Evaluating Feed Purchasing Options: Energy, Protein, and Mineral Supplements

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Introduction

Cow–calf production in Florida utilizes forages to provide most of the nutrients needed for maintaining the cow, growing the calf, and developing replacements. However, beef cattle need supplements in addition to forages during some phases of production and seasons of the year to support genetically achievable and economically optimum performance. Several other presentations during the Short Course are focusing on beef cattle requirements, forage management, and nutrient needs of beef cattle.

My initial plan for this presentation was to focus on comparing costs of nutrients from the wide range of supplementation options. However, in asking cattlemen what they wanted to hear, it was suggested to focus on how cattlemen can evaluate the many different supplementation products and options. This is a more complex process because comparing supplements with a cost–return approach requires prediction of the performance response of a particular supplement in a given situation. From cattle research and experiences by cattlemen we know that these responses vary depending on the cattle requirements, forage nutrient concentrations, and the nutrient that is most limiting to performance in a given situation. Simplification of this complex situation requires an organized approach to apply present knowledge and experiences to a range of situations.

In this paper I outline an approach and provide "thumb rules" to evaluate the level and type of a supplemental nutrient or additive and to define the situation in which a rule does and doesn't apply. This approach is organized into priorities of nutrient supplementation with mineral–vitamins as first priority, protein as second priority, and energy as third priority. This provides a sequential approach (4 steps) to balancing a forage-based diet and fits closely to the economic importance of providing limiting nutrients.

Step 1: Define the Situation

A. Determine Requirements. The nutrients required by cattle will vary depending on weight, age, growth, gain or loss in body condition, pregnancy status, and milk production. Other factors that will impact requirements in some situations are breed, activity, and heat or cold stress. For this discussion of supplementing beef cattle on forage-based diets, we will focus our discussion on total digestible nutrients (TDN) and crude protein (CP) requirements. Table 1 lists TDN and CP requirements for cattle of several different weights and production levels. A more extensive listing of requirements is available in *Nutrient Requirements of Beef Cattle*, published by the National Research Council (1996).

The nutrient requirements were determined in cattle that had been treated for internal and external parasites and vaccinated for common diseases. Parasites and diseases have been shown to increase nutrient requirements, and reduce nutrient utilization and forage intake. Effective control programs for parasites and diseases are essential to efficient production and should be evaluated along with nutrition if performance is below expectations.

B. Determine Forage Composition. Forage is the base for Florida cow–calf nutrition and provides many of the nutrients needed in most situations. However, forage quality and composition varies with maturity, species, season, environmental conditions, and other factors. The forage composition is needed to compare to requirements and quantify the adequacy of CP and TDN. The Florida Forage Testing Program (contact county agents) was developed to assist producers in estimating forage quality and provide information needed to make supplementation decisions. Table 2 provides forage composition of several improved forages, across seasons and maturities, and may be useful along with your experiences (forage tests and cattle performance) in estimating forage CP and TDN concentrations.

Step 2: First Economic Priority

Evaluate Mineral–Vitamin Supplementation

An effective mineral–vitamin supplementation program is evaluated first because mineral and vitamin deficiencies can reduce growth, body condition score, and pregnancy rate. When considering cost, mineral–vitamin supplements are usually more cost effective than other supplemental nutrients. An effective mineral–vitamin supplementation program that can be followed by most producers costs $8 to $12/cow each year.

Minerals known to be deficient and reduce performance in Florida cattle grazing forages are sodium, phosphorus, copper, cobalt, and selenium. Vitamins are not usually deficient, but cattle consuming dry forages (hay or frosted grass) for 2 months or more may have depleted liver reserves of vitamin A and benefit from supplementation.

A complete mineral supplement containing salt, calcium, phosphorus, and trace minerals is recommended to be provided free-choice. Mineral consumption varies across pastures, seasons and cattle, but average consumption of 2 oz/head/day of a mineral containing 25% salt, 14 to 18% calcium, 8% phosphorus, .4% zinc, .2% iron, .2% manganese, .15% copper, .016% iodine, .01% cobalt and .002% selenium has been sufficient in many situations.

