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CIR1140

Bermudagrass: Growing, Storing, and Feeding for Dairy Animals[1]

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INTRODUCTION

Bermudagrass has excellent agronomic characteristics making it a popular perennial forage grown in much of the southeastern U.S., including Florida. The grass has high-yielding ability, high-drought resistance, and sufficiently tolerates highly-acidic soils. Bermudagrass does, however, have its limitations; for example: 1) It does not grow well in poorly drained soils such as commonly found in southern Florida and 2) It must be established by planting underground rhizomes or above-ground stems rather than by seed. Nevertheless, it is a strong perennial grass. With good management, fields can last for *many* years. Recommendations for increased yields, persistence, and high forage quality are outlined in the following paragraphs.

HYBRIDS

Several hybrids of bermudagrass are available. **Coastal** was the first major hybrid developed and occupies more acreage than all other hybrids combined. **Alicia**, the lowest quality forage of the group, is susceptible to rust disease, is lower yielding than Coastal, and should be the last choice for planting. **Coastcross-1** is the highest quality bermudagrass but is not winter-hardy and should not be planted in north central Florida. **Callie** also is of good quality--superior to Coastal, but is susceptible to rust in the spring of the year. This disease can reduce yield and quality, depending upon the extent of the rust problem. **Tifton 44** is the most winter-hardy of the group but forage quality is lower than other newly developed hybrids. **Tifton 78** produces high-quality forage but establishment has been a problem for many producers. The most recent release is **Tifton 85** bermudagrass, the fastest growing, tallest, and largest stem hybrid of the group. Early data indicates that it may be the best of all hybrids released to this point. It was easy to establish, partly because of large rhizomes, and produced more than three tons per acre more DM (dry matter) than Coastal. When compared to Tifton 78 in a 3-year grazing study using steers, Tifton 85 supported equal body weight gains and more grazing days per acre (Hill, Gates, and Burton 1993).

FERTILIZATION

Bermudagrass responds well to proper fertilization. Forage yields increase when the amount

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of nitrogen applied per acre is increased. Using data collected during a wet and a dry growing season (Prine and Burton 1956), yields of DM and protein from bermudagrass were measured under increasing application rates of nitrogen (Table 1). The amount of nitrogen applied must be efficiently used by the plants. If too much is applied, nitrogen may appear in either underground water or runoff water, possibly resulting in environmental pollution.

The University of Florida currently recommends applying 80 pounds of nitrogen at the beginning of the growing season and after every cutting. If five cuttings are made between June and October, then a total of 480 pounds per acre of nitrogen will be applied (six applications). At this rate (using 500 pounds per acre in Table 1), only a small amount of nitrogen (22 pounds per acre [500-478=22 lbs.]) will escape utilization when rainfall is sufficient (Table 1). Of course, when rainfall is insufficient and grass is not growing, fertilizer should be reduced--this lowers the risk of inefficient nitrogen absorption.

Soil should be sampled periodically and tested for pH, P, K, and micronutrients. Lime, phosphorus, and potash must be applied according to soil tests results in order to maintain yields. The University of Florida recommends forty pounds of K_2O per cutting if soil tests are not available.

HARVESTING SCHEDULE

Bermudagrass should be harvested every 3 to 5 weeks in order to maintain high feed intakes of high-quality forage. Quality of grass drops off drastically if harvest is delayed (Table 2).

Not only does digestibility and crude protein value decrease with increasing age at harvest, but animal intake decreases as well. Sheep were fed Coastcross-1 bermudagrass hay harvested at 4, 6, and 8 week ages of maturity. Table 3 indicates that as the grass matured from 4 to 8 weeks, TDN (total digestible nutrients) concentration decreased from 57.3 to 43.8%, intake decreased from 2.28 to 1.84% of body weight, and intake of TDN decreased from 1.31 to 0.81 lbs/day (assuming that sheep weighed 100 pounds). Less digestible forage likely spends more time in the rumen thus depressing daily feed intake.

STORING AS SILAGE

Daily summer rainfall creates a tough environment for making good quality hay. As a result, many people store bermudagrass as silage. Management procedures for making good quality silage were examined at the University of Florida recently (Umana et al. 1991). Bermudagrass was ensiled either immediately after cutting or wilted prior to ensiling. In addition, grass either received at ensiling one of the following: No additive, molasses, a bacterial inoculant, or both molasses and a bacterial inoculant. A few recommendations based on that research include:

1. Wilt the forage in the field for 3 to 5 hours or overnight before ensiling. Positive results of wilting:
    - Increased digestibility of organic matter and fiber.
    - Improved fermentation; that is, a faster decline in pH after sealing the silo and a greater concentration of desirable organic acids, e.g. lactic acid.
    - Greater recovery of protein and less ammonia produced.
2. Adding molasses (5% of silage DM) improved silage quality when grass was ensiled directly but was not needed when grass was wilted. Positive results of the molasses addition included:
    - Lower final pH of silage.
    - Greater concentrations of lactic acid.

