WARM-SEASON FORAGES AND PASTURE MANAGEMENT FOR DAIRY COWS

by

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Introduction

In the last two years, some dairy farmers in Florida have switched from confinement housing of the lactating cow herd to pasture-based dairying. Others have started new pasture-based dairies. Reasons for this shift include high capital inputs of confined housing systems, decreasing profits, increasingly negative public perception of effects of dairying on quality of life of surrounding communities, growing pressure by regulatory agencies and environmental interests, and desire for more leisure and family time.

The practice of pasture-based dairying is not new; it occurred widely in this country until about 30 years ago. To be successful using pastures as a major source of feed for lactating cows will require different skills and priorities than systems based on harvested feeds and dry-lot feeding. Perhaps the most critical difference will be the need for the dairyman to become a grass farmer (grazier) as well as a dairy herd manager.

This paper is written to address issues of importance to a grass farmer who is pasturing dairy cows. Specific topics will include a) warm-season forages that fit into Florida production systems for lactating cows, b) key management decisions that influence profitability of pasture-based systems, c) factors that should be considered in making these decisions, and d) how some of the more important warm-season forages in Florida should be managed.

Warm-Season Perennial Forages for Pasture-Based Dairying

Perennial warm-season forages have been planted and grazed by beef cattle throughout Florida for many years. Vigorous and grazing tolerant species like

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bahiagrass (*Paspalum notatum*) fit well into the low-input systems used by beef cattle ranchers. Other more productive and higher quality annual and perennial forages have been developed for use in the state. The purpose of this section of the paper is to provide an overview of some of the forages that likely will fit best into pasture-based dairy systems. Before discussing the more desirable forages that can be planted in pastures, the question of what to do with old herd pastureswill be considered.

Use of degraded herd pastures

Given a choice, most farmers would prefer not to have their high producing dairy cows on bahiagrass or common bermudagrass (*Cynodon dactylon*) pastures. Despite this, existing dairies that convert from dry-lot feeding to grazing often find themselves with relatively large acreages of bahiagrass and common bermudagrass. These forages commonly occur on land that formerly was used as "herd pasture" or an exercise lot.

What should we do with this land? Get out the Roundup? Or should we graze it? This question, like most that we will discuss in this paper, may have a different answer depending on the individual farm. However, it is reasonable to argue that because milk production per cow will likely decrease for pasture-based dairies in Florida, keeping costs low is critical to insure profitability. Wholesale replanting of herd pastures is not likely to be practical. Instead, it may be best to renovate small acreages of these less desirable pastures each year over a period of time. That accomplishes several good things. First, it limits inputs during the time that the dairy operator is deciding if the pasture approach to dairying is working for him or her. Secondly, it does not take a large amount of land out of production at one time for pasture establishment. This is critical because many dairies switching to pasture are limited in the amount of land available for grazing. Thirdly, these areas may work well as pastures for the low production group or for dry cows. Lastly, it allows farmers time to decide which forage might work best under their management program and in their environment. As a result, the decision of which forage to plant can be made more intelligently.

There is one last point to consider relative to the use of herd pastures. Some people argue that there is no need to replant old herd pastures because of the tremendous improvement that can be achieved simply by cross fencing, fertilization, and rotational grazing. In parts of the United States, the changes that occur are remarkable. Clovers (*Trifolium* spp.) and high quality temperate grasses like Kentucky bluegrass (*Poa pratensis*) frequently come on and cover the pasture when good management is applied. Unfortunately, in Florida the typical plants that will grow in these areas are low quality grasses and broadleaf weeds. Bahiagrass and common bermudagrass are a lot better than bare ground, but they are not the most nutritious or productive forages available for a dairy operation.

Hybrid bermudagrasses

In north Florida, hybrid bermudagrasses fit well into pasture-based dairy systems. Bermudagrasses are very productive, but they do require higher soil fertility than bahiagrass or limpograss (*Hemarthria altissima*). Both yield and crude protein concentration of bermudagrasses increase with increasing nitrogen fertilizer rates on pasture. Most bermudagrass cultivars are higher in crude protein than bahiagrasses or limpograsses when all receive the same amount of nitrogen fertilizer (Adjei et al., 1989). Clipping studies have shown bermudagrasses to have from 12 to 18% protein when cut every 2 to 4 weeks and fertilized well with nitrogen.