Step 3: Second Economic Priority

Evaluate Protein Supplementation

Protein supplements have been shown to increase forage intake and digestibility when protein is deficient. Protein is deficient relative to energy when the TDN-to-CP ratio (TDN:CP) is over 7. When protein is deficient, results of several studies indicate that protein supplements increase forage consumption by 15 to 45%. A few studies have also shown a 2 to 5 percentage-unit increase in forage digestibility. In these situations, supplementing protein is usually more cost effective than purchasing energy supplements.

A. Protein Response Limited. <u>Thumb rule</u>*: if desired cattle gains are .5 lb/day or more above forage fed alone, then go to Step 4.* Supplemental protein, when deficient, will usually provide an economical response. However the improvement in gain over forage alone is usually limited to .5 lb/day or less.

B. When to Feed Protein. <u>Thumb rule</u>*: protein supplements will usually improve performance when the TDN:CP ratio is higher than 7.* Forages with high TDN:CP ratios (especially 10 or higher) typically have low intakes (1.5% body weight or less), and feeding a protein supplement increases forage intake and digestibility and improves performance. Florida forages that are mature (8 weeks' or more regrowth, Table 2) often have high TDN:CP ratios and protein supplements would be expected to improve performance in cattle fed this forage. Cattle tend to selectively graze forage that is higher in quality than the average forage available if given a choice. Knowing what grazing cattle are consuming at a particular time usually requires estimation based on obser-vations of what the cattle are eating and the composition of the different plants or parts of plants.

C. NPN Utilization. *Thumb rule: for low- to medium-quality forages, the requirement for ruminally degraded protein is 11% of TDN intake and this can be met with ruminally degraded protein sources and NPN.* Ruminally degraded crude protein (DIP) includes part of the protein in plants and supplemental feeds as well as NPN. This DIP can be synthesized into bacterial protein that will be digested in the small intestine, but digestible energy limits bacterial growth. Bacterial protein synthesized per unit of TDN is not constant and is affected by intake level, fiber content of the diet, and forage digestibility. Ruminal microbes need approximately 11% of the TDN as ruminally degraded crude protein (DIP) to be incorporated into bacterial protein (amino acids) for medium- to low-quality, forage-based diets (45 to 55% TDN). Therefore, NPN cannot raise the protein concentration above 11% of the TDN in the diet. Usually 65 to 75% of forage protein is degraded in the rumen, and forage DIP is available to support microbial protein synthesis and the remainder of the DIP requirement can be met by NPN or other sources of DIP. In situations where supplements supply more NPN than is needed for microbial growth, excess DIP is converted to ammonia that will be absorbed from the rumen, converted to urea in the liver (energy is used to convert ammonia to urea), then either recycled to the rumen or excreted in urine.

The thumb rule that the DIP requirement is 11% of the dietary TDN can be used to determine how much supplemental CP from NPN can be utilized in a given situation. As an example, if a 1,000-lb cow eats 17 lb DM/day (1.7% body weight) of bahiagrass containing 50% TDN and 6.5% CP in DM, and 70% of the forage protein is degraded in the rumen, then the cow is consuming 8.5 lb TDN/day (17 ∗ .50) and needs .94 lb/day ruminally degraded crude protein (8.5 lb TDN ∗ .11). The forage contains 1.11 lb CP (17 ∗ .065) and approximately 70% protein, or .78 lb/day (1.11 ∗ .70), is available for microbial protein synthesis leaving an estimated deficit of .16 lb/day (.94–.78) DIP needed for optimum ruminal microbial fermentation. This situation would require feeding approximately 1.2 lb/day of a range cube containing 20% CP (NPN or other source of ruminally degraded protein), if you assume that feeding the range cube does not change forage consumption. The TDN (60%) in 1.2 lb range cube also requires .08 lb/day DIP (.72 lb TDN ∗ .11); therefore the total DIP deficit is .24 lb/day (.16 + .08), which should be met if CP provided by the range cube is 20% DIP.