- Less loss of protein as ammonia.

3. Adding a bacterial inoculant and molasses to the wilted forage proved more beneficial than adding just molasses or inoculant alone. Specific positive effects were:

   - Lower final pH of silage.
   - Greater and faster increase in lactic acid concentration.

TESTING FORAGE QUALITY

In order to estimate the energy content of a forage--Total Digestible Nutrients (TDN) or Net Energy of Lactation (NEL)--the commercial laboratory first measures the fiber content of the plant. Then an equation is used to convert from fiber to energy. The fiber measured is neutral detergent fiber (NDF) and acid detergent fiber (ADF). As the plant matures, the NDF and ADF contents will increase. The greater the NDF and ADF values, the lower the energy content of the forage. This is because the fiber portion of the plant contains the least digestible portions of the plant. The nonfiber portion of the plant is 95 to 100% digestible. Therefore plants which contain the least fiber are the most digestible.

The concentration of NDF and ADF changes dramatically as some forage species (such as alfalfa, clovers, and small grains) mature. In tropical grasses like bermudagrass, however, values of NDF and ADF are not as reliable as indicators of energy. This is because their NDF values do not change dramatically with increased maturity. That does not mean their digestibility remains unchanged with maturity. Quite the contrary. Nutritive value decreases as the plants get older. Therefore in order for the laboratory to estimate the energy content of these forages, it must actually digest a portion of the plant with some microorganisms from the rumen of the ruminant. (The lab at Ona, Florida is one of only a few labs that uses this procedure).

If the hay is a tropical species such as bermudagrass, bahiagrass, digitgrass, limpograss, etc., the hay should be analyzed at the Ona Research Center, Rt. 1 Box 62, Ona, FL 33865. Mailing-bags and forms are available through your county Extension office.

REPLACEMENT HEIFERS GRAZING IN BERMUDAGRASS PASTURES

Holstein replacement heifers weighing about 550 pounds were used to graze Callie bermudagrass pastures either continuously or rotationally at the University of Florida Dairy Research Farm (Mathews, Sollenberger, and Staples 1994). The rotational grazing strategy was either short-term (2 days of grazing followed by a 30-day rest) or long-term (10 to 14 days of grazing followed by a 30-day rest). Heifers were fed 3 pounds (DM) of a concentrate mix daily to supplement their grazing and were provided portable shades in the pastures. Daily body-weight gain was similar among management strategies, averaging 1.1 pounds per day over two growing seasons. This is less than the 1.8 pounds desired for replacement heifers and indicates that additional concentrate needs to be fed with Callie to achieve target gains. As stated earlier, Callie is susceptible to rust and rust *was* a problem in this study. Gains were greater than 1.3 pounds per day when data involving rust infestation were eliminated. Other bermudagrass hybrids may provide greater gains than observed with Callie.

Bermudagrass plants under rotational (vs. continuous) grazing showed greater persistence. After the second year of grazing, only 62% of the plants were Callie bermudagrass on continuously grazed pastures whereas 85% of the plants remained Callie bermudagrass under both rotational grazing systems. If the study had continued for another year or longer, differences in body weight gain may have been observed due to increasing loss of Callie bermudagrass under continuous grazing management. Encroachment by common bermudagrass and weeds would likely become an increasing problem.

FEEDING BERMUDAGRASS SILAGE

Two major factors affecting the value of bermudagrass for lactating cows is the maturity of the bermudagrass and the mixture of bermudagrass and concentrate. By allowing the forage to grow longer, yield per acre may increase. Can the negative effects of lower quality forage be neutralized by feeding more concentrates in the diet? A study at the University of Florida examined this question (Bernal 1993).

Bermudagrass was harvested at 4 and 8 weeks of maturity, ensiled, and mixed with grain to form a total of 8 diets. The chemical composition of the two bermudagrass maturities are in Table 4. Crude protein content decreased dramatically from 16.6 to 11.1% by delaying the harvest an extra 4 weeks. As was expected for a tropical grass, the NDF and ADF fractions increased only slightly (less than 3 percentage points) with increasing maturity. Energy in the forages was measured using IVOMD (in vitro organic matter digestibility) and were quite different (55 vs. 43%).

Each maturity level of bermudagrass was mixed with concentrate to make up four dietary ratios of forage and concentrate (F:C), namely, 52:48, 44:56, 36:64, and 28:72 (DM basis). When averaged across all F:C ratios, cows eating the less mature bermudagrass produced more milk (56.2 vs. 53.4 lb/day) with no difference in milk fat content (3.55 vs. 3.51%) or feed intake (43 vs. 44.5 lb/day; Table 5). This greater milk yield was because the diets containing the 4-week-old bermudagrass were more digestible, (mean of 60 vs. 54.4%). This difference was due mainly to the difference in NDF digestibility, namely an average of 44.9 vs. 31.2% for 4 and 8 week maturity respectively.

When formulating diets, people often assume that by feeding more concentrate they can make up for low quality forages. By examining Table 5, it can be seen that this assumption is only partially true. Cows fed the 4-week-old forage mixed in the 52:48 F:C ratio produced 51.1 lb/day. In order for cows fed the 8-week-old forage to produce the same amount of milk, they had to receive more concentrate; that is, the 44:56 F:C ratio (a diet 8% greater in concentrate). In a second example, cows fed the 4-week-old forage mixed in the 44:56 F:C ratio produced 54.7 lb/day. In order for cows fed the 8-week-old forage to match that milk production, they had to receive the 36:64 F:C ratio diet (again, 8% more concentrate). However, cows fed the 8-week-old forage with the most concentrate (28:72 F:C ratio) were not able to produce as much milk (57.8 lb/day) as cows fed the 4-week-old forage with less or equal concentrate (approximately 60 lb/day for diets 36:64 and 28:72 F:C ratio). On average, in order to obtain similar milk production, cows fed 8-week-old bermudagrass required 6.5 lb/day (as-fed) more concentrate than cows fed 4-week-old bermudagrass. High-quality forage can substitute for concentrate and protein supplements.

Corn silage is also a widely used silage in the state. How does bermudagrass silage compare to corn silage when used for milk production? This comparison was made recently at the University of Florida using three ratios of F:C in the diets (Ruiz et al. 1994). The diets were formulated to three dietary NDF concentrations, that is, 31, 35 and 39% NDF. Therefore bermudagrass and corn silage were compared on an equal fiber basis. The makeup of the diets as well as the performance of the cows are summarized in Table 6.

Cows fed either corn silage or bermudagrass silage were similar in feed intake and milk production. However, cows fed bermudagrass silage needed greater amounts of concentrate added to their diet in order to produce as much milk as cows fed corn silage. About 8 pounds of grain had to be substituted for bermudagrass in order to equalize performance. An economic comparison estimating profitability is important as bermudagrass often costs less to produce than corn silage. Milk income minus feed costs was calculated for each diet and an average determined for each silage. Growing, harvesting, and storing costs used were $26.25/wet ton of corn silage and $22.85/wet ton of bermudagrass silage. Milk was priced at $15/cwt. Corn silage diets were more profitable by an average of $0.43/cow/day. However, when corn silage had to be purchased at $35/wet ton, corn silage diets were more profitable by an average of only $0.09/cow/day and were actually less profitable for the two diets containing the most grain. It appears that bermudagrass silage is worth about $12/wet ton less than corn silage when both contain an equal amount of moisture.

RECOMMENDATIONS

- Fertilize with 80 pounds of nitrogen and 40 pounds of K_2O per acre after every cutting.

- Wilt the grass for 3 to 5 hours or overnight before ensiling to improve digestibility and fermentation.

- Harvest every 3 to 5 weeks in order to maintain high feed intakes of high-quality forage.

- While NDF and ADF are good indicators of quality for legumes and small grain hays, they are poor indicators of quality for subtropical forages such as bermudagrass. Use the laboratory at Ona, Florida to measure subtropical forages for energy content.

- More than three pounds of concentrate daily are needed for 550 pound replacement heifers grazing bermudagrass pastures to gain the desired body weight. Bermudagrass pastures retain a purer stand of bermudagrass over years when managed with a rotational rather than a continuous grazing method.

- Cows fed 8-week-old bermudagrass silage required 6.5 lb/day more concentrate than cows fed 4-week-old bermudagrass silage in order to produce the same amount of milk. Higher quality forage can substitute for concentrate but concentrate cannot always substitute for lower-quality forage.

- Cows fed bermudagrass silage can produce as much milk as cows fed corn silage but require about 20% more concentrate in the diet. As a result, bermudagrass is worth about $12 a ton (wet basis) less than corn silage.