Recently released bermudagrass cultivars include Florakirk and Tifton 85. Both of these grasses are well adapted to north Florida. Florakirk originated from a cross between Tifton 44 — one of the most cold-tolerant bermudagrasses — and Callie bermudagrass. Florakirk has persisted to 8°F at Jay, FL and is better adapted to wetter sites than most bermudagrasses. It establishes faster and more reliably and stands last longer than Tifton 78. At Gainesville, Florakirk outyielded Coastal by 10% during an 8-year study, and its digestibility is 6-7 percentage units greater than Coastal or Alicia (Mislevy, 1995).

Tifton 85 bermudagrass is a cross between Tifton 68 bermudagrass and a bermudagrass from South Africa. Tifton 85 has produced higher yields of more digestible forage in south Georgia than other bermudagrasses (Hill et al., 1993; Table 1). During summer, yearling steers (600 lb at start of trial) grazed Tifton 85 and Tifton 78 pastures for an average of 169 days in each of 3 years (Hill et al., 1993). Pastures received 220 lb of nitrogen/acre per year. Daily gains on Tifton 85 (1.50 lb/day) and Tifton 78 (1.43 lb/day) were similar, but Tifton 85 pastures supported a 25% higher stocking rate than Tifton 78. Research on Tifton 85 is ongoing in Florida, but more study is needed to fully assess its potential here.

Table 1. Yield and digestibility of bermudagrasses harvested at 4-week intervals at Tifton, GA in two trials. Adapted from Hill et al., 1993.

	Trial 1		Trial 2	
Cultivar	Yield (tons/acre)	Digestibility (%)	Yield (tons/acre)	Digestibility (%)
Tifton 85	8.3	60	6.6	57
Tifton 78	—	—	5.0	56
Tifton 44	7.0	55	4.6	51
Coastal	6.9	54	4.9	50

Rhizoma peanut

Rhizoma peanut is a legume that can be used on well-drained soils in north Florida. It tolerates heavy grazing and is high in nutritive value, approximately 15 to 20% protein and 65 to 70% digestible at four weeks of regrowth (Ortega-S., 1990). Resistance of farmers to using peanut has primarily been related to its slow rate of establishment and relatively low yields.

Yield increases due to effluent application have been measured during 2 years of experiments at the Dairy Research Unit (French et al., 1994). Peanut yields generally average 3.5 to 4 tonsof dry matter/acre per year with no irrigation, but yields increased to 6 tons of dry matter/acre per year when lagoon effluent was applied.

The major factor limiting peanut establishment is spring drought and weed competition following planting. In a number of north Florida plantings, it has been demonstrated that peanut can achieve more than 80% ground cover by the end of the first year during years of abnormally high spring rainfall. Effect of irrigation on peanut establishment has not been evaluated under research conditions, but it is likely that supplemental water will contribute to a more rapid establishment. Grass control may be more difficult under lagoon irrigation, however, because nitrogen is being added to the system.

The two recommended cultivars of rhizoma perennial peanut are Florigraze and Arbrook. Florigraze provides a more dense ground cover and appears to be more tolerant of grazing than the upright-growing Arbrook. In addition, Florigraze is more cold tolerant and should be the cultivar of choice for the northern part of the peninsula and the panhandle.

Stargrass

Stargrass (*Cynodon nlemfuensis*) is in the same genus as bermudagrass (*Cynodon)* and often is confused with bermudagrass. In fact, the grass called giant Callie bermudagrass in Florida often is stargrass. The main difference between the two grasses is that stargrass has no underground stems, called rhizomes, while bermudagrass does have rhizomes. Bermudagrass rhizomes provide additional cold tolerance and allow it to do well in north Florida. Stargrass on the other hand is not recommended north of I-4 because of its lack of cold tolerance.

Stargrasses are commonly used for grazing in south Florida. They are very productive and generally start growth earlier in spring and continue growing longer in fall than bermudagrasses. Like bermudagrasses, they require good soil fertility and respond very well to nitrogen fertilizer. Stargrasses are very aggressive and,

if well managed, outcompete most invading weeds. Digestibility varies among stargrasses, but the best new stargrasses are similar in digestibility to Pangola digitgrass (*Digitaria eriantha*, formerly *Digitaria decumbens*) and usually higher in digestibility than bermudagrasses. In grazing work done at Ona, FL with yearling beef steers, daily gains on Florico stargrass were 1.2 lb/day compared to 0.9 lb/day on Florona stargrass, and 0.8 lb/day on Florakirk bermudagrass. Higher gains on Florico occurred because forage digestibility was two to three percentage units greater than for Florona stargrass or Florakirk bermudagrass.

For new plantings of stargrass, farmers should use either Florico or Florona. Florico is higher in digestibility and overall forage quality, but it is not as productive as Florona during periods of drought in spring and fall. Florona is more tolerant of heavy grazing, but under good fertility and grazing management both persist well.