D. NPN vs Natural Protein. *Thumb rule: use natural protein supplements for young, growing cattle fed medium- and low-quality Florida forages.* The TDN consumed limits the synthesis of DIP into microbial protein but in situations where low quality forages are fed, the microbial protein may not meet the animals' protein requirements for maintenance and growth. This is the situation for growing cattle and young cows, and feeding natural protein that contains protein not degraded in the rumen (UIP or bypass protein) improves their performance. In research conducted in Florida, a summary of 12 comparisons evaluating the effects of feeding .20 to .36 lb/day of UIP from feather, blood, or corn-gluten meals to growing cattle fed warm-season perennial grass pasture or hay showed that gains were improved .32 lb/day. In these trials the DIP needs were met with NPN or other sources of DIP. For reference, 1 lb cottonseed meal contains approximately .41 lb protein, and .25 lb (60%) of the protein is DIP while .16 lb (40%) is UIP; 1 lb feather meal contains approximately .80 lb protein, and .26 lb (33%) of the protein is DIP while .54 lb (67%) is UIP. Table 3 provides the composition of several supplemental feeds.

E. Protein Cost. *Thumb rule: select the protein supplement that is the correct type and has a low cost/lb CP consumed.* The cost of protein will depend on the supplement, quantities purchased, losses, and equipment and labor availability and cost. The first decision is to narrow the list of supplements to those that fit your situation and can be used in your system, then evaluate the cost of protein from these sources. The cost of protein ($/100 lb) is calculated by dividing the cost of 100 lb of each protein source by the protein fraction (% protein/100). As an example for soybean meal costing $235/ton or $11.75/100 lb (235/20), 100 lb soybean meal contains 48 lb protein and 100 lb protein costs $24.48 (11.75/.48).

The cost of protein (purchase costs only) from several supplements available in central Florida ranges from $10 to $67 for 100 lb protein (Table 4). Much of this variation in purchase cost can be attributed to quantities purchased and supplements that are formulated to be self-fed, which require less equipment and labor. Other costs that need to be added to purchase cost include transportation to your ranch, storing and feeding equipment maintenance and replacement costs, storage and feeding losses, and labor costs for storage and feeding each supplement. As an example for one of these costs, meals are usually fed in feedbunks to minimize wastage which increases the equipment and labor costs of using this supplement.

Protein supplements offered free-choice may be consumed above or below what is needed to meet supplemental protein requirements. As an example, if a protein supplement needs to be consumed at 1.5 lb/day to meet protein requirements but is consumed at 3 lb/day, the additional 1.5 lb/day will improve performance based on its energy concentration. The additional supplement consumed above that needed to meet protein requirements should be valued at the cost of TDN supplements if the additional performance will result in additional income.

Step 4: Last Economic Priority

Evaluate Energy Supplementation

The costs of energy supplements can be significant so it is essential to supplement only cows and heifers that will give an economical response. Cows that lost calves or cows in BCS 5 or above and calving late probably will not improve performance and need to be removed from the herd being fed energy supplements.

A. Calculate Feeding Level. *Thumb rule: 1 lb supplemental TDN balanced with protein, minerals, and vitamins improves gain .2 lb/day over forage alone when an ample supply of low- to medium-quality forage is available.* The level of supplement needed to meet performance targets depends on the forage quality, animal condition, level of production, weather, and other factors. The improvement in gain/lb of supplemental TDN fed has varied from .1 to .3 lb/day depending on the situation and it is suggested to use .2 lb increase in gain for lb TDN supplemented, for planning purposes. Estimate the level of supplement needed based on requirements and forage quality, then monitor the cattle weight and condition change and adjust the supplement level to meet the performance desired. The response to energy supplements will be better if a lower level of supplement is fed over a longer time period. Do not wait until the cattle are thin to start feeding supplements.

B. Energy Cost. *Thumb rule: select an energy supplement that has a low cost/lb TDN consumed.* Selecting an energy supplement that will provide TDN balanced with protein, minerals and vitamins at a low cost is essential. Cost of energy supplements, like protein supplements, will depend on the supplement, quantities purchased, losses, and equipment and labor availability and cost. The cost of TDN (purchase costs only) from several supplements available in central Florida ranges from under $5 to over $18 to purchase 100 lb TDN (Table 5). Much of this variation in purchase cost can be attributed to quantities purchased and supplements that are formulated to be self-fed, which have lower labor costs. The low-cost TDN sources may not be balanced in protein and major minerals, which is essential for good responses in performance. As an example, soybean hulls are nearly balanced in protein, calcium, and phosphorus for many situations, but citrus pulp is deficient in protein and phosphorus in many cases and the costs of balancing protein and phosphorus must be considered when evaluating this alternative. Other costs that need to be added to purchase cost include transportation to your ranch, storage and feeding equipment maintenance and replacement costs, storage and feeding losses, and labor costs for storing and feeding each supplement.

