Nutritional Value of Native Range and Improved Forages: A Perspective from Central and South Florida

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Introduction

The beef cattle industry in Florida is centered around cow–calf production. With 1.1 million head of beef cows as of January 1, 1997, Florida ranked 10th in all states in the United States, and third behind Kentucky and Tennessee in states east of the Mississippi River. After weaning, generally from July through December, most calves are shipped to Texas (39% of out-shipments), Oklahoma (29% of out-shipments), and Kansas (12% of out-shipments) for winter grazing and(or) feedlot finishing. Some calves, primarily replacement heifers, are retained in Florida after weaning.

Because cow–calf production is the primary focus of the beef cattle industry in Florida, forage forms the base of cattle nutrition programs. The key is to match variation in forage characteristics of selected grasses and legumes to the animal production schedule. For example, various forages can be selected based upon their seasonal distribution of growth and quality, taking into account grazing management and pest issues that affect persistence. Utilization of these grasses can be timed based upon breeding, calving and weaning seasons.

Range

There is a simple method of measuring nutritive value of forages that is used by every rancher. That is to observe the weight change of cattle during the year. A plot of the annual weight change of cattle reveals an annual pattern of the nutritional weakness and strengths of a forage program. Kirk et al. (1945) plotted these changes over a 5-year period for Florida native cows grazing range year-round (Figure 1). From March to June, the nutritional value of range forage improved greatly, and cattle gained weight. Although cows continued to gain weight until September, laboratory estimates of nutritive value would probably have indicated that flatwoods range was on a slow downhill trend after June. Weight changes are the result of nutritive value and available forage. Available forage is very limiting from March to May on range, but increases from June to September when forage growth ceases. After September, mature weathered forage declines rapidly in nutritional value, and cows can easily lose an average 16% of their body weight from October to March.

If you compare the nutritional demands of the cow along with the ability of range forage to meet these needs, a picture of reproductive performance emerges. Hughes (1974) showed clearly why cows grazing flatwoods range year-round in south Florida had a 50% calf crop (Figure 2). Cows lost weight after December and this loss continued through June for cows that calved the previous winter. Lactating cows continued to lose weight through the 90-day breeding season, did not conceive, and went through the next year as open cows.

In the early 1980s, diets of esophageally fistulated steers grazing range at the Range Cattle REC were collected throughout summer (June to September) and winter (December to March). Available forage dry matter at the start (and end) of summer was about 1,000 lb/acre (1,700 lb/acre) and for winter was 1,700 lb/acre (600 lb/acre). Bluestems and maidencane made up 41 and 32%, respectively, of the diet dry matter in summer, while in winter these grasses made up 33 and 7% of the diets (Kalmbacher et al., 1984). Diets contained an average of 8.2% crude protein (CP) and 51.2% total digestible nutrients (TDN) in summer. In winter, diets contained 6.7% CP and 44.6% TDN

(Long et al., 1986). We can see why an open cow would gain weight in summer while a lactating cow would lose weight, especially in winter.

Other than burning range and feeding supplements, there is little that can be done to limit winter weight loss of cows. What happens during summer is another matter. Substituting improved pasture for range beginning in March is a practice that began in the early days of the Range Cattle REC. It had dramatic results on both reproductive performance and calf weaning weights because cows were on a higher plain of nutrition in the breeding season, which meant they conceived. During summer, they regained weight lost in the winter. More milk and good grazing from improved pasture meant heavier calves. Florida cattlemen who still own large acreage of range know that a combination of well managed range and bahiagrass pasture is a practical system. At the Range Cattle REC, 2 acres of bahiagrass (fertilized with 50 lb N/acre in March) per cow, grazed from March to September and 13 acres of range per cow grazed from October to February resulted in an 7-year average pregnancy rate of 78.5%, with 445-lb calves. Cows graze a combination of burned and unburned range, and are fed 5 lb/head/day of a molasses-based liquid feed containing 20% CP from December through the breeding season.

