 operations of the experimental dairy are as follows:

1) Annual milk production per cow in the group getting concentrate averaged 6,953 pounds per year during the 4-year period. On the other hand, average annual production per cow in the group getting no concentrate was 6,354 pounds of milk in the same period.

2) The average number of milking days of the concentrate-fed group was 309 per cow, while for the group fed no concentrate the average was 304 days.

3) Average production per cow per day in the concentrate-fed group during the period was 22-6/10 pounds of milk per day, whereas the group getting no concentrate averaged 21 pounds per cow per day. This is a difference of 1-2/3 pounds, or less than a quart of milk per day.

4) In this experiment, where cows have an abundance of grazing and hay, the concentrate fed failed to increase milk production enough to pay for the concentrate. The amount of concentrate fed averaged 2,167 pounds per cow per year during the period. The average amount of increase in milk production of the concentrate-fed group over the group getting no grain was only 599 pounds of milk per cow.

These results show that a dairy farmer having a large amount of good grazing and hay could cut out his expense for concentrate and still maintain production of about 6,300 pounds of milk per cow per year, provided his cows have good milk production ability.

5) It is contended by some people that a

**Summary of Milk Production, 1942-46**

| Feed groups* | Milk production per cow per year | | | | |
|---|---|---|---|---|---|
| | 1942-43 | 1943-44 | 1944-45 | 1945-46 | Average |
| | *Pounds* | *Pounds* | *Pounds* | *Pounds* | *Pounds* |
| Group fed concentrate | 6,322 | 6,717 | 7,548 | 7,225 | 6,953 |
| Group fed no concentrate | 6,195 | 6,596 | 5,968 | 6,659 | 6,354 |
| Difference | 117 | 121 | 1,580 | 566 | 599 |
| | Milk production per cow per day | | | | |
| Group fed concentrate | 20.2 | 21.7 | 24.1 | 24.8 | 22.6 |
| Group fed no concentrate | 19.3 | 21.0 | 19.6 | 23.9 | 21.0 |
| Difference | 0.9 | 0.7 | 4.5 | 0.9 | 1.6 |

*Both groups had all the grazing and hay they could eat.

concentrate in the ration is necessary for maintaining high butterfat content. Four years' results, however, do not support this contention. The butterfat content of milk from the cows getting concentrate averaged 5 per cent, while the cows wholly on good grazing and hay averaged 4.9 per cent--only 1/10th of 1 per cent less.

6) The net returns from process milk production of the entire experimental dairy averaged $2,709.72 per year. This is what was left after all expenses for land rent; feed; veterinary services; maintenance of bull, nurse cows, and calves; and miscellaneous items including labor were taken out of the total returns from process milk sales.

7) The experimental dairy produced a surplus of seed and grain, sale of which averaged $2,821.29 per year for the 4-year period. A dairy farmer producing his own feed by such a system might market his surplus grain through hogs and poultry, such as is being practiced by the Station.

8) All of the feed and forage used was charged to milk production and was credited to sales of the farm unit. In other words, the experimental dairy sold itself necessary feed supplies. This is exactly what a farmer does when he grows his own feed needs--instead of buying the other fellow's feed, he buys his own.

9) The combined net annual income amounted to $5,531.01, or $63.57 per acre, in the 4-year period of the experiment.

## PRODUCTION SYSTEM and CROP USE

**Acreage per animal.** Methods and practices found to give the most economic results at the Substation were combined into a cropping system to provide large amounts of feed and forage the year around. This system requires 3½ acres per cow, and is as follows:

1) One acre of permanent pasture, consisting of white clover, hop clover, blue grass, and Dallis grass.

2) One acre of crimson clover-rye grass mixture planted in late July, which is followed by grain sorghum the next June, and in turn followed by fall oats seeded the following September.

3) One acre of oats planted in September, followed by crimson clover and rye grass seeded the next July, and in turn followed by grain sorghum planted the next June.

4) One-half acre of a perennial hay crop, such as alfalfa, lespedeza sericea, or kudzu.

Seventeen acres of permanent pasture in three separate areas are used for grazing replacement heifers and the herd bull.