C. Byproduct Feeds. <u>Thumb rule</u>*: highly digestible byproduct supplements have 15 to 30% higher value per unit TDN when fed at .50 to 1.5% body weight to cattle, with forage available free-choice.* Feeds such as soybean hulls, citrus pulp, and wheat middlings are highly digestible but contain 35% or less of starch plus sugars, whereas corn contains 75% starch. Several experiments indicate that when the sum of the starch plus sugars are fed at levels above .4% body weight, the forage intake and digestibility may be reduced. In these situations when a forage is being supplemented, choosing a highly digestible supplement such as soybean hulls, compared to a high-starch supplement such as corn, appears to give 15 to 30% better improvement in performance per unit supplemental TDN.

D. Growth-Promoting Antibiotics. <u>Thumb rule</u>*: Rumensin®, Bovatec® and Gainpro™ improve gains of cattle fed forages by .15 to .25 lb/day, which is similar to feeding 1 lb/day supplemental TDN balanced with other nutrients.* These antibiotics must be consumed regularly to be effective, and mixing in a protein or energy supplement is a good way to deliver these antibiotics. Cattle need to be fed antibiotics at least every other day for them to be effective. Daily feeding in a carrier or protein supplement is often not cost effective unless other ingredients in the supplement increase performance. Mixing Rumensin® in mineral supplements often reduces consumption. Consumption of all growth-promoting antibiotics mixed in minerals may be once each week, or less for some cattle, which reduces their effectiveness. Each product is approved at different feeding levels and not all are approved for all types of cattle. Read the label for information on each product.

Supplementation Tips

Other factors that impact supplementation responses include effects on cattle grazing behavior and variation in supplement intake. In addition, the manager decides what, when, who, and how to supplement—which impacts the response and economic return. Following are a few tips and suggestions that may improve the response to supplements:

- If forage supply is short, start supplementing long before the forage is gone.
- Consider weaning calves early when drought conditions require supplemental feeding.
- Get the most from pasture before feeding hay. Also, remember that the pasture is “used up” long before the last bite is gone.
- If cows are thin (<BCS 5), put condition on cows before calving.
- Early weaning calves (>5 months of age) may benefit cows in thin condition.
- Open cows and cows that have lost calves should be separated from the herd if energy supplements are being fed.
- Group cows by supplementation needs. Many ranches have herds of heifers, first calf cows, second calf cows, mature cows and bulls.

- If cows look full, supplementation probably will not increase forage intake.
- If cattle look shrunk, make sure they have water and forage, consider moving them to another pasture, and evaluate whether supplementation will improve forage intake.
- Do not wait until cattle are thin to start feeding supplements. Allowing cattle to get thin and then attempting to supplement to increase body condition in cows grazing low- to medium-quality forages often requires twice as much supplement as supplementing to *prevent* the condition loss. It is usually not economically justified.
- Response to energy supplements will be better if a lower level of supplement is fed over a longer period of time.
- Time supplemental feeding to facilitate grazing. Feeding supplements midday often causes less interruption of grazing.
- Alternate day or three times per week feeding of supplement works well for high-protein supplements. This is less effective for high-starch supplements fed at higher levels (>.3% body weight).
- For cube or bunk feeding, make sure all cattle are in the area when feed is offered and distribute so all cattle eat the supplement.
- For self-fed supplements, provide enough feeding sites and locate them so all cattle will have access to the supplements.
- When feeding higher levels of supplement, consider balancing major minerals and adding trace minerals to the supplement because intake of free-choice minerals may decline.

