Pasture Management for Dairy Cattle

University of Tennessee Agricultural Experiment Station

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PASTURE MANAGEMENT
FOR
DAIRY CATTLE

R. H. Lush

THE UNIVERSITY OF TENNESSEE
AGRICULTURAL EXPERIMENT STATION
KNOXVILLE
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PASTURE MANAGEMENT FOR DAIRY CATTLE

R. H. Lush

Dairy Husbandman

INTRODUCTION

Low production of many pastures may be traced to lack of planning and avoidance of one or more of the necessary initial expenses for location, labor, seed, lime, fertilizer, clearing, drainage, fencing, and seedbed preparation; and to poor management (6).

Dairymen have found that the best land makes the most economical pasture. With proper drainage, nearly all creek and river bottom land can be made to produce excellent pasture; and much of the hill land, if properly handled, can be made into satisfactory pasture. The individual farmer must choose land that fits into other farm operations, but dairy cow pastures should be near the barn.

Preparation of the seedbed will depend upon the history of the land. The ideal preparation, especially when seed is expensive, is that which permits planting seed uniformly at a depth of three times the seed’s greatest length. Legumes should be seeded where the most productive pastures are desired. Legumes add variety, longevity and palatability to the grazing; and, eventually nitrogen to the soil. The soil should be tested for acidity, phosphorus and potassium; and, two to four months before seedbed preparation, sufficient finely-ground liming material should be added to bring the soil reaction to a pH of 6.5 (13). Legumes especially need phosphoric acid, potash, borax, and usually nitrogen to become quickly established. If any one of these is absent it should be added to the soil.
Protection of New Pastures

Dairy cattle should be kept out of new pastures until a sod is formed and the grass is four to six inches high. Perhaps the most practical procedure is to let the first seeding grow up for a hay crop. Even if the growth is not heavy enough to save for hay, spring mowing will prevent weeds and tall grass from shading out legumes and young seedlings, and will encourage the spreading type of grasses. After the first six to eight months, a new pasture can be used somewhat intensively with light grazing in September to aid reseeding and to avoid close grazing of Ladino clover.

After the first year, a pasture should be mowed every time weeds start to bloom, or grasses to head out. Ladino clover, because of its long petioles and above-ground runners, should not be grazed closer than three to four inches in height, especially in late summer. It performs better in an alternate grazing-hay system or a rotational grazing system than under continuous grazing. Regulated grazing and mowing will keep down most sprouts and weeds but if weeds become prevalent, it might pay to use some of the 2-4, D sprays or their derivatives (5).
Pastures should be allowed to grow ungrazed for about two or three weeks prior to the coming of cold weather in order to permit the storage of sufficient food reserves in the roots to make an early start in the spring. However, after that rest period, pastures again may be grazed down. Most permanent pastures should not be grazed early in the spring but should be allowed to grow to smother out wild onions and other weeds. However, fescue pastures should be grazed early to avoid shading out clover. Winter cereal or ryegrass pastures are justified on these two points alone; i.e., to give permanent pastures a rest in fall and a start early in the spring.

**Management of Old Pastures**

Most farmers are faced with the task of keeping an old pasture productive. Chief causes of pasture failure are: a sod-bound condition which prevents aeration, lack of fertility, over-grazing, and many weeds. The latter cause largely can be remedied by an early topping of weeds, followed by a lower mowing in late summer. But when an old plowable pasture becomes weedy, it is usually advisable to renovate it completely at the same time correcting other causes of low production.

Data of the Dairy Experiment Station at Lewisburg for the four years 1943-1946 show that the best treatment included liming, manuring, mowing, and reseeding with 15 pounds of orchardgrass and two pounds of Ladino clover per acre. When grazed, this pasture gave 317 pounds of butterfat and a net return of $176 per acre, compared with only 85 pounds of butterfat and $49 per acre for old bluegrass sod (15). The seeding of clovers and lespedeza on **unprepared bluegrass sod** or of bluegrass with orchardgrass and clover on cropland was of questionable value. The use of two tons of lime and the annual use of 4.8 tons of manure per acre increased yields of pasture about 40 percent; 16 pounds of nitrogen per acre annually increased yields of pasture about 20 percent; and mowing once or twice yearly increased yields 23 percent. Each dollar spent for nitrogen gave a return of $5.26; for hauling manure, $6.04; and for mowing, $8.57. On **newly seeded cropland**, Ladino clover and orchardgrass exceeded **untreated bluegrass sod** by 201 percent in yield and gave 3½ times the net returns in milk per acre. Ladino clover was not maintained satisfactorily beyond six years under continuous grazing without reseeding.