Other perennial forages

There are other forages that may fit into production systems for dairy cattle. In north or south Florida, limpograss is well adapted to the wetter flatwoods sites. An important advantage of limpograss is that it grows better during cooler weather than most of the warm-season grasses, and it starts to regrow quickly when mild weather follows a winter frost in south Florida. This characteristic makes it an excellent forage in south Florida to minimize the period of time when forage is in short supply on pastures. Limpograss is high yielding and high in digestibility. Digestibility of limpograss is similar to that of digitgrass or Florico stargrass at comparable maturities, but limpograss forage is relatively low in crude protein. The protein in the concentrate portion of the ration will usually need to be increased when cattle are grazing limpograss.

Digitgrass can be grown only in south Florida. It is high in digestibility and animals perform well on digitgrass. The major shortcoming of digitgrass is that it does not persist well under heavy grazing. Bahiagrass and common bermudagrass can invade the pasture if it is not very well managed.

Callide rhodesgrass (*Chloris gayana*) is a seed-propagated warm-season forage that is being used by some dairies in south Florida. Rhodesgrass pastures are not likely to tolerate abusive grazing, but the grass grows back quickly after frost and can provide reasonably good quality forage for the cow herd.

Warm-Season Annual Forages for Pasture-Based Dairying

Along with the perennial forages, there are a number of annual species that can contribute to the goal of maintaining a feed supply on pasture during a greater percentage of the year. Two of the more important warm-season annuals in Florida are pearl millet (*Pennisetum glaucum*) and sorghum-sudangrass hybrids (*Sorghum bicolor*).

Pearl millet

Pearl millet is recommended for use as a summer annual forage for grazing in Florida. Pearl millet is not adapted to wet flatwoods but does very well on moderately- to well-drained soils. It is much more drought tolerant than either corn (*Zea mays*) or sorghum-sudangrass hybrids. Pearl millet can be planted in early to mid-April in north Florida. It requires warmer soil than corn to germinate and grow, so it must be planted later than corn. Pearl millet establishes readily and grows rapidly. Experiments over a number of years at Jay, FL generally have been seeded in mid-April, harvested first around June 10, and harvested every 4 to 5 weeks thereafter through mid-September. Annual yields of the better pearl millets have ranged from 4 to 7 tons/acre of dry forage (Dunavin et al., 1992, 1993, 1994, and 1995), with an average of about 5 tons/acre.

Under grazing, pearl millet can be grazed three to four times over a 90- to 100-day period. Pearl millet's rapid growth has led to the perception that it is hard to manage under grazing. Rotational grazing every 21 to no more than 28 days during summer should provide high quality forage that is not excessively stemmy.

An alternative to April planting is planting during summer to provide forage during fall when growth of warm-season perennials is limited. This practice in north Florida allows the farmer to hold off planting of oat (*Avena sativa*) for winter grazing from mid-September, when it may be attacked by the fungal disease *Helminthosporium*, until mid-October when disease will not have a major effect.

An advantage of pearl millet over sorghum-sudangrass hybrids is that pearl millet does not have potential to cause prussic acid poisoning. Chinch bug can be a problem on pearl millet. Yellowing patches in the field are symptomatic of chinch bug damage.

Pearl millet should be distinguished from Japanese millet (*Echinochloa crusgalli*), a relative of barnyardgrass, and browntop millet (*Panicum ramosum*). Both Japanese and browntop millet seed will be much cheaper than pearl millet, but their productive period may be only 45 days in hot weather, essentially time for one or perhaps two grazings.

Sorghum-sudangrass hybrids

Sorghum-sudangrass hybrids serve many of the same purposes as pearl millet. The hybrids are more tolerant of wetter soils than pearl millet. In a wet year at Jay, FL sorghum-sudangrass outyielded pearl millet (Dunavin et al., 1995). In most years, the yields of the best pearl millets were as good or better than the best sorghum-sudangrasses.

Like pearl millet, sorghum-sudangrass is susceptible to attack by chinch bugs. Unlike pearl millet, the sorghum-sudangrass hybrids have the potential to produce the animal toxin prussic acid. The toxin is most likely to be present in young growth of sorghum (*Sorghum bicolor*) or sorghum-sudangrass hybrids soon after a frost or drought. Pastures must not be grazed at these times.

Keys To Profitable Pasture Management

It often has been said that pasture management is as much an art as it is a science. The art is learned through experience and observation, but there are some guiding principles that can be implemented directly. In this section of the paper, we will focus on perhaps the two most critical decisions made by a grazier. These are fertilization and grazing management.