Comments

You may be wondering whether computer programs are available to balance cattle diets. Several programs are available that are excellent for calculating cattle requirements and formulating backgrounding and feedlot diets. However for grazing and forage-based production systems, these computer programs do not account for the intake and digestion effects that are important in economic evaluation of protein and byproduct feed supplementation. Another factor is the learning curve associated with most computer programs; if you only balance the diet once each year, then it will usually be faster to do it without the computer program. Several universities are working to develop mathematical equations that accurately describe the biology in forage-based systems, and to develop interactive computer programs with shorter learning curves.

Summary

Evaluation of supplemental feeding alternatives can be a confusing and frustrating process. The supplementation approach outlined is based on economic priorities and levels and types of nutrients required. This approach and thumb rules were developed to increase your understanding of the principles involved, assist in evaluating the economically optimum type and level of supplementation, and make you feel more comfortable with your decisions.

Table 1. Nutrient requirements for beef cattle[a]

Body Weight (lb)	Daily Gain (lb)	Dry Matter Intake (lb)	Crude Protein lb/day	Crude Protein % of DM	TDN lb/day	TDN % of DM	Ca (%)	P (%)
Heifer calves								
400	1.5	10.2	1.17	11.4	7.0	68.5	.45	.24
500	1.5	12.1	1.25	10.3	8.3	68.5	.38	.22
600	1.5	13.8	1.32	9.5	9.4	68.5	.32	.21
Pregnant yearling heifers — last third of pregnancy								
750	1.4	16.6	1.5	8.9	10.0	59.9	.32	.21
850	0.9	17.6	1.4	8.2	9.6	54.5	.26	.20
950	0.9	19.0	1.5	8.0	10.3	54.1	.27	.20
Dry pregnant mature cows — middle third of pregnancy								
1000	—	18.1	1.3	7.0	8.8	48.8	.18	.18
1100	—	19.5	1.4	7.0	9.5	48.8	.19	.19
1200	—	20.8	1.4	6.9	10.1	48.8	.19	.19
Dry pregnant mature cows — last third of pregnancy								
1000	0.9	19.6	1.6	7.9	10.5	53.6	.26	.21
1100	0.9	21.0	1.6	7.8	11.2	53.2	.26	.21
1200	0.9	22.3	1.7	7.8	11.8	52.9	.26	.21
Two-year-old heifers nursing calves — first 3 to 4 months postpartum; 10 lb milk per day								
800	0.5	17.6	1.9	10.8	11.2	63.8	.34	.24
900	0.5	19.2	2.0	10.4	12.0	62.7	.32	.23
1000	0.5	20.8	2.1	10.0	12.9	61.9	.31	.23
Cows nursing calves — first 3 to 4 months postpartum; average milking (10 lb/day)								
1000	—	20.2	2.0	9.6	11.0	56.6	.28	.22
1100	—	21.6	2.0	9.4	11.5	56.0	.27	.22
1200	—	23.0	2.1	9.3	12.1	55.5	.27	.22
Cows nursing calves — first 3 to 4 months postpartum; superior milking (20 lb/day)								
1000	—	20.6	2.5	12.3	13.8	67.0	.39	.27
1100	—	22.3	2.6	11.9	14.5	65.2	.38	.27
1200	—	23.8	2.7	11.5	15.2	63.7	.36	.26
Bulls — maintenance and slow rate of growth (regain condition)								
1400	2.0	27.7	2.2	8.0	17.8	64.0	.25	.20
1600	1.0	29.7	2.2	7.3	16.6	55.8	.22	.19
1800	0.5	30.9	2.2	7.0	16.1	52.0	.20	.20

[a]Vitamin A requirement for (1) pregnant heifers and cows = 1270 IU per lb dry feed; (2) lactating cows and breeding bulls = 1770 IU per lb dry feed.

Source: NRC. 1984. Nutrition Requirements of Beef Cattle (6th Ed). National Academy Press, Washington, DC.

Table 2.Effects of Season and Maturity on Quality of Perennial Warm Season Grasses Grown in Florida.