Renovation not only aerates the soil and provides an opportunity for adding needed adapted seed but usually it encourages white clover and lespedeza for a season or two by checking grass
growth. It also makes grazing more appetizing because manure has been worked underneath.

**Top Dressing**

Pastures need to be treated as well as other field crops. An average milk cow may eat the equivalent of two tons (dry weight) of pasture vegetation during the grazing season. That much feed causes a net loss from the soil of about 57 pounds of nitrogen, 13 pounds of phosphoric acid and 28 pounds of potash (7). If manure is not properly conserved and returned or if a crop is entirely removed as hay, losses are even greater. For intensive grazing of grasses and even legume mixtures, a somewhat liberal application of nitrogen, as well as of phosphoric acid and potash, may be needed in fall and early spring when the soil is too cold for bacterial action. Where legumes predominate in the pasture, and especially in hayfields, the greatest need may be for annual winter top-dressing with potash, phosphoric acid, and sometimes borax. Early top-dressing gives time for plant nutrients to penetrate the soil and to stimulate early growth when needed.

**Rotation of Pastures**

For the best grazing management there should be two or more permanent pasture fields plus one or more fields for supplementary grazing crops in summer, fall and early spring. This will make possible rotational grazing, hay or grass silage production from surplus growth, more even distribution of grazing and milk production, and opportunity for efficient manure and fertilizer application. There may be little direct yield advantage as compared with continuous grazing, but waste can be largely eliminated, alfalfa and Ladino clover maintained, and cows furnished with fresh, palatable grazing for each new grazing period. Alternate grazing as compared to continuous grazing has averaged 10 to 20 percent more milk and longer life for clovers. Special rotations including summer crops like Sudangrass and millet, alone or with legumes, need to be alternately grazed for maximum production. This is generally true for all upright growing pasture plants. For example, alternate grazing and haying of alfalfa gave good results at the Middle Tennessee Experiment Station for distribution of haying labor and for grazing. A field of alfalfa and orchardgrass seeded in the spring of 1946 produced slightly more than 1.5 tons of hay in two cuttings early in 1947 (1). It was then rotationally grazed in five plots by division with electric fence from July 16 to September 19, a period when permanent pastures are usually poor.
The milk production per acre was 1,472 pounds greater with less decline in milk production, more gain in body weight, and larger returns above feed costs than from bluegrass-white clover pasture during the same period. There were no bloat difficulties, but by the end of the third summer of grazing the stand of alfalfa was noticeably reduced, possibly due to soil fertility changes or other causes. Two early crops of hay were cut each year. Four years' results at the Dairy Experiment Station show higher milk yields and 13% more returns per acre from all-season April-October rotational grazing of an alfalfa mixture over one cutting of hay or silage and delayed rotational grazing, but with more injury to the stand of legumes (18). Summer supplementary grazing crops give permanent pastures an opportunity in favorable seasons to grow more hay or grass silage and aid reseeding of legumes.

**Dragging Pastures**

Next in importance to a mowing machine is some kind of drag to spread manure evenly, to prevent foul grass and to aid in natural seed distribution. A spike tooth harrow turned nearly flat or a chain drag is sometimes satisfactory. Dragging should be done preferably in fall or early spring after a light shower, or in rotational grazing just after the cattle have been taken off the field.

**Irrigation of Pastures**

Where a suitable water supply exists, and land is limited, irrigation of permanent pastures may be considered for extending the grazing period of succulent feed. The average milk production from April to November 1945-48, was 43 percent greater and returns over all costs $61.30 per acre or 43 percent greater for

*Irrigation at the Dairy Experiment Station, Lewisburg. Water is supplied from a creek.*
irrigated than for non-irrigated bluegrass-white clover pasture at the Middle Tennessee Experiment Station. Even greater differences were shown in the dry years of 1947-48. Little difference was observed between irrigated and non-irrigated Bermuda pasture in earlier tests (2). A single test in 1950 indicated that liberal applications of nitrogen would increase the value of irrigation. Results here and in other Southern states point out the necessity of including seedings like Ladino clover and orchardgrass and adequate fertility if maximum use is to be made from the irrigation equipment and the additional labor involved. Applications of water averaging 19.9 inches to alfalfa-orchardgrass-Ladino at the Dairy Experiment Station, Lewisburg, in 1951-53 gave an increase of 4,501 pounds milk or 56 percent more, with a return of $99.68 per acre over a $49.64 per acre total cost of irrigation and increased costs for supplemental feed (8,17). Milk production was more uniform through late summer with the rotational grazing system used.