This unit of 3½ acres per cow is based on yields on land at the Substation under normal weather conditions, such as 40 bushels of corn, 3 tons of hay, and 75 bushels of oats per acre. Under average weather conditions, this system has produced surpluses of grain and hay. Such sur-

Average Number of Grazing Days per Year Provided by Crops, 1942-46*

| Crops | Average number of days by months | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | M | A | M | J | J | A | S | O | N | D | J | F | Total |
| Permanent pasture | 11 | 4 | 21 | 22 | 14 | 15 | 18 | 7 | 7 | 4 | - | - | 123 |
| Alfalfa | - | - | - | 8 | 24 | 22 | 1 | - | 5 | - | - | - | 60 |
| Crimson clover and rye grass | 24 | 28 | 12 | - | - | - | - | 13 | 24 | 14 | 10 | 15 | 140 |
| Winter oats** | - | - | - | - | - | - | - | 7 | 16 | 12 | 13 | 8 | 56 |

* The period shown begins with March and ends with February; adverse rainfal conditions (65 per cent of normal) in the first 2 years cut grazing capacities of the crops.

** Oats grazed only by dry cows and heifers.

pluses might be used for feeding work stock, hogs, and poultry. Any additional surplus grain might be sold. A backlog of stored hay, however, is an advantage in times of lower yields in poor cropping seasons.

It is pointed out that any such acreage unit per cow is dependent upon the fertility of the land on which the crops are to be grown.

**Use of crops.** In this system of providing feed for the dairy, some of the crops are gathered by the milk cows. The amount of grazing provided by each of the crops is shown in the chart on page 3.

Production and use of the crops grown in the system follow.

**Permanent pasture.** Since the permanent pasture is located next to the barn, it is used as a night pasture throughout the year. From about May 1 to October 1, it supplies all of the grazing for the cows except in drought periods. In such periods the cows are grazed on alfalfa to relieve the permanent pasture. The permanent pasture is also used at times in March, April, and November when the land is too wet to graze.

In the 4 years of the experiment, the permanent pasture provided an average of 123 days of grazing per year. Supplemental grazing was required an average of 60 days in June, July, August, September, and November.

The permanent pasture used in this dairy unit was started in 1929. To establish such a pasture, the land is thoroughly prepared by plowing and disking for either spring or fall seeding. Before planting, 1 ton of lime, 300 to 400 pounds of superphosphate, and 100 pounds of muriate of potash are applied per acre. One ton of basic slag per acre may be used in place of the lime and phosphate. Each year an application of 300 to 400 pounds per acre of superphosphate and 50 pounds of muriate of potash, or 600 pounds of basic slag plus the potash is given.

For spring seeding the entire mixture is planted at one time at the rate of 10 pounds each of Dallis grass, orchard grass, blue grass, and common lespedeza; 4 pounds of white clover; and 1 pound of hop clover. In the case of fall seeding, the same rates per acre are used, but the lespedeza is not included and the Dallis grass is not planted until the following spring.

The common lespedeza and orchard grass are added in order to provide grazing the first years of establishing the pasture. The sod finally will consist of blue grass, Dallis grass, hop clover, and white clover.

**Hay crops and temporary pastures.** Alfalfa has proved to be an important and adaptable crop in this system, because it can be used wholly as a hay crop or as a combination hay and temporary grazing crop, depending upon immediate needs. For instance, alfalfa was used for hay and for temporary grazing in the 4 years. The first 2 or 3 cuttings have been baled and stored. During the dry summer periods the alfalfa has been used as a temporary pasture to relieve the permanent pasture, providing an average of 60 days per season of emergency grazing.

The alfalfa can be used wholly as a hay crop. On the other hand, it is well suited to temporary grazing during summer drought periods in addition to providing several cuttings for hay.

The alfalfa hay is fed at the rate of 30 pounds per day per cow, or about 3/4 ton per year per cow during periods in the winter when pasture is not available because weather conditions do not permit grazing the temporary crops.