Spring Growth — Pensacola Bahiagrass

Regrowth Weeks	Date Mon.day	Yield lb/A	Protein % DM	IVOMD %	TDN % DM	TDN/CP ratio
2	4.03	240	21.7	67.6	63.0	2.9
4	4.17	430	16.1	66.5	62.4	3.9
6	5.01	810	13.1	63.2	60.5	4.6
8	5.15	1190	9.3	63.6	60.8	6.5
10	5.29	2190	6.7	58.0	57.6	8.6
12	6.12	2460	4.5	54.5	55.7	12.4
14	6.26	3120	4.4	52.5	54.6	12.4
17	7.18	3810	4.6	49.9	53.1	11.5

Summer Growth — Pensacola Bahiagrass

Regrowth Weeks	Date Mon.day	Yield lb/A	Protein % DM	IVOMD %	TDN % DM	TDN/CP ratio
2	6.06	440	12.5	60.1	58.8	4.7
4	6.19	1420	10.3	61.3	59.5	5.8
6	7.03	2280	8.6	59	58.2	6.8
8	7.17	2960	6.8	52.6	54.6	8.0
10	7.31	3690	7.0	52.5	54.6	7.8
12	8.15	4240	5.1	49.8	53.0	10.4
15	9.04	5550	5.5	48.1	52.1	9.5

Fall Growth — Pensacola Bahiagrass

Regrowth weeks	Date Mon.day	Yield lb/A	Protein % DM	IVOMD %	TDN % DM	TDN/CP ratio
2	8.28	500	18.2	59.6	58.5	3.2
4	9.12	900	14.9	54.5	55.7	3.7
6	9.25	1030	11.5	53.8	55.3	4.8

Spring Growth — Ona Stargrass

Regrowth weeks	Date Mon.day	Yield lb/A	Protein % DM	IVOMD %	TDN % DM	TDN/CP ratio
2	4.03	820	14.0	61.4	59.5	4.3
4	4.17	1550	9.7	61.6	59.6	6.1
6	5.01	2200	7.1	59.5	58.5	8.2
8	5.15	3350	5.3	55.9	56.5	10.7
10	5.29	3620	4.8	46.1	51.0	10.6
12	6.12	4340	3.7	45.6	50.7	13.7
14	6.26	4950	3.8	39.8	47.5	12.5
17	7.18	5160	4.6	38.2	46.6	10.1

Summer Growth — Ona Stargrass

Regrowth Weeks	Date Mon.day	Yield lb/A	Protein % DM	IVOMD %	TDN % DM	TDN/CP ratio
2	6.06	280	23.6	79.9	69.9	3.0
4	6.19	1480	15.4	64.8	61.4	4.0
6	7.03	4870	8.2	52.5	54.6	6.7
8	7.17	5440	6.3	45.2	50.5	8.0
10	7.31	6060	5.2	38.3	46.6	9.0
12	8.15	6610	4.6	34.4	44.4	9.7
15	9.04	7500	4.2	35.5	45.0	10.7

Fall Growth — Ona Stargrass

Regrowth Weeks	Date Mon.day	Yield lb/A	Protein % DM	IVOMD %	TDN % DM	TDN/CP ratio
2	8.28	390	28.1	71.2	65.0	2.3
4	9.12	2280	12.7	59.3	58.4	4.6
6	9.25	4060	9.7	50.0	53.2	5.5
8	10.9	4710	8.3	47.2	51.6	6.2
11	10.30	5670	6.3	36.9	45.8	7.3

Spring Growth — Pangola digitgrass

Regrowth weeks	Date Mon.day	Yield lb/A	Protein % DM	IVOMD %	TDN % DM	TDN/CP ratio
2	4.03	400	21.4	77.6	68.6	3.2
4	4.17	800	14.1	70.2	64.5	4.6
6	5.01	1260	9.0	71.7	65.3	7.3
8	5.15	2270	5.4	70.8	64.8	12.0
10	5.29	2810	3.5	67.3	62.8	18.0
12	6.12	3040	3.3	64.9	61.5	18.6
14	6.26	3730	3.2	62.7	60.3	18.8
17	7.18	4380	3.6	51.5	54.0	15.0