SUPPLEMENTARY PASTURES

Few pastures are productive for more than four months. Usually there is too much grass during a short period in May or June, and too little for a very long period for efficient, uniform production of milk. This requires intensive use of adapted supplementary grazing crops during periods when permanent pastures are not at their best—in late summer, fall and through the winter and in early spring. In a rotation, one-half acre or more should be available for each cow. It should be definitely planned and planted at the right time to give grazing when needed most (10,14).

Cereals

One of the several advantages of growing one variety of the small grains is that it fits into a rotation, covers the land in winter, may permit a light seeding to be grown with it; and when livestock are removed early in the spring, a nearly normal grain, hay, or silage crop may be obtained. The cereals should be cold-resistant rye or barley for additional grazing rather than for grain. Balbo rye is suggested for most sections, particularly the mountainous areas. It will grow under a wide variety of conditions, withstand cold, and will not adversely flavor milk (11). For the five winters, 1937-41, cows on fair Balbo rye and crimson clover had an average of 64 days winter grazing and produced 4 percent more milk than similar cows fed free choice on silage at the Middle Tennessee Experiment Station. At uniform feed prices, the return per cow was
about $10.00 higher for the winter period. Another group receiving 65 days of permanent pasture in addition produced 12 percent more milk than the barn-fed cows. The return per cow for this group was $22.00 higher than for the average barn-fed cow.

A somewhat similar test for 1946-47, except that both groups received limited grain and hay, showed 21 percent more milk produced and 46 percent less hay consumed with less loss in weight while cows were on Balbo rye and crimson clover all but 20 days in winter than when barn-fed only. Three recent tests (1948-50) at Columbia showed that cows kept on good cereal-clover pasture for 3 to 5 hours daily, or cows on pasture continuously except at milking time, produced milk more efficiently than cows barn-fed only with all groups receiving alfalfa hay, limited silage, and grain (9). The cows on pasture 3 to 5 hours daily averaged 33 percent more milk and ate 31 percent less hay, while those on pasture continuously produced 10 percent more milk and ate 54 percent less hay than the barn-fed cows. For the 5-month periods, November 1-March 31, the average cow on pasture returned $38.00 more above feed costs, maintained better production and nearly the same weight, stayed cleaner, and required far less labor and housing costs than the average barn-fed cow. The pasture was not badly injured by trampling in wet weather, but it is apparent that productive winter pasture plus other roughage, grain, and some improved perennial pasture should be provided to insure an adequate feed supply for all kinds of weather. Winter barley grazed to April 1 gave the equivalent of 327 pounds of alfalfa hay, but a reduced grain yield at the Dairy Experiment Station, Lewisburg.

**Ryegrass** is valuable chiefly for quick, easy seeding on lesspedeza or crimson clover or in permanent pasture sods grazed down and lightly scarified. It hardly can be counted on to give as early fall grazing as oats or barley but can be seeded somewhat later and on non-plowable or wet pasture land. **Button-clover** with Balbo rye to insure early fall grazing, and planted to Sudan or other sorghum in summer has given satisfactory rotation grazing at low seed and little fertilizer cost for 11 years at Columbia (3).

**Sudangrass** is suggested as usually giving quicker returns and more milk per acre than any other summer crop for the dairy farm (12). The Tift variety is more disease resistant and has less danger of forming cyanide poisoning under drouth or rapid early growth than Sweet Sudan. At Columbia a 3.8 acre field of Sweet Sudan following winter pasture gave an average of 43 days' graz-
Sudangrass is one of the best of supplementary grazing crops. It has been valuable for shading out Bermudagrass and producing a grass silage crop at Lewisburg. Sudangrass has been especially valuable for increasing and maintaining the milk production over bluegrass pasture available during dry summers. Less milk production will be produced from lespedeza in dry weather, but lespedeza has an advantage in that less land preparation is required, seed is cheap, and it is generally adapted to the State. It fits into late summer and early fall grazing when permanent pastures are low in production; or, if not needed then, makes a more acceptable hay crop than Sudan. Sericea lespedeza has practically the same advantages, once established, but it must be grazed early, or cut for hay early before becoming stemmy to produce a palatable feed. It does not make as good hay as the common or Korean lespedeza. Five comparisons of early-cut and late-cut Korean lespedeza hay at Columbia indicated that early-cut hay was more palatable, but late-cut hay produced more milk per acre. However, early cutting has an advantage in permitting some later grazing or earlier preparation of land for a following grazing crop. Two feeding trials at Lewisburg indicated that about five tons of U. S. Sample Grade lespedeza were required to equal four tons of U. S. No. 3 Korean lespedeza because of the large refusal of foreign material (16). Soybeans with Sudangrass or millet will furnish some summer grazing or provide a good hay or silage crop. Kudzu has some value on rough land.