In establishing the alfalfa, the land was summer fallowed, with enough disking to kill weeds and conserve moisture. Before planting, 2 to 3 tons of lime, 500 pounds of superphosphate or 1,000 pounds of basic slag, and 100 pounds of muriate of potash were applied per acre and disked into the soil. The alfalfa seed were inoculated and were seeded in late August or early September when there was good season in the ground, and was planted at the rate of 25 pounds per acre of the Kansas common variety. Best results were obtained from annual applications of 500 pounds of superphosphate per acre or 1,000 pounds of basic slag.

Kudzu or lespedeza sericea may be substituted for the alfalfa. These two crops

are better suited to less fertile land.

**Winter oats.** The winter oat acreage is used for fall and winter grazing by the dry cows and calves. Grazing is started about October 15, and it is continued as weather and soil conditions permit until March 1, when the animals are removed to allow the oats to produce grain. The grain sorghum stalks left in the field at harvest are eaten along with the oats. During the four seasons the oats were grazed an average of 56 days per year.

The average yield at this Substation over a period of years has been about 70 bushels per acre. Surplus oats are used for work stock, poultry, and other livestock on the farm. Any additional surplus could be sold for grain or seed.

A red rustproof strain of oats is used in this rotation. The oats are planted at the rate of 3 bushels per acre in the middles of the grain sorghum about September 1, using a three-row drill. No fertilizer is applied at planting time, but about March 1 the oats are top-dressed with 200 to 300 pounds per acre of sodium nitrate, or 160 to 220 pounds of ammonium sulfate, or 100 to 150 pounds of ammonium nitrate.

Following the harvest of oats about June 10, the stubble is turned immediately, and the land is summer fallowed preparatory to planting crimson clover and rye grass in late July or early August.

**Crimson clover and rye grass.** By planting the crimson clover and rye grass in late July, the combination crop is ready for grazing about October 1 to 15, and it is grazed whenever soil conditions permit until early May. In the 4-year period, this combination crop provided an average of 140 days of grazing per season.

The latest date of grazing crimson clover is about May 10, when the cows are removed and the crop is allowed to ripen seed. The seed crop is combined the latter part of May, and the stubble is turned preparatory to planting sorghum. About 400 pounds per acre per year of crimson clover seed have been harvested in this system. All of the seed in excess of that needed for later plantings are sold on the market.

(In case a farmer does not have a market for his surplus crimson clover seed, 50 to 75 per cent of the clover acreage can be turned April 15 and planted to corn. He still would have enough crimson clover acreage to supply grazing required by the cows until the clover matured seed.)

To obtain maximum results, the crimson clover-rye grass combination is planted early on fertile land that has been summer fallowed, preferably following small grains. The land is thoroughly disked and worked down to a firm seedbed in June or early July, and it is later disked as often as it is necessary to control weeds and to conserve moisture during the fallowing period. Previous to planting, 200 to 300 pounds of superphosphate or the equivalent in basic slag are disked into the soil. Twenty pounds of rye grass are seeded ahead of a disk-harrow, which is given a slight set, and 35 pounds of crimson clover are planted on top of the soil behind the harrow. The land is then section-harrowed and rolled to smooth the soil and to put the crimson clover seed slightly under the surface. The seeding is done the latter part of July or early August when a good season is in the ground. For good growth of the crimson clover, it is necessary to inoculate the seed.

The purpose of using the rye grass in combination with the crimson clover is to provide greater volume of grazing, to give more variety, and to prevent clover bloat. The rye grass is used in preference to small grains because it is freer from insect and disease injury, and, therefore, it can be planted with safety at the same time as the crimson clover.

**Grain sorghum.** At this Substation, corn and late-maturing grain sorghums will not make grain following crimson clover that has been allowed to mature seed. Therefore, one or more of the quick-maturing, dwarf-type grain sorghums are planted in June or early July after the crimson clover has been harvested for seed. It has been found by this Substation that Martin's Combine, Caprock, or Plainsman are the best suited varieties in the Tennessee Valley area.

After thorough breaking of the clover land, the grain sorghum is planted in 3½-foot rows, 3 to 6 inches apart in the row. No fertilizer is needed if the crop follows this rotation. Eight to 10 pounds of seed per acre are required for this spacing. A regular sorghum plate is used for seeding either of the three varieties.