Summer Growth — Pangola digitgrass

Regrowth Weeks	Date Mon.day	Yield lb/A	Protein % DM	IVOMD %	TDN % DM	TDN/CP ratio
2	6.06	70	20.6	75.1	67.2	3.3
4	6.19	530	13.4	71	64.9	4.8
6	7.03	2230	8.2	60.5	59.0	7.2
8	7.17	2480	6.2	58.2	57.7	9.3
10	7.31	3910	4.7	59.6	58.5	12.5
12	8.15	5350	3.7	56.4	56.7	15.3
15	9.04	6790	3.5	53.3	55.0	15.7

Fall Growth — Pangola digitgrass

Regrowth Weeks	Date Mon.day	Yield lb/A	Protein % DM	IVOMD %	TDN % DM	TDN/CP ratio
2	8.28	260	27.6	65.9	62.0	2.2
4	9.12	1530	11.9	60.9	59.3	5.0
6	9.25	1660	8.7	55.8	56.4	6.5
8	10.09	1860	5.5	51.2	53.8	9.8
11	10.30	2260	5.9	47.1	51.5	8.7

Fall Growth — Limpograss

Regrowth Weeks	Date Mon.day	Yield lb/A	Protein % DM	IVOMD %	TDN % DM	TDN/CP ratio
2						
4	9.01	3000	9.6	63.0	60.4	6.3
6	9.15	5000	10.2	62.0	59.9	5.9
8	10.01	9000	5.0	61.0	59.3	11.9
10	10.15	9100	4.5	60.0	58.8	13.1
12	11.01	9500	4.0	58.0	57.6	14.4
14	11.15	10000	3.8	56.0	56.5	14.9
16	12.01	10800	3.2	55.0	56.0	1705

Formula to convert IVOMD (In vitro organic matter digestibility) to TDN is: TDN= OM*(26.8 + .595*(IVOMD))

Formula from John Moore Use .94 for OM if do not have actual values

Data for all except limpograss is from 1988 Beef Research Report, p 46-54, Brown and Mislevy, Department of Animal Science, University of Florida.

Table 3. Nutrient concentration and bulk density of supplemental feed ingredients

		Concentration in dry matter									
Feed	**Dry Matter %**	TDN %	NEm mcal/lb	NEg mcal/lb	Starch–Sugars %	Fat %	Crude Protein %	Bypass Protein % CP	Ca %	P %	**Bulk Density lb/ft^3**
Grains											
Corn	88	87	0.96	0.64	75	4.2	10	65	0.02	0.30	48
Oats	89	76	0.81	0.52	47	4.6	13	21	0.09	0.40	25
Rye	89	81	0.88	0.58	—	1.7	12	20	0.07	0.39	45
Wheat	89	88	0.98	0.65	69	2.0	12	—	0.06	0.40	48
High-energy feeds											
Citrus pulp, pellet	90	79	0.85	0.55	25	3.9	8	37	1.80	0.15	20
Cotton gin trash	91	45	0.44	0.05	—	2.0	11	—	1.70	0.25	—
Hominy	90	92	1.03	0.70	52	5.3	11	44	0.04	0.45	28
Molasses, heavy	78	78	0.79	0.50	60	0.0	9	0	1.10	0.10	78
Peanut skins	92	~70	—	—	—	20.0	17	—	0.19	0.20	20
Rice bran	91	66	0.68	0.38	27	15.8	14	34	0.08	1.68	20
Soybean hulls, ground	91	77	0.82	0.53	14	2.5	14	30	0.63	0.22	20
Wheat middlings	89	82	0.89	0.59	35	4.6	18	24	0.14	1.04	20
Medium-protein feeds											
Brewers grains	92	84	0.92	0.61	14	7.4	30	56	0.30	0.60	15
Broiler litter	78	53	0.52	0.16	—	2.0	25	—	2.10	1.80	35
Cottonseed, whole	90	94	1.06	0.72	8	18.0	23	39	0.16	0.62	25
Corn gluten feed	90	82	0.89	0.59	30	3.3	24	25	0.20	0.85	30
Distillers grains	92	87	0.96	0.64	12	9.0	27	47	0.30	0.75	15
High-protein feeds											
Blood meal	91	66	0.66	0.37	—	1.3	92	82	0.29	0.23	38
Corn gluten meal	91	89	0.99	0.67	19	2.4	67	60	0.05	0.51	42
Cottonseed meal	91	76	0.81	0.52	12	2.0	47	41	0.21	1.18	42
Feather meal	92	69	0.71	0.43	7	5.0	88	72	0.40	0.60	15
Fish meal	90	72	0.75	0.47	2	8.0	66	63	6.40	3.60	40
Meat and bone meal	93	71	0.74	0.46	—	10.4	55	53	9.95	5.00	37
Peanut meal	91	77	0.82	0.53	25	4.5	48	28	0.20	0.52	29
Soybean meal	91	87	0.96	0.64	10	1.2	55	30	0.28	0.70	42
Soybeans, whole	88	93	1.04	0.71	10	18.5	40	30	0.27	0.64	48