Improved Forages

There are many pasture grasses that can be grown on Florida ranches, but we can devote time to only four. There are two basic perennial grasses for central and south Florida: bahiagrass and limpograss. They form the foundation of the perennial grass pasture program on most Florida ranches. These are extensively managed grasses that have attained their status because they are dependable, long-lived, and highly adapted to the soil, climate and management abilities of most ranchers in the cow–calf business. In addition, there are two special-use grasses: stargrass (in-

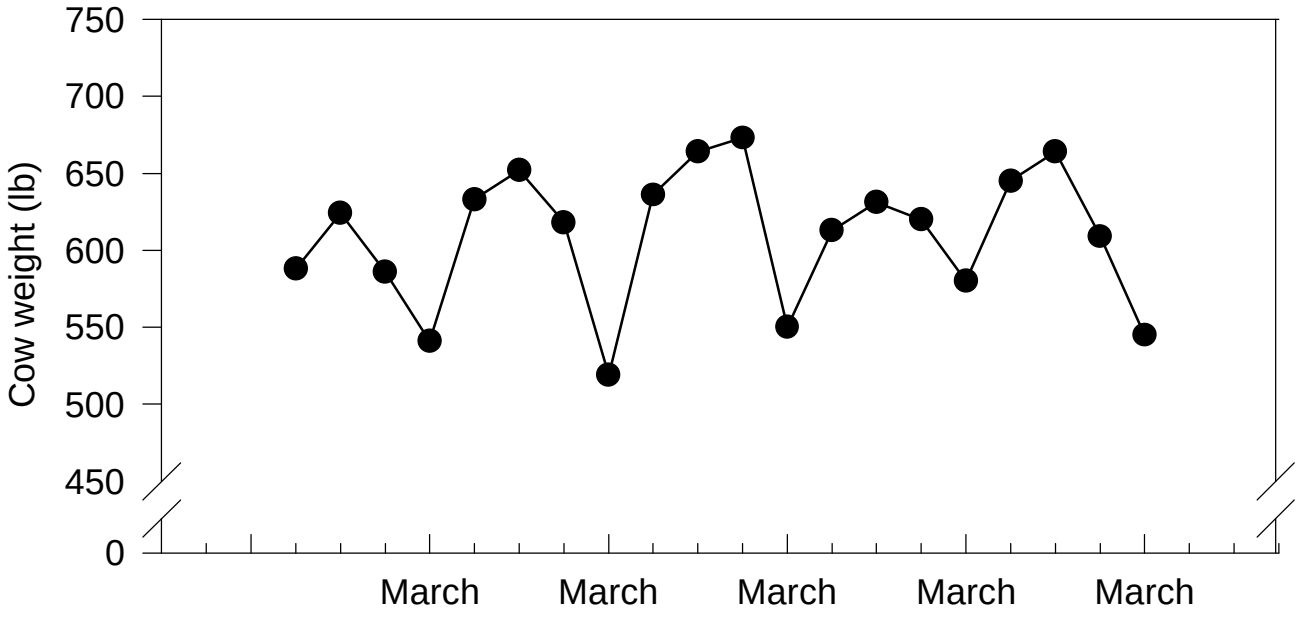


Fig. 1 Weights at three month intervals over 5 years

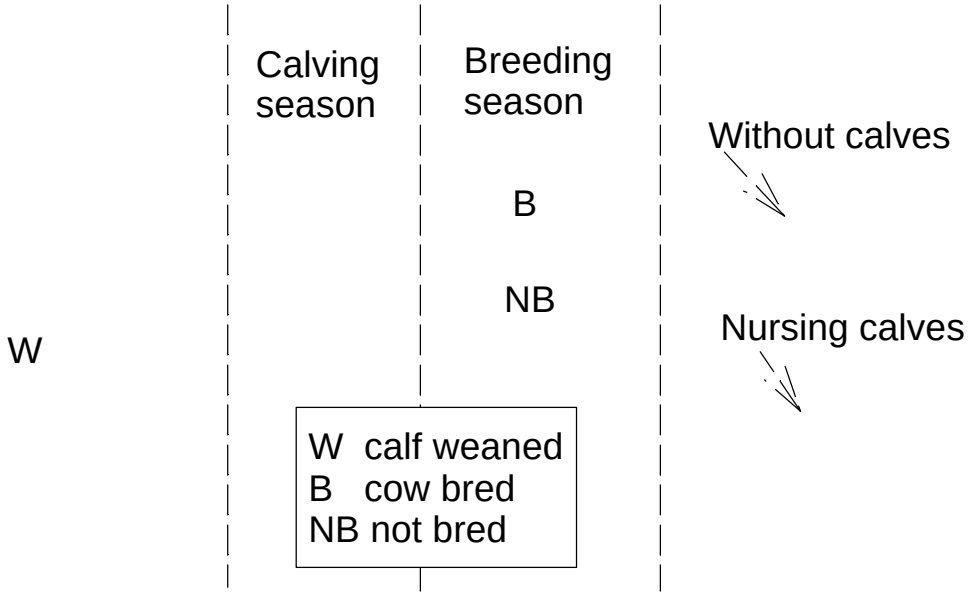
cluding bermudagrass) and rhodesgrass. These fill a special niche in a forage program and can be used for cattle with high nutritional needs such as growing calves or lactating cows. Special-use grasses are intensively managed for hay or silage, or can be used in a rotational grazing program. Some mention will be made to digitgrass today, but digitgrass has lost its prominence due to poor persistence. Generally, forage production is not a problem with these grasses from May to October.

From an agronomic standpoint, there are three elements that influence nutritional value of pasture. They are (in order of magnitude of effects on nutrition): maturity, grass species (to a lesser extent cultivar), and fertilization. On a ranch, what can be accomplished with these elements is limited by climate, economics, and other factors—except for the selection of grass species. So in this paper, the emphasis will be on species, with consideration to maturity and fertilization where they are important and provide practical consequences.

Variation in forage quality exists among tropical grasses, and these grasses vary in response to maturity. Dr. John Moore at the Animal Science Department in Gainesville used sheep in digestion trials to study feeding value of bahiagrass, digitgrass, limpograss, bermudagrass and stargrass at 4, 6, and 8 weeks of regrowth (Table 1). TDN intake combines differences in TDN concentration among grasses and differences in intake among grasses, and is directly related to animal performance. TDN intake is expressed as grams per unit of metabolic weight. Consider the relative differences in TDN intake among grasses and regrowth intervals.

