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Strategies for Cost-Effective Supplementation of Beef Cattle[1]

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Forage should provide the majority of the nutrition for the beef herd. Seasonal forage growth and changes in forage quality challenge most cattle managers to provide adequate nutrition at reasonable costs. The following article gives several alternatives to consider in your cow-calf production system.

Stretching the Forage Supply

Many areas of Florida occasionally will experience both seasonal and weather-induced drought. The forage harvested as hay and standing forage available in pastures are decreased, and changes in management may be needed to mitigate the effects of drought on production. Owners should consider multiple strategies to stretch the forage supply, including forage, supplement, and cattle management options.

Forage Management

Selectively fertilize. Forage growth can be increased if there is adequate soil moisture, temperature, and daylight length. Timing of fertilizer application and the amount of fertilizer applied are key factors that dictate the success of fertilization. Warm season perennials such as stargrass and limpograss have more growth potential in the fall and will likely provide more forage production than bahiagrass.

Rotationally graze. Forage production is often increased when forage is rotationally grazed compared to continuously grazed. If forage supply is limited, rotational grazing allows both better rationing of the forage to the cattle and time for forage regrowth.

Make hay. Forage conserved as hay can be managed to reduce waste and defer forage resources for later use. Harvesting hay from fields not fenced or purchasing hay from another producer may be possible. Consider purchasing hay early and storing in a manner that limits weathering losses.

Use hay feeders. Round bale hay feeders can reduce hay wastage especially with low-quality forage or forage fed in wet weather. The savings in waste will often pay for the bale feeder in one season. Hay waste can be as great as 42% when fed on the ground and limited to only 3.5% when fed in tapered-cone feeders. Unrolling hay bales may be an alternative to reduce hay wastage, but waste can be as great as 24%.

Plant annual forages. Rye, wheat, oats, and/or ryegrass can produce good yields of high-quality forage if rainfall and temperature are favorable. Likewise, the use of summer annuals to bridge gaps in perennial forage production should be considered. Summer annuals can have good yields of high-quality forage, and several are drought tolerant. Selecting fields with better soils and moisture is suggested for good results. Rotational or limited grazing is suggested to increase the stocking density and improve forage use.

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Cattle Management

Wean calves early. Weaning and selling calves early will reduce the forage needed to feed the mature cow herd. Early weaning will also reduce the nutritional requirements of the cow, which allows adequate performance with lower quality forage and less total nutritional resource inputs.

Sell cows. Cull cows that are open. Only cows that are productive contributors to the cow herd should be retained. Also consider culling thin cows with no teeth and cows with bad eyes, bad udders, bad feet, or a poor calf.

Feed supplements. Harvested forage and concentrate supplements can be used to stretch the pasture. This may be needed for adequate cattle performance when grazing lower quality residual forage. Supplements should be started before all residual forage is gone, and supplements need to be fed where all cattle can eat the supplement at one time.

Strategies to Optimize Cattle Performance

Forage quality and quantity may not always meet the nutritional requirements of the cattle. Cattle owners can evaluate the nutritional status using the body condition score (BCS). BCS has been shown to be closely related to pregnancy rate. A BCS of 5 or above is needed for acceptable reproductive rates. Monitoring the BCS of cows and heifers is a good management tool to evaluate the adequacy of your nutritional program. BCS needs to be considered when evaluating forage management, cattle management, and supplementation alternatives.

Forage Management

Select species. In South Florida, limpograss and stargrass have good growth in the fall. The quality of stargrass declines rapidly with maturity but limpograss maintains quality with advancing maturity. Stargrass should be grazed or cut at 4–6 weeks regrowth, and limpograss should be accumulated for grazing later in the fall. Improved varieties of bermudagrass should be utilized for conservation of forage for later use. Likewise, winter/summer annuals offer viable opportunities to incorporate additional forage resources for the cow herd.

Manage grazing. Cattle selectively graze the higher quality forage first. Heifers and/or thin cows that need higher quality forage should be grazed on pastures first, and then cows in good flesh can graze the lower quality forage.

Test forage. Each cutting and field of forage harvested as hay should be sampled and sent to a forage testing laboratory to determine nutrient content. Contact your county Extension agent for details on the Florida Forage Testing Program. Feed the higher quality forage to growing heifers, thin cows, and lactating cows. Feed lower quality hay to cows in good body condition score before calving.