Red clover or alfalfa and orchardgrass and timothy meadows, the latter especially in the higher parts of the State, may furnish
considerable grazing either preceding or following a hay crop in summer. The former practice may be desirable to distribute haying labor; the late grazing is that usually needed. But neither should be grazed so heavily nor continuously as to destroy profitable stands of hay.

At the Dairy Experiment Station, alfalfa, later replaced by **white clover**, and **fescue** furnished grazing from April 1 to September 30 equivalent to 3,917 pounds of alfalfa hay as compared to an average of 4,563 pounds alfalfa hay equivalent from **orchardgrass** and **white clover**. Fescue was definitely not as palatable as orchardgrass and gave less summer grazing, especially after the alfalfa had been selectively grazed out. Another test of **fescue-crimson clover** for March and April furnished grazing equivalent to that for **crimson clover** alone. Commercial nitrogen was added to both fields in February and grazing was palatable. However, the fescue was grazed for another 50 days starting in June, giving 1,069 pounds alfalfa hay equivalent or over 3,000 pounds per acre for the season plus a reserve growth for fall. In later work, fescue did not give as satisfactory summer grazing as orchardgrass. From these tests, experiment station, and farm observations, it is apparent that under special conditions fescue or preferable orchardgrass, each with an adapted legume or with nitrogen applied may furnish satisfactory early spring grazing, a hay or grass-silage crop, and some fall grazing as a low-cost supplement to other improved permanent pasture (See Annual Experiment Station Reports).

**Hay and Silage**

Both hay and silage should be looked upon as by-products of successful pasture management and essential for winter feeding of nearly all dairy herds. A surplus of pasture in late spring is unavoidable in order to provide adequate grazing the rest of the year. Most of this early growth can be made into high quality hay or silage suitable for liberal feeding on every dairy farm. Barn-dried hay has been successfully made and fed by experiment stations and farmers. Field choppers and crushers, or automatic balers, help to reduce labor and make high quality silage or hay. For owners of herds of 10 or more milk cows, some type of silo adapted to local needs is suggested. Silage is a cheap feed and almost essential for the Grade A milk producer interested in a winter milk supply, no matter how good the grazing is the other 9 to 10 months. With modern harvesting equipment and a reinforced
upright or horizontal silo, surplus pasture and hay crops can be stored and fed more effectively as silage than as hay, especially the first cutting of a crop such as alfalfa-orchardgrass. With partial curing and suitable weather, where moisture content can be reduced to 65 to 70 percent, no preservative is necessary. In rainy weather or when 50 percent or more of the crop is a legume, preservatives such as ground corn and barley, dried citrus or beet pulp, molasses, sodium meta-bisulfite or acid will insure better quality of silage when properly used. Alfalfa, sweet and crimson clovers, sericea lespedeza, Sudangrass and soybeans and other crops besides corn and sorgo have been made into good silage by the Tennessee Agricultural Experiment Station. The latter two, because of high yields per acre, remain as the chief silage crops.

**RATe OF CONCENTRATE FEEDING**

Good pasture, whether mixed vegetation or a supplementary grazing crop, may be looked upon as a “watered concentrate, growing in the open instead of being fed in a manger.” Its feeding value is highest in cool weather but production is greatest in warm, moist weather.

Adapted cereals grown in the fall at the Experiment Station in Knoxville contained as high as 30 percent protein and produced an average of 10 pounds of digestible dry matter per acre per day in the winter months. Thus the need to supplement pasture is for concentrated energy feeds such as corn, oats, and barley or for a ration averaging about 12 to 16 percent protein, rather than other protein and vitamin-rich feeds, or with roughages like hay and silage which also are bulky. In late summer, when the protein content of vegetation drops, a slightly higher protein supplement may be desirable.