TDN content of all grasses declined as harvest date was delayed from 4 to 8 weeks of regrowth (Table 1). Also, sheep ate less of the more mature forage. The additive effects of lower TDN and reduced intake resulted in much lower intake of TDN for the more mature hay.

At younger stages of growth, there was less difference in TDN, intake, and intake of TDN among the grasses, than at older stages of growth (Table 1). This was because limpograss and digitgrass maintained their quality with advancing ma-



turity better than bahiagrass, bermudagrass, and stargrass. At each maturity level, limpograss and digitgrass were greater in feeding value than the other grasses. Some of the difference in forage quality between species at a given regrowth interval is due to differences in forage production between grasses. For example, TDN content of bahiagrass at each regrowth interval was similar to, or greater than that of bermudagrass and stargrass, however at a given regrowth interval less bahiagrass forage would be produced. For most grasses, the decline in forage quality was greater between 6 and 8 weeks' regrowth, than between 4 and 6 weeks' regrowth.

Bahiagrass. Three cultivars are commonly grown: Pensacola, Tifton-9, and Argentine. Grazing trials at the Range Cattle REC have indicated little difference in livestock performance among these cultivars. Five-year average live weight gains ranged from 195 to 225 lb/acre for Argentine and Pensacola, respectively (Hodges et al., 1976). Another trial compared live weight gains of cattle grazing Pensacola (330 lb/acre) and Tifton-9 (300 lb/acre) (Mislevy, 1993). In small plot clipping trials conducted throughout Florida, no consistent differences in CP and IVOMD among these cultivars have been found. The changes in nutritional value that occur during the growing season are more obvious than differences in bahiagrass cultivars. These are changes over which the rancher has little control.