Pasture fertilization

First, it needs to be stated clearly that fertilization requires the largest cash outlay of any input into an existing pasture system. With that in mind, it is important to establish some principles for fertilizing pastures. The principles are common sense, but sometimes they are not applied to decision making about fertilizers.

On an existing dairy farm, the first thing to consider is what was the prior use of the land area. If it was a herd pasture or cattle lounging area, chances are that nutrients like potassium and phosphorus are present in amounts exceeding requirements of any plants that you would like to grow there. On the other hand, if the area was a corn or hay field and little or no manure was applied, it may be deficient in fertilizer nutrients needed for pasture growth. How can you determine the nutrient status of your pastures? The best answer is through a soil test. Soil test kits are available at the County Extension Offices and the cost is minimal. Only with soil test results in hand can you make intelligent decisions about fertilization. Since it is the largest cash input into your pasture system, doesn't it make 'cents' to make an informed decision?

There are a number of other issues that need to be kept in focus when making fertilizer decisions. First, know who is testing your soil and making the fertilizer recommendations. If you have doubts about the accuracy of the recommendations that you are receiving, split a soil sample in two parts and send one to your lab and one to IFAS. Then have your county agent or someone at the university look with you at the results from the two labs. Always remember that you are fertilizing for a plant response not to achieve an ideal soil. In other words, supply the nutrients that are needed to grow this year's crop. Don't try to "build up" the soil because in actuality you will be wasting money and possibly damaging the environment.

Grazing management

Stocking rate. The grazing management decision that has the greatest impact on profitability of pasture systems is stocking rate. Why is stocking rate so important? Stocking rate affects the amount of forage available to the animal, so it plays a major role in determining intake. Intake drives animal production and farm income. Stocking rate also determines what proportion of the available forage the animal will consume. The greater the percentage of available forage that is consumed the smaller the opportunity the animal has to select leaf and the lower the quality of the diet consumed. Because grazed pasture generally is the cheapest source of nutrients, to maximize profit we would like to utilize our pasture resource as effectively as possible.

How do we decide what stocking rate to use? We need some information. We need to know what forage is being grazed, what fertilizer (particularly nitrogen) rate is being used, how the pasture is being grazed, how much forage is produced on the pasture per day, and the forage intake that we desire. Next are several examples using data from forages that may fit into dairy systems in Florida.

First, we will consider the annual forage pearl millet. The purpose of this example is two fold. First, we will get a general idea about the growth rate of pearl millet and the stocking rate to use. Secondly, we can see that growth rates change during the growing season, and that needs to be accounted for in our choice of stocking rate. The data used in this example are from Jay, FL and are for Tifleaf II pearl millet. During 3 years of study, pearl millet was planted around April 10 and four harvests were made approximately every 28 to 35 d starting around June 10. Nitrogen was split applied and totals for each year were approximately 200 lb/acre. For this example, we will assume a 1300 lb cow eating 1.5% of her body weight per day of forage dry matter. We will allow another 0.5% of cow body weight for wasted forage and assume that the forage is being grazed no closer than 8 inches. Using these assumptions and the forage growth data we can calculate an approximate stocking rate for pearl millet pastures (Table 2).

In the second example, we will consider Florico stargrass. The purpose of this example is to illustrate the effect of rest interval between grazings on production and nutritive value of Florico. The data are from pastures that were grazed every 2, 3, 4, 5, or 7 weeks to a 6-inch stubble at Ona, FL during a grazing season of about 200 days in each of 3 years (Mislevy and Brown, 1991; Mislevy, 1989). All pastures received a total of 220 lb N/acre. For this example, average growth rate was calculated over the 200 days and used to determine the recommended stocking rate (Table 3). The same assumptions were made about cow weight and intake as for pearl millet. Of course, a lower stocking rate may be needed in spring and fall and a higher one in summer if the forage is to be utilized completely.

Table 2. Growth rate in four summer months of pearl millet growing in Jay, FL. Stocking rate is calculated as growth rate divided by forage intake per cow per day (e.g., a 1300 lb cow consumes forage at 1.5% of body weight/day plus 0.5% of body weight/day is allocated for wastage due to trampling and manure for a total of 26 lb of dry forage needed/day).

	Month			
Item	June	July	August	September
Growth rate (lb dry forage/acre/day)	60.1	66.4	72.3	54.6
Stocking rate (cows/acre)	2.3	2.6	2.8	2.1

Table 3. Yield, growth rate, calculated stocking rate, crude protein concentration, and in vitro digestibility of Florico stargrass at Ona, FL. Date are means over 3 years and are adapted from Mislevy (1989).