CONCLUSIONS

Bermudagrass is a perennial grass well-adapted to subtropical and tropical climates. It has proven responsive to improved breeding practices with about 7 to 10 hybrids currently available for commercial planting. It responds well to fertilization, increasing yield and crude protein content when increasing amounts of nitrogen are applied. It ensiles well under good ensiling practices. To define quality, use the laboratory at Ona, Florida because fiber analysis alone (as done by most commercial labs) is a poor indicator of energy content of tropical forages. The amount of time for regrowth is the best field indicator of good quality. Bermudagrass should always be harvested no later than 5 weeks after regrowth if it is to be fed to lactating dairy cows. Under grazing conditions, bermudagrass with a small amount of concentrate can support gains of about 1.3 pounds per day by dairy replacement heifers. Bermudagrass silage can support at least 60 pounds of milk production if formulated with the right proportion of concentrates.

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Table 1. Bermudagrass fertilized with increasing amounts of nitrogen and harvested every four weeks.*

Optimum Growing Season				Dry Growing Season		
Applied N, lb/acre	Crude Protein, % DM	Dry Matter, tons/acre	N Removal, lb/acre	Crude Protein, % DM	Dry Matter, tons/acre	N Removal, lb/acre
0	9.2	1.2	35	10.9	0.5	17
100	11.2	4.4	158	11.0	2.0	70
200**	13.2	6.1	258	13.2	3.4	144
300	15.2	7.9	384	15.4	4.2	207
400**	15.8	8.5	430	16.3	4.5	235
500**	16.4	9.1	478	17.2	4.8	264
600	17.0	9.7	528	18.1	5.0	290

* Crude protein content and dry matter yield in a wet (39.7 inches from April 1 to November 1) and dry year (13.7 inches).

** Fertilization rate was not used in experiment. Data listed for this rate are estimated.

Table 2. The effect of weeks of regrowth upon total digestible nutrients (TDN) and crude protein contents of bermudagrass (Moore, 1984).

Weeks of regrowth	TDN9%DM)	Crude protein (%DM)
2	56.3	16.0
4	57.1	13.6
6	52.6	9.0
8	47.9	7.5
10	46.1	8.3

Table 3. Sheep intake of bermudagrass as influenced by weeks of regrowth (Moore et al, 1981).

Weeks of regrowth	TDN (%DM)	Organic matter intake (% of body weight)	Intake of TDN (lb/day)
4	57.3	2.28	1.31
6	52.4	2.24	1.17
8	43.8	1.84	.81

Table 4. Chemical composition of Tifton 81 bermuda grass ensiled at 4 and 8 weeks of regrowth.

ITEM	4 WEEK	8 WEEK
Crude Protein, %DM	16.6	11.1
Neutral detergent fiber, %DM	70.2	72.9
Acid detergent fiber, %DM	37.2	40.1
Calcium, %DM	0.40	0.38
Phosphorous, %DM	0.35	0.24
Potassium, %DM	2.67	1.84
IVOMD, %	54.7	43.2

Table 5. Effect of bermudagrass maturity and dietary ratio of bermudagrass and concentrate of dairy cow performance.

Forage maturity and forage: Concentrate ratio (DM basis)								
	4 week maturity				8 week maturity			
Measurement	53:48	44:56	36:64	28:72	52:48	44:56	36:64	28:72
DM intake, lb/d[2]	36.6	39.7	45.6	50.0	38.6	40.8	48.9	49.6
OM digestion, %[2,3]	58.0	57.3	59.7	64.8	49.9	52.2	56.0	59.6
Actual milk, lb/d[2,3]	51.1	54.7	59.5	60.0	48.1	51.1	56.2	57.8
4% FCM, lb/d[2,3]	48.3	50.9	55.1	54.5	43.7	47.0	52.7	53.8
Milk fat, %	3.66	3.59	3.51	3.42	3.47	3.47	3.57	3.54
Milk protein, %[2]	2.82	2.90	3.11	3.12	2.90	2.96	3.17	3.23
[1] There were no Maturity by forage:Concentrate interactions (P>.10), except for linear effects on milk fat percentage (P=.075).								
[2] Linear increase with increase concentrate in diet (P<.05).								
[3] Four-week-old bermudagrass greater than eight-week-old bermudagrass (P<.05).								

Table 6. Comparison of corn silage and bermudagrass silage as forages for lactating dairy cows.

		Corn silage% NDF in diet		Bermudagrass silage% NDF in diet		
Item	31	35	39	31	35	39
Corn silage, %	46.8	56.2	65.7	-	-	-
Bermuda silage, %	-	-	-	29.8	35.8	41.8
Grain, %	53.2	43.8	34.3	70.2	64.2	58.2
DM intake, lb/d	43.9	43.0	41.2	43.4	41.2	40.8
Milk yield, lb/d	51.6	51.6	50.5	51.1	50.5	47.0
Fat, %[1]	3.39	3.38	3.51	3.26	3.36	3.27
Protein, %	3.20	3.10	3.10	3.20	3.04	3.09

[1] Corn silage greater than bermudagrass silage ($P<.05$).