Ammoniate low-quality hay. Anhydrous ammonia treatment of low-quality hay will improve hay quality and intake, reduce hay wastage, and improve cattle performance. Ammoniated hay will give cattle performance similar to average quality hay and reduce the need for supplements. Low-quality hay, especially hay that has been weathered or stored outside since last year, usually shows significant improvements in feeding value from ammoniation.

Cattle Management

Calculate cattle requirements. The generalized target weights and gains to grow heifers to calve at two years of age and to maintain cows are outlined in Table 1. The total digestible nutrients and crude protein requirements increase at higher weights and gains (Table 2). The quantities of hay and supplements required can be estimated from the nutrient requirements and forage quality. Complete nutrient requirements for cows and calves can be found in AN190 and AN254, respectively.

Calve at BCS 5 or above. Cows calving in good body condition will rebreed sooner and have higher pregnancy rates than thin cows. Cows should be managed from weaning to calving so they will calve at BCS 5 or above. Cows in BCS 4 or lower should be managed from weaning to calving to gain weight and be in BCS 5 at calving. If cows can put on extra body flesh above BCS 5 using better forage management or low-cost strategic supplementation, it will allow additional flesh loss after calving with minimal effects on reproductive performance.

Group cattle by requirements. During the fall and winter, cattle with higher nutritional requirements need to be managed in separate groups and fed to meet the target weights and BCS. Weaned heifers should be managed separately from older heifers and cows. If some cows are below BCS 5, then these cows should be separated and grazed on the best pasture and fed supplements as needed. Cows in BCS 5 or higher can be grazed on residual forage and supplemented to maintain BCS.

Table 1. Target Weights and Body Condition Scores (BCS) for Heifers and Cows.[a]

Date	Days	Weight			Comments
		Begin	Ending	Daily Gain	
Heifer-calve at 24 months of age		lb	lb	lb	
9/15 - 3/15	180	450	650	1.1	Wean to breeding
3/15 - 5/15	60	650	710	1.0	Breeding season
5/15 - 12/15	210	710	875	0.8	Grow and calve at BCS 6
12/15 - 4/1	105	875	825	-0.5	Calving-no flesh loss
4/1 - 6/1	60	825	850	0.5	Rebreeding in 60 days
Cow-weaning to calving	100–160	1000	1120	0.9	Higher gain if BCS below 5
Cow-calving to breeding	60–90	1000	960	-0.5	Calve at BCS 5 to 6 and lose 0.5 to 1 BCS through breeding

[a]Target weights are for cows weighing 1000 lb at BCS 5 when mature. Adjust target weights for smaller or larger beef cows. Dates are designed for calves born in the winter.

Table 2. Daily Total Digestible Nutrients (TDN) and Crude Protein (CP) Requirements of Heifers and Cows.[a]

Stage of Production	Daily Gain	Dry Matter Intake	TDN		Crude Protein	
			lb	%	lb	%
Heifers	lb	lb				
500 lb	0	9.8	4.9	50.0	0.75	7.6
500 lb	0.5	11.0	6.2	56.0	0.94	8.5
500 lb	1.0	11.8	7.3	62.0	1.11	9.4
500 lb	1.5	12.1	8.3	68.5	1.25	10.3
700 lb	0	12.6	6.3	50.0	0.89	7.1
700 lb	0.5	14.1	7.9	56.0	1.11	7.9
700 lb	1.0	15.1	9.1	62.0	1.27	8.4
700 lb	1.5	15.5	10.6	68.5	1.40	9.0
Cow-late gestation	0	18.1	8.8	48.8	1.3	7.0
	0.9	19.6	10.5	53.6	1.6	7.9
Cow-lactation						
10 lb milk, peak lactation	0	20.8	11.5	56.6	2.0	9.6
20 lb milk, peak lactation	0	20.2	13.8	67.0	2.5	12.3

[a]Nutrient Requirements of Beef Cattle, National Research Council, 1984.

Supplementation Strategies

Energy - 1st Economic Priority

Supplement only cows and heifers that will respond. It is essential to supplement only the cattle that will give an economical response. Cows that lost calves, cows in BCS 5 or above, and those calving late need to be segregated from the herd being offered any energy supplement.

Calculate feeding level. The level to feed depends on the forage quality, BCS, level of production, weather, and other factors. A guideline to supplementing heifers with different forage qualities for different gains is presented in Table 3.

Estimate the level of supplement needed, monitor the cattle weight and BCS 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 period time. Do not wait until the cattle are thin to start feeding supplements.