While mature cows may obtain an adequate diet from bahiagrass from May to October, young growing cattle, such as weaned calves and replacement heifers, have difficulty getting sufficient nutrition from bahiagrass, especially in late summer and early fall. Calves, weaned in early June and placed on bahiagrass without supplemental feed, gained .7 lb/hd/day in the 28 days from mid-June to mid-July, but in August (.2 lb/hd/day), September (.1 lb/hd/day) and October (–.3 lb/hd/day) average daily gains declined (4-year averages, Kalmbacher et al., unpublished data).

Alternatives to supply nutrients to cattle grazing bahiagrass in late summer include growing a legume with bahiagrass, feeding supplements, or switching to one of the speciality grasses. Considering the first alternative, daily gains of yearling steers grazing bahiagrass without a legume averaged .6 lb/head/day during the summer but increased to 1.0 lb/hd/day when grazing aeschynomene–bahiagrass pasture (Hodges et al., 1976). This improvement was due to high CP and digestibility of the legume in August and September. While legumes such as aeschynomene, carpon desmodium, and Savannah stylo will improve nutrition of bahiagrass pastures, legumes require a high level of management, and they depend greatly on weather.

Fertilization of bahiagrass in summer leads to great increases in forage production with small

Table 1. Influence of maturity (age in weeks) on the feeding value of various tropical grasses

	TDN[a]			Forage Intake			TDN Intake		
Forage	4	6	8	4	6	8	4	6	8
Bahiagrass	56.0	55.4	53.5	2.26	2.11	1.74	35.6	32.9	25.7
Digitgrass	60.1	57.8	56.6	2.53	2.72	2.18	44.3	44.2	34.4
Limpograss	62.6	63.2	56.3	2.46	2.33	2.22	44.5	42.1	34.8
Bermudagrass	57.3	52.4	43.8	2.28	2.24	1.84	37.6	33.2	22.0
Stargrass	59.5	52.7	48.8	2.35	2.54	2.07	39.7	37.5	28.9

[a]TDN = total digestible nutrients, %; forage intake expressed as a percentage of body weight; TDN intake is expressed as grams per unit of metabolic body weight.

increases in nutritional value. Other than fertilization with 60 lb N /acre in March, fertilization is not an economically viable option for increasing nutritional value of bahiagrass. The March fertilization of bahiagrass is done to provide forage at a time when it is greatly needed.

Limpograss. There are two cultivars grown in Florida: Bigalta and Floralta. Although grazing evaluation and laboratory estimates of nutritional value have indicated that Bigalta is slightly higher than Floralta, Bigalta has not been persistent in pasture. As a result, Floralta is most widely grown, and the discussion will focus on this cultivar. Unlike bahiagrass, which produces only 10 to 15% of its annual growth between November and March, limpograss can produce 30 to 35% of its growth during the cool period. This is one of the reasons limpograss is included as a basic pasture grass. Another is that digestibility remains high after forage has accumulated for several months, thus fall growth can be stockpiled for grazing from late fall through February. In our discussion, we will treat nutritional value of limpograss in summer separately from that of winter.

In summer, limpograss can provide relatively good grazing. For example, steers grazing Floralta from May to July gained .7 lb/head/day at the Range Cattle REC (Pitman et al., 1994). Compared with bahiagrass for summer grazing, limpograss is not a better pasture. At Deseret Cattle and Citrus, average calf weight from 236 cows grazing bahiagrass was 478 lb compared with 441 lb for calves from 300 cows grazing Floralta (P. Genho, personal communication). Calves gained 96 lb over 56 days on bahiagrass compared with 74 lb over 60 days with Floralta. The problem is low CP in limpograss. Nitrogen fertilization will increase CP and improve livestock performance, but not as economically as feeding protein supplements.

Experiments at Gainesville, and the Range Cattle REC have evaluated protein supplementation of young cattle (weaned and yearling) grazing limpograss on a year-round basis. In experiments conducted at Gainesville, providing a protein supplement (either non-protein-nitrogen from urea or natural protein from corn-gluten meal and blood meal) to cattle grazing limpograss during the summer and fall, generally has improved animal performance. Experiments conducted at the Range Cattle REC have not shown improvements in animal performance by providing a protein supplement to young cattle grazing limpograss during May through December. These differences may be geographical to some degree, however, there were differences in how pastures were grazed at the two locations. In Gainesville, cattle were grazed heavier so that more of the available forage was used before they were moved to a new pasture in the rotational system. Also, experiments were concluded in the late fall, at which time much of the forage was utilized. At the Range Cattle REC, pastures were more lightly grazed so that forage was stockpiled during the summer and fall, for use during the winter and spring. In this case, quite a bit of forage remained in the pasture when cattle were moved to a new pasture in the rotational system. Therefore, in the Gainesville experiments, cattle grazed more stem relative to leaf, than in experiments conducted at the Range Cattle REC. The leaf and stem of limpograss are similar in TDN, however the stem is much lower in CP than the leaf. This may explain why cattle responded to supplemental protein in experiments conducted at Gainesville, but not in experiments at the Range Cattle REC.

Bermudagrass and Stargrass. There are many bermudagrass cultivars, but common ones in use include Coastcross, Callie, Tifton-78, Florakirk, and Tifton-85. Tifton-85, the most recent bermudagrass release, has generated much interest because of its high yield and nutritional value. Commonly used cultivars of stargrass include Ona, Florona, and Florico. While these stargrasses share many of the same characteristics, Florico is slightly

higher in nutritional value compared with other stargrasses. Florico is similar to Tifton-85 in yield and nutritional value in central and south Florida. Florona has a finer stem than Florico which can influence drying and wilting time, and has been more persistent at the Range Cattle REC.

As mentioned earlier, nutritional value of bermudagrasses and stargrasses is greatly reduced by age. When grazed at 2- compared with a 7-week frequency in June, CP in Florico declined from 18 to 8% and TDN declined from 68 to 53%, respectively (Mislevy et al., 1989). The decline in nutritional value of these grasses is especially rapid after 5 weeks of age. At the Range Cattle REC, Florico (grazed in a 3-pasture rotation with 2 weeks' grazing and 4 weeks' regrowth with 3.2 yearling steers/acre) provided average daily gains of 1.2 lb/hd/day and live weight gains of 720 lb/acre over a 208-day growing season. Compare these live weight gains with those of bahiagrass. Stargrass should be grazed when grass height reaches 6 to 18 inches above a 6- to 10-inch stubble. This management will result in a leafy top layer and provide the most opportunity to obtain a high intake of nutritious forage. Properly established and well managed stargrass pastures are persistent and dependable. They represent the highest level of nutrition available to Florida cattlemen at this time.

Research at the Range Cattle REC compared the feeding value of stargrass hay harvested after 5 and 10 weeks' regrowth. Crude protein and TDN of the hay were greater in the 5- compared to the 10-week regrowth hay (Table 2). An even larger effect of forage maturity was the influence on intake; cattle ate more of the less mature forage. Effects on TDN and intake were additive; cattle fed the more mature forage ate less of a lower TDN hay compared to the 5-week hay. This had a large effect on daily gain. Less mature, better quality hay will require less supplemental feed to meet the protein and energy requirements of cattle compared to mature hay harvested after 10 or 12 weeks' regrowth.

Rhodesgrass. Its ability to be rapidly established from seed has been instrumental in the recent popularity of rhodesgrass. It provides relatively good yields and high levels of nutrition in the fall and early winter—another reason for its popularity—and is utilized for hay and grazing. Limited small plot data are available for Callide, the cultivar used by Florida cattlemen, but there are no data on animal performance on any rhodesgrass cultivar in Florida. At Immokalee, 31-day-old regrowth had 8.4% CP and 58.1% TDN in mid-July, and 46-day-old regrowth was 6.3% CP and 43%TDN in late August (Kalmbacher, 1991). These values are from whole plant samples and would represent nutritional value of hay, not grazed forage. At Fort Pierce, Callide fertilized with 100 lb N/acre on October 16, then cut on November 27 contained 12% CP and 52% TDN (Chambliss and Kretschmer, 1995).

The Need for Supplement

There are times during the year when grasses fail to meet the nutritional needs of cattle regardless of how we manage them. Over the past 2 years, bahiagrass pasture samples have been collected at various times during the year at the Range Cattle REC, and several ranches in south Florida, and analyzed for CP and TDN. Differences existed in fertilization practices among ranches, and

Table 2. Influence of maturity on the feeding value of stargrass hay

	Weeks of Regrowth	
	5	10
Crude protein, %	10.6	4.4
TDN, %	58	44
Intake, lb DM daily	9.5	6.4
Daily gain, lb	.5	0

the amount of forage available at the time of sampling varied at each ranch. In general, cows began calving in November–December, pastures were fertilized in February–March, breeding season began in February–March, and calves were weaned in late summer.

Using this animal production schedule, Figure 3 shows the plot of estimated CP intake (lb/day) and CP requirements (lb/day) for a 1,000-lb cow. Figure 4 shows the same relationships for TDN. Adequate forage availability and quality were noted during the summer and early fall; however, after approximately June, CP and TDN of the bahiagrass forage began to decline from approximately 11 and 56%, respectively, in June to approximately 6 and 45% in January. In addition to poor quality during late fall and winter, forage availability can be limiting in many cases; the combination of these two situations can lead to reduced forage intake.

Requirements for CP and TDN exceeded that consumed from bahiagrass pasture during 2 to 3 months before calving, and into the breeding season. During the last trimester of pregnancy the shortfall in CP and TDN was .5 to 1.0 lb CP and 2.5 to 4.5 lb TDN. This represents (on an as-fed basis) approximately 3.0 to 4.0 lb liquid feed or 2.0 to 3.0 lb dry feed, each containing 16 to 20% CP.

There are several strategies for supplemental feeding during the last trimester of pregnancy. If cows are in good body condition, weather is suitable, and bahiagrass pasture is in good supply and better than average quality, some producers will not supplement cows before calving. This approach may work in some cases, but can be dangerous because after calving, cows can not catch up in body condition (from an economical standpoint) if they are somewhat thin going into the calving season. Some producers will feed a small amount of supplement over a longer period, beginning 2 to 3 months prior to calving. Another option is to utilize stargrass or bermudagrass if frost has not occurred; in this case supplement may not be needed.

After calving, shortfalls in CP and TDN are approximately 1.0 to 1.5 lb and 5.0 lb, respectively, until after fertilization, and pastures begin to regrow in March–April. This represents (on an as-fed basis) approximately 6.0 to 8.0 lb liquid feed, or 5.0 to 7.0 lb dry feed, each containing 16 to 20% CP.

Summary

Range can meet the nutritional demands of mature, dry pregnant cows in the fall, but will not provide adequate CP or TDN after calving. Supplementation of the diet is required, and cows must be moved to pasture before the breeding season in order to improve reproductive performance. Relatively great differences do exist among the four grasses in common use in central and south Florida. At equal age and fertilization, nutritive value of bahiagrass, limpograss, rhodesgrass, and bermuda/stargrass are ranked from least to greatest. There is relatively little difference in nutritive value among cultivars of improved pasture grasses. Increasing maturity decreases nutritive value least for limpograss and most for stargrass and bahiagrass. There are times of the year when no perennial pasture grass will meet the nutritive value for some classes of cattle and supplementation of the diet is necessary

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Figure 3. Seasonal changes in crude protein intake and requirements for a 1000 lb cow.