Results obtained a few years ago at the West Tennessee Experiment Station showed that Jerseys on an all-year pasturing
system without concentrates for two lactations averaged 8,043 pounds of 4 percent-fat-corrected milk or 76 percent as much as when fed concentrates at the rate of one pound to three pounds of milk and with the same kind of pasture, alfalfa hay and silage (4). The cows also calved normally and were in as good physical condition. Each additional pound of milk resulting from such feeding required three-fourths of a pound of concentrate feed. With good pasture and roughage feeding, it may be unprofitable to feed concentrates when milk is low in price, but profitable when milk is sold on a high market, and nearly always for high producing cows. In tests at the Middle Tennessee Experiment Station, Jersey cows fed at the rate of one pound of concentrates per six pounds of milk and on supplementary and permanent pasture 346 days in the year, produced 6,265 pounds of milk, compared with 6,442 pounds of milk for cows fed concentrates at the rate of one pound for each three pounds of milk and on pasture only 198 days (19). Again the feed cost of producing 100 pounds of milk was materially lower on the lighter rate of feeding, with a consequent saving of about one-half ton of concentrates and greater returns per cow. Other work at Lewisburg showed 16 records on dehydrated hay alone averaged 6,333 pounds of milk or 67 percent as much as for the same cows full-fed on concentrates in addition to roughage.

The summary of all tests shows that good cows may make a reasonable, economical production with (1) a limited amount or no concentrates if adequate pasture and roughage of good quality are provided; (2) liberal amounts of concentrates if feed costs are low and milk prices fairly high or if maximum production is desired throughout the lactation. Moreover, a certain amount of concentrate feeding is desirable during periods of pasture shortage, to provide salt and other minerals, to maintain uniform production under a winter base plan, and perhaps to aid in orderly milking procedure.

Supplemental feeding should be looked upon as a substitute for pasture, rather than the usual practice with pasture occasionally replacing some concentrate. Its greatest importance is for high-producing milk cows, but calves under eight or ten months of age need concentrate feeds to insure sufficient intake of nutrients and to reduce milk consumption. Experiments have shown that heifers from the age of 10 months to calving can be raised satisfactorily on pasture, hay and silage. In winter experiments at Knoxville, yearling heifers made normal gains on both alfalfa and soybean
hay. There was no significant difference in field dried or barn dried hay.

**Mineral Feeding**

Where small amounts of concentrates are fed on pasture, phosphorus deficiency should be guarded against on nearly all unfertilized soil areas of the state except the Central Basin and on alluvial land of the Mississippi. A mixture of two parts of bonemeal or other low fluorine calcium-phosphate supplement and one part common salt should be provided free choice or mixed with the concentrate ration. Where a shortage of calcium may exist as where no legume hay or pasture is fed or where animals are maintained on poor, acid soils, a mixture of equal parts of a calcium supplement, of a phosphate supplement and of common salt may be fed at slightly lower cost. Most commercial mixed feeds now contain recommended minerals for the areas where sold. Under no conditions should raw rock phosphate or superphosphate be fed to dairy or breeding animals because of the presence of fluorine. Crops and pasture from well-fertilized lands, or roughage grown on fertile soil, will not need much mineral supplement other than common salt. Under such feeding there is not likely to be a shortage of vitamins especially if young calves are kept out in the sunshine as much as possible, and good management practices are followed. Salt should be fed free-choice to all classes of dairy cattle.

**Shade and Water**

Feed can be saved and production maintained more evenly by providing water, shade and shelter. Milk cows especially need

*Permanent pasture in May, with water and shade in the background.*
shade protection or night pasturing in the hot days of summer. Two or three large trees per acre, located on the fence line or higher ground, may provide all of the shade necessary. Fewer trees facilitate pasture mowing, haying or renovation operations. A clean source of water also is necessary. A cow will drink from two and one-half to four times as much good water in a day as milk produced. Drinking from drainage ditches or muddy ponds is undesirable. Such water may be a source of contamination of the milk through udder contact.

**Control Bloat**

Bloat is rare where 50 percent or more of the vegetation consists of grasses or when vegetation is in the maturing, fibrous stage. The condition usually can be controlled by keeping animals partially filled with feeds high in fiber such as hay, silage, or even straw; grazing on grass pastures at night and early morning in the periods of rapid growth and bloat danger; and using legume pastures sparingly in spring except for hay or grass silage. When clover pastures must be used in spring, milk cows should be removed after 40 minutes of grazing or the pasture should be patrolled with gags, drenches and trocars available and a palatable hay made accessible.

(Additional information on pastures may be obtained from county agricultural agents and agronomy and livestock publications of The University of Tennessee).
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