Select a cost-effective energy supplement. Selecting an energy supplement that will provide TDN balanced with protein at a low cost is essential. The source of energy with the lowest cost depends on the quantities purchased, handling and storage system, processing and mixing required, feeding system, and labor available. Comparing

costs of TDN from several sources shows citrus pulp, rye pasture, sorghum silage, and hay to be lower cost sources of supplemental TDN (Table 4).

Lower starch supplements may give a better response. Supplements with high grain content have high TDN levels, and the grain contains high levels of starch. Starches and sugars are fermented rapidly in the rumen, resulting in a lower rumen pH, and this can lower the forage intake and digestibility. Recent research using by-product feeds that have lower levels of starch but relatively high levels of TDN has shown these feeds have fewer negative effects on forage intake and digestibility, resulting in better cattle performance. Feeds such as soybean hulls, wheat middlings, and citrus pulp fed at 5 lb/head/day or higher usually give better responses per unit of supplemental TDN. In situations when forage is being supplemented, choosing a highly digestible supplement such as soybean

Table 3. Daily Levels of 75% TDN Supplement Required For Various Gains of 600 lb Heifers Fed Different Quality Forages.[a]

Gain	Forage QI=1.0[b]		Forage QI=1.2[c]		Forage QI=1.4[d]	
	Level[e]	Protein[f]	Level[e]	Protein[f]	Level[e]	Protein[f]
lb	lb	%	lb	%	lb	%
1.0	6	15	4	13	2	8
1.5	10	13	8	12	6	12

[a]Quality Index (QI) = TDN intake as a multiple of maintenance (1.0 = maintenance).
[b]QI = 1.0, TDN = 47%, Crude protein = 6%.
[c]QI = 1.2, TDN = 54%, Crude protein = 9%.
[d]QI = 1.4, TDN = 58%, Crude protein = 12%.
[e]Supplement (lb/day) needed along with forage available ad libitum.
[f]Crude protein (%) needed in a 75% TDN supplement to meet requirements of a 600 lb heifer.

Table 4. Nutrient Composition and Costs of Energy Supplements.[a]

Feed	Total Digestible Nutrients	Crude Protein	Cost	Cost of TDN on Dry Matter Basis[b]
	% as fed	% as fed	$/unit	$/100 lb
Bahiagrass hay, round bales	51	8	35/800 lb	9.22
Sorghum silage (30% DM)	18(60)	2(7)	25/ton	6.94
Shelled corn				
bulk, 25 ton	88	9	308/ton	19.89
bagged, 50 lb	88	9	9.00/50 lb	23.24
Hominy	91	12	295/ton	18.01
Citrus pulp	82	9	245/ton	16.42
Wheat midds	73	18	250/ton	16.92
Corn gluten feed	80	24	260/ton	17.86
Soybean hulls, 25 ton	70	12	250/ton	19.62
Blackstrap molasses, 25 ton	72	5	143/ton	12.57
Liquid supplement, 16% CP				
bulk, 25 ton	53	16	200/ton	24.37
delivered to lick tank	53	16	225/ton	27.41
Steer grower-12%	70	12	8.00/50 lb	28.57
Whole cottonseed, bulk-25 ton	95	24	390/ton	22.31
Rye pasture	70	15	150/acre	5.85–10.20

[a]Prices quoted during Fall 2011 from suppliers in central Florida; prices vary in different areas of the state and with different quantities purchased.
[b]Cost of feed ($/100 lb) is calculated by dividing the cost per ton by 20, then dividing by the dry matter %.The cost TDN ($/100 lb TDN, dry matter) is calculated by dividing the $/100 lb of dry matter by the TDN content (% TDN/100). Example for soybean hulls: $250/ton = $13.74/100 lb (($250/20)/0.91); 100 lb of soybean hulls contains 70 lb TDN, and 100 lb TDN costs $19.62 ($13.74/0.70).

hulls, wheat middlings, or citrus pulp compared to a high starch supplement such as corn appears to give 15%–30% better performance per unit of supplemental TDN. When comparing the cost of TDN in these situations, this suggests you can pay 15% –30% more per unit of TDN and still get the same performance.

Protein - 2nd Economic Priority

Feed 0.15 to 0.30 lb crude protein when forage has a TDN:CP ratio greater than 7. Protein supplements have been shown to increase forage intake and digestibility when forages have a TDN to crude protein (CP) ratio greater than 7. Results of several studies have shown a 15%–45% increase in forage consumption when forages deficient in protein relative to TDN are supplemented with protein. A few studies have also shown a 2–5 percentage unit increase in forage digestibility. The amount of protein needed to stimulate intake with bahiagrass is usually less than 0.30 lb daily. Additional levels of protein usually have no effect on forage intake and may be detrimental if the levels consumed are too high. Supplemental protein fed at 0.2–0.3 lb daily typically costs 5–10 cents, and the cow is expected to have an increase of 2 or more pounds of TDN. This is usually more cost-effective than purchasing energy supplements.

Use natural protein for young cattle. Non-protein nitrogen (NPN) such as urea has been shown to effectively increase forage intake in many situations where forage was low in protein. NPN supplements usually improve performance, but natural protein supplements such as cottonseed meal usually give better results than NPN. In growing calves grazing low quality forages, natural protein supplements usually give better results than supplements high in NPN.

Table 5. Nutrient Composition and Costs of Protein Supplements.[a]

Feed	Crude Protein	Total Digestible Nutrients	Cost	Cost of Protein on Dry Matter Basis[b]
	% as fed	% as fed	$/unit	$/100 lb
Soybean meal				
bulk, 25 ton	48	88	475/ton	54.37
bagged, 50 lb	48	78	15.00/50 lb	66.55
Cottonseed meal				
bulk, 25 ton	49	75	230/ton	25.51
bagged, 50 lb	41	72	12.00/50 lb	53.24
Wheat middlings, 25 ton bulk	18	83	250/ton	76.33
Corn gluten feed, 25 ton bulk	24	80	260/ton	59.52
Range cubes	20	65	6.75/50 lb	76.70
Protein block, 33 lb	24	60	10.00/33 lb	131.58
Molasses blocks				
200 lb	24	60	41.00/200 lb	97.06
500 lb	24	60	91.25/500lb	86.41
Liquid supplement, 16% CP				
bulk, 25 ton	16	57	200/ton	86.81
delivered to lick tank	16	57	225/ton	97.66
Liquid supplement, 32% CP				
bulk, 25 ton	32	43	215/ton	46.66
delivered to lick tank	32	43	240/ton	52.08
Whole cottonseed, 25 ton	24	95	390/ton	88.32

[a]Prices quoted during Fall 2011 from suppliers in central Florida; prices vary in different areas of the state and with different quantities purchased.
[b]Cost of feed ($/100 lb) is calculated by dividing the cost per ton by 20, then dividing by the dry matter %. The cost protein ($/100 lb protein, dry matter) is calculated by dividing the $/100 lb of dry matter by the protein fraction (% protein/100). Example for soybean meal: $475/ton = $26.09/100 lb (($475/20)/0.91); 100 lb of soybean meal contains 48 lb protein, and 100 lb protein costs $54.37 ($26.09/0.48).

Select a cost-effective supplement. Selecting a high protein supplement that provides protein at a reasonable cost is desirable. The cost of protein will depend on the supplement, quantities purchased, handling and storage system, processing and mixing required, feeding system, and labor available. The first decision is to narrow the list of supplements to those that can be used in your system and then compare prices based on the cost of the nutrients from each source. Comparing the costs of protein from several supplements shows that liquid supplement and several commodities when purchased in bulk quantities are some of the lowest cost sources of protein (Table 5). Limitations of each feed must be considered. As an example, the meals need to be fed in feedbunks to minimize wastage, which increases the cost of using these supplements.

Monitor the forage and cattle. Protein supplements will stimulate forage consumption when forage protein content is low. Visually monitor the forage quality and fill (digestive fullness) in the cattle. If the cattle are not full, start feeding supplements. Protein supplements have been proven to be effective when fed three times per week.

Minerals - Last Economic Priority

Mineral deficiencies lower BCS. Acute mineral deficiencies can result in characteristic symptoms such as the lack of pigmentation in hair associated with copper deficiency. However, many deficiencies are borderline and do not result in specific symptoms. The most likely results of a chronic mineral deficiency are "poor-doing" cows that have a lower BCS, which can be caused by many different factors.

Feed a complete mineral supplement. 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 an average consumption of 2 ounces/head/day of a mineral containing 25% salt, 14%–18% calcium, 8% phosphorus, 0.4% zinc, 0.2% iron, 0.2% manganese, 0.15% copper, 0.016% iodine, 0.01% cobalt, and 0.002% selenium has been sufficient in many situations.

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