	Weeks of Regrowth Since Last Grazing				
Item	2	3	4	5	7
Yield (tons/acre)	3.4	4.3	4.8	6.6	9.1
Growth rate (lb dry forage/acre/day)	34	43	48	66	91
Stocking rate (cows/acre)	1.3	1.7	1.8	2.5	3.5
Crude protein (%)	18	16	13	12	8
Digestibility (%)	68	67	60	59	53

The third example is for Florakirk bermudagrass and will be similar to that for stargrass. The data are from pastures that were grazed every 2, 4, 5, or 7 weeks over a 3-year period and received 140 lb nitrogen/acre over a 200-day grazing season (Table 4).

The last example is for rhizoma peanut grazed at Gainesville, FL. This example will be like those for stargrass and bermudagrass. The data are from pastures that were grazed every 1, 3, 5, 7, or 9 weeks to a 6- to 7-inch stubble during a grazing season of 160 days (Table 5; Ortega-S. et al., 1992). Procedures used for the calculations were the same as for the pearl millet example.

Table 4. Yield, growth rate, calculated stocking rate, crude protein concentration, and in vitro digestibility of Florakirk bermudagrass grazed at Ona, FL. Date are means over 3 years and are adapted from Mislevy (1995).

	Weeks of Regrowth Since Last Grazing			
Item	2	4	5	7
Yield (tons/acre)	5.5	7.5	7.5	7.6
Growth rate (lb dry forage/acre/ day)	55	75	75	76
Stocking rate (cows/acre)	2.1	2.9	2.9	2.9
Crude protein (%)	12	10	10	8
Digestibility (%)	59	55	55	51

Table 5. Yield, growth rate, calculated stocking rate, crude protein concentration, and in vitro digestibility of Florigraze rhizoma peanut forage grazed at Gainesville, FL. Data are adapted from Ortega-S. et al., 1992, and Ortega-S., 1990.

	Weeks of Regrowth Since Last Grazing				
Item	1	3	5	7	9
Yield (tons/acre)	3.2	3.6	3.8	4.2	4.6
Growth rate (lb dry forage/acre/ day)	40	45	48	53	58
Stocking rate (cows/acre)	1.5	1.7	1.8	2.0	2.2
Crude protein (%)	18.5	19.2	18.8	16.8	13.3
Digestibility (%)	65	69	70	69	65

Grazing method. Another important grazing management decision is the grazing method to use. Grazing method simply means either rotational or continuous grazing. For most dairy situations, especially those involving the milking cow herd, rotational grazing offers several advantages. Many of the higher quality forages that we would like to have our cow herd grazing simply respond better to rotational grazing. Rotationally grazed pastures often produce more forage (Ortega-S. et al., 1992), are less weedy, and the desired forage lives for more years than if the pastures were grazed continuously (Mathews et al., 1994).

If we choose to graze rotationally, the obvious question is how long should be the rest period between grazings. This decision is affected by a number of factors. The forage species we are grazing is one of the most important. A second factor includes how close we are grazing the pasture; the closer we graze the longer the rest period must be. Thirdly, the class of animal that will use the pasture and the forage quality that they require are important; the longer the rest period the lower the quality (Tables 3-5). Lastly, the season of the year has a major effect on growth rate of the forage (Table 2) and how soon it will be ready to be grazed. During spring and fall, when warm-season grasses are growing slowly, the rest period can be longer without sacrificing much quality. During mid-summer, shorter rest periods are needed because plants grow and mature rapidly and decrease in quality quickly.

What are some ballpark numbers for length of rest period for warm-season forages? For bermudagrass, stargrass, and pearl millet, rest periods of 20 to 28 days are about right. Rest periods shorter than 20 days may result in fairly large sacrifices of yield or over time may weaken the pasture. Periods longer than 28 days, especially during summer, will result in reduced forage quality. As rhizoma peanut matures, quality does not decrease nearly as rapidly as it does for grasses, so rest period is less critical from a quality perspective. Yields do increase with longer rest periods, and a good compromise for peanut is in the range of 28 to 35 days.

Conclusions

For anyone starting a grazing operation there is a steep learning curve in the first year or two. It is true that grazing is both an art and a science. This paper has presented some of the science to be considered. Experience at your location and talking with other graziers are good ways to develop the art. The ideas presented in this paper should provide a starting point, but the stocking rates and rest intervals that work best for you will depend on many factors specific to your farm. If the significance of these grazing management tools is understood, you should be able over time to develop an effective system that fits your farm and management style.

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