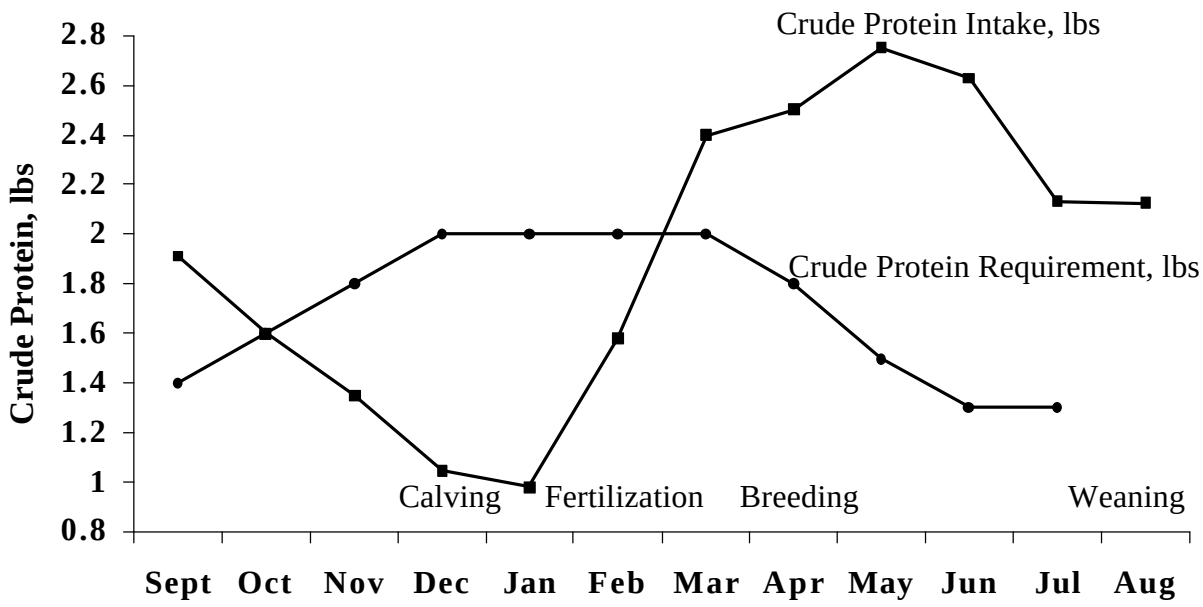
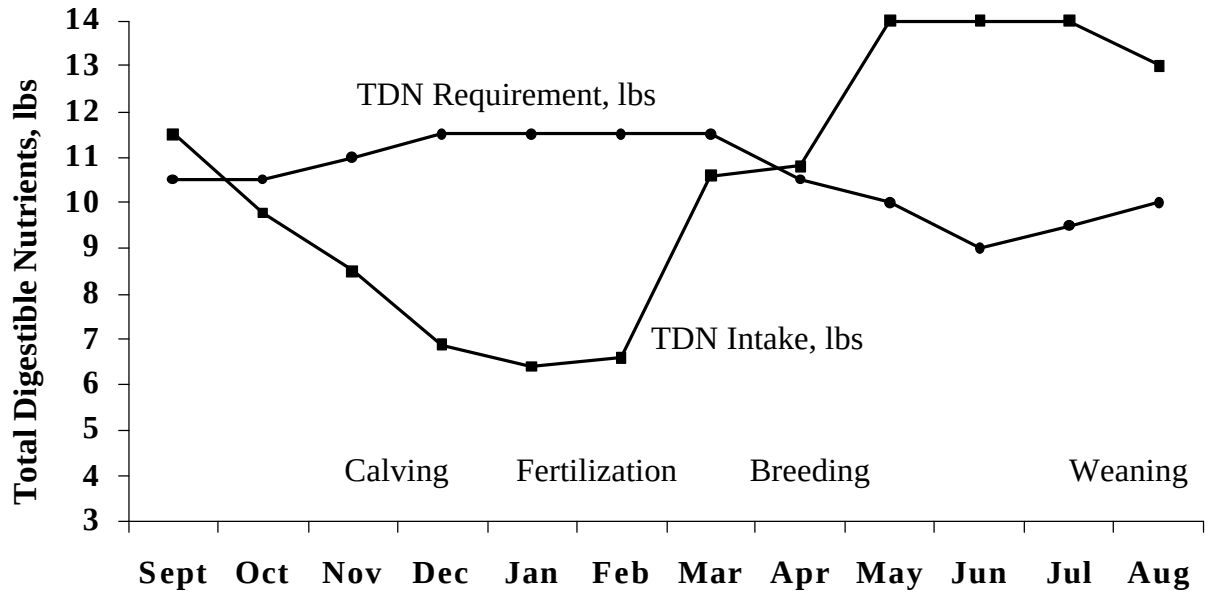


Figure 4. Seasonal changes in TDN intake and requirements for a 1000 lb cow.



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