Table 4. Nutrient composition and costs of protein supplements[a]

Feed	Crude Protein % as fed	TDN % as fed	Cost $/unit	Cost of Protein[b] $/100 lb
Soybean meal				
bulk, 25 ton	48	78	235/ton	24.48
bagged, 50 lb	48	78	8.60/50 lb	35.83
Cottonseed meal				
bulk, 25 ton	41	72	195/ton	23.78
bagged, 50 lb	41	72	6.60/50 lb	32.20
Wheat middlings				
bulk, 25 ton	18	73	90/ton	25.00
bagged, 50 lb	18	73	5.70/50 lb	63.33
Range cubes	20	60	6.40/50 lb	64.00
Protein block, 33 lb	24	60	8.10/50 lb	67.50
Molasses blocks				
200 lb	27	60	29/200 lb	53.70
500 lb	27	60	69/500 lb	51.11
Liquid supplement (16% CP)				
bulk, 25 ton	16	55	112/ton	35.00
delivered to lick tank	16	55	145/ton	45.31
Liquid supplement (32% CP)				
bulk, 25 ton	32	43	116/ton	18.13
delivered to lick tank	32	43	145/ton	22.66
Whole cottonseed, 25 ton	22	80	150/ton	34.09
Broiler litter	20	42	40/ton	10.00

[a]Prices quoted during spring 1998 from suppliers in central Florida, prices vary in different areas of the state and with different quantities purchased.

[b]Cost of protein ($/100 lb) is calculated by dividing the cost of 100 lb of feed by the protein fraction (% protein/100). Example for soybean meal: $235/ton=$11.75/100 lb (235/20); 100 lb soybean meal contains 48 lb protein and 100 lb protein costs $24.48 (11.75/.48).

Table 5. Nutrient composition and costs of energy supplements[a]

Feed	TDN % as fed	Crude Protein % as fed	Cost $/unit	Cost of TDN[b] $/100 lb
Hay, round bales	50	8	60/ton	6.00
Sorghum silage (30% DM)	18(60)	2(7)	18/ton	5.00
Shelled corn				
bulk, 25 ton	80	8	137/ton	8.56
bagged, 50 lb	80	8	4.95/50 lb	12.38
Hominy, 25 ton	83	10	128/ton	7.71
Citrus pulp, 25 ton	71	7	72/ton	5.07
Wheat middlings				
bulk, 25 ton	73	18	90/ton	6.16
bagged, 50 lb	73	18	5.70/50 lb	15.62
Soybean hulls, 25 ton	70	12	100/ton	7.14
Blackstrap molasses, 25 ton	62	7	80/ton	6.45
Liquid supplement (16% CP)				
bulk, 25 ton	53	16	112/ton	10.57
delivered to lick tank	53	16	145/ton	13.68
Steer grower (12%)	65	12	6.00/50 lb	18.46
Broiler litter(80%)–corn(20%)	50	18	48/ton	4.8
Whole cottonseed, 25 ton	80	22	150/ton	9.38
Rye pasture	70	15	100/acre	4-7.00

[a]Prices quoted during spring 1998 from suppliers in central Florida, prices vary in different areas of the state and with different quantities purchased.
[b]Cost of TDN ($/100 lb) is calculated by dividing the cost of 100 lb feed by the TDN fraction (% TDN/100). Example for hay: $60/ton=$3/100 lb (60/20); 100 lb hay contains 50 lb TDN and 100 lb TDN costs $6 (3/.50).

NOTES: