



Supplementing Beef Cows

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On average, nearly 40% of total operating costs in cow-calf enterprises are associated with nutrition because purchased and harvested hay and concentrate feeds make up the majority of that cost. Consequently, the nutritional program represents a major target to trim cost of production. However, it is widely recognized that nutritional status of the cow is closely related to reproductive performance. If too many corners are cut in the nutritional program, pregnancy and calving rate can suffer dramatically.

A ranching operation can appropriately be thought of as a forage production and utilization enterprise. Ranchers are in the business of converting sunlight, water, and carbon dioxide into a high quality human food resource – namely beef. In fact, with good management, forage is an extremely valuable renewable resource. As such, it represents the least expensive feed resource to maintain animal health and production in cow-calf and many stocker operations. Excellent forage production and grazing management generally results in minimum reliance on purchased and harvested feeds. Nevertheless, there will still be times when specific nutrients must be supplemented. Occasionally, cow-calf producers need to feed a concentrate or harvested forage to further increase body condition of the cows or to replace pasture forage due to limited pasture forage availability. This practice, known as feeding or substitution, is in contrast to supplementation because the alternative feed or forage actually replaces consumption of the original forage resource. As a general rule of thumb, consumption of the original forage resource declines when cattle are fed concentrate feeds at the rate of 0.5% of body weight (6 lb for 1,200 lb cows) or more. Substitute feeding is more frequently used for growing cattle than it is for mature beef cows. In the following discussion, a supplementation objective is assumed.

Identifying a Supplemental Need

The first step in implementing and maintaining an efficient supplementation program for grazing or forage fed cattle is to identify specific supplementation needs. Said in another way, the producer must identify specific forage nutrients that are not provided in adequate quantity to meet the animal's nutrient requirements. The following steps provide a logical approach in identifying a supplemental need and evaluating supplement alternatives.

1. Determine the nutrient requirements for the appropriate stage of production.
2. Estimate the amount of nutrients cows will receive from forage.
3. Subtract item #1 from item #2 to determine if a nutrient deficiency or excess exists.
4. Evaluate supplement alternatives.

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Nutrient requirements for cattle of various stages of production, mature size, age, and productivity are discussed and presented in tabular form in Fact Sheet ANSI-3009. It should be noted that all possible combinations of the above factors are not available in the tables, simply because there are literally infinite possibilities. Computer software, such as OSU Cowculator and OSUNRC2002, can better pinpoint an animal's nutrient requirement at a specific time and in a specific situation. These tools can be found at <http://www.ansi.okstate.edu/software/> along with other useful tools.

Average nutrient composition of various feeds and forages common to Oklahoma are presented in Table 1 (page 4 and 5). Anticipating nutrients supplied by the forage base is the most difficult task in grazing cattle nutrition. The formula for nutrient intake is simple: forage intake multiplied by concentration of available nutrients in the forage.

However, many factors influence both components in this formula. Forage intake is dramatically influenced by forage quality as well as forage availability, and both of these factors can vary dramatically from year to year and month to month. Estimates of forage intake are given in Table 2 for beef cows. The next step is to estimate nutrient content of standing forage or hay. These values are variable, depending on forage type, maturity, and weathering. The most accurate method to determine supplemental needs for cows that will receive primarily a hay diet is to have the hay analyzed for nutrient concentration. This will cost from \$15 to \$40 per sample, but can save hundreds, even thousands of dollars in some cases. As a starting point, Table 1 includes "average" nutrient values for a few common feeds and forages found in the Southern Plains.

Once nutrient requirements have been established and a reasonable estimate of the nutrient contribution of the forage has been made, determining supplemental needs is simply a comparison of the two. Again, this comparison is easily and perhaps more accurately made using computer software, such as OSU Cowculator.

For example, let's assume that cows are grazing winter range (receiving little or no hay supplementation), average cow weight is 1,100 lb and average calving date is March 15. Consequently, these cows would be grazing low quality winter range throughout the last one third of gestation. From the tables in ANSI-3009, it is apparent that this 1,100 lb cow requires about 1.8 lb of protein and 12 lb of TDN per day. Table 1 indicates that late winter native range would be expected to contain only around 4% protein and be around 49% digestible. Forage capacity of beef cows is shown in Table 2 for different stages of production and forage quality. These cows would be expected to consume around

Table 2. Forage capacity of beef cows^a.

Forage Type and Maturity	Stage of Production	Forage Dry Matter Intake Capacity, % of Body Weight
Low quality forage (< 52% total digestible nutrients)	Dry	1.8
Dry winter forage, mature legume and grass hay, straw	Lactating	2.2
Average quality forage (52 – 59% total digestible nutrients)		
Dry summer pasture, dry pasture during fall, late-bloom legume hay, boot stage and early-bloom grass hay	Dry	2.2
	Lactating	2.5
High quality forage (> 59% total digestible nutrients)		
Mid-bloom, early-bloom, and pre-bloom legume hay, pre-boot stage grass hay	Dry	2.5
	Lactating	2.7
Lush, growing pasture	Dry	2.5
	Lactating	2.7
Silages	Dry	2.5
	Lactating	2.7

^a Intake estimates assume that protein requirements are met by the forage or through supplementation when forage protein is not adequate. When protein requirements are not met, forage intake will be lower than the values shown in the table. Source: Hibbard and Thrift, 1992.

1.8% of their body weight, or 19.8 lb of diet dry matter (1,100 x 1.8%), assuming adequate supplemental protein is provided.

By using this information, supplemental needs can be calculated as shown in Table 3. Without supplementation, this group of cows would be deficient in both protein and energy and would be expected to lose considerable body condition before calving. Here, beef cows are used in the example. However, the process to determine supplemental needs for growing cattle is the same.

Once the supplemental need is determined, various supplement alternatives are relatively easy to compare. In this example, all three supplement alternatives provide adequate protein when fed at the daily amount shown. Energy or TDN is provided in considerable excess (compared to the supplemental need) with the 20% supplement option. Therefore, this strategy might be desirable if increased weight gain or body condition were desired. However, if the cows were in good body condition, this strategy would simply be more expensive than one of the other strategies given in the example because of the increased feeding rate. Feeding 2.5 lb of 38% supplement provides adequate protein and the supply of energy is expected to be within about ½ a pound (of TDN) per day of the animals' requirement. In other words, if this supplementation program is chosen, the cows may

slightly loose weight during late gestation. The producer must consider the cows' current body condition and stress associated with inclement weather in choosing the most appropriate plan. Obviously, this program would not be adequate for thin cows or during years when severe winter weather persists.

Supplemental Programs for Common Situations in Oklahoma

Producers can make these calculations using this approach or a computer software program, then evaluate the costs, necessary feeding rate, convenience, and expected animal performance outcome for each possible alternative.

In cases where one supplemental nutrient is needed, a very effective method to evaluate cost of nutrient sources is on a cost per unit of nutrient basis. In the example, the primary nutrient needed is protein. Assuming the 20% supplement cost \$175 per ton, the cost per pound of protein is \$.44 (\$175 per ton divided by 400 lb of protein per ton). If the 38% supplement cost, \$230 per ton, the cost per pound of protein is \$.30 (\$230 per ton divided by 760 lb of protein per ton).

In the above example, the cows can maintain or slightly loose some body condition (assuming that it is adequate) with

Table 3. Nutrient supply compared to requirements for 1,100 lb beef cow grazing native range during last 1/3 of pregnancy.

	Crude Protein, lb per day	TDN, lb per day	Supplemental Cost/day
Required	1.80	12.0	
Supplied by forage	0.88	10.8	
Supplemental need	0.92	1.20	
Nutrients supplied by supplement alternatives ^a			
5 lb of 20% CP supplement	1.0	3.75	0.44 @ 175/T
4 lb of 25% CP supplement	1.0	3.0	0.39 @ 195/T
2.5 lb of 38% CP supplement	0.95	1.9	0.29 @ 230/T

^aAll supplements are assumed to contain 75% TDN. Source: NRC, 2000.

a supplementation program that costs about \$.29 per head per day. Had the producer chosen the 20% supplement program, not recognizing that the higher feeding rate and, therefore, higher energy intake was not necessary, he would spend about \$.44 per head per day or approximately \$13.50 more per cow in a 90-day period.

When hay or pasture nutrient concentration can actually be measured (samples collected and analyzed) and monitored, the methodical approach presented previously will be the most cost effective way to determine the type and amount of supplement to feed. However, many low-cost producers do not feed hay and prefer to use their cows to harvest standing forage. If forage type and conditions are relatively constant from year to year, producers can develop a consistent supplementation program and fine-tune it when necessary. For example, when cattle graze native tall grass prairie pastures, forage quality consistently declines through the summer, fall and winter months. Protein supplementation needs are quite predictable and may vary more due to changing genetics or time of calving than due to forage conditions. The following table shows supplementation schedules for this type of forage under different calving seasons and winter weather conditions. Notice that the feeding rate of the high-protein supplement gradually increases in order to offset the declining forage protein.

More energy is necessary when wet, cold weather conditions persist for long periods of time. Therefore, feeding higher daily amounts of a moderate-protein supplement is advised when these conditions exist or anytime when cows are observed to be losing weight and condition too rapidly.

Remember that the goal for a spring calving herd is to strive for a body condition score of 5 in mature cows by the time they calve in order to achieve optimum rebreeding during the spring and early summer months. Fall calving cows usually calve in very good body condition (BCS of 6-8) and the producer can allow these cows to gradually lose some condition through the winter. The main objective for a fall calving cow is to not allow her to lose too much condition before the end of the breeding season. Once she is pregnant, additional weight and condition loss, and lower rates of supplementation, will not hinder the established pregnancy.

When gestating cows consume hay or pasture that remains above eight percent protein, low to moderate protein (energy) supplements, such as corn grain, soybean hulls, wheat middlings, or milo can be used at about the same feeding rates as shown in Table 4. However, after calving, a moderate protein supplement may be necessary in order to offset the protein requirement for lactation. The amount of protein, or concentration of protein in the supplement will depend on the protein concentration in the forage base.

Additional Considerations for Supplementing Low Quality Forage

Supplementation Priorities

If supplementation is the goal for cattle grazing low quality forage, priority should first be placed on meeting the protein requirement in order to maximize forage intake and digestion. Many years of research have consistently shown that protein supplementation for cattle grazing protein-deficient forage is extremely effective (Table 5). In fact, energy supplementation will not be effective if dietary protein is deficient.

Once the producer ensures that the supplementation (or feeding) program will meet the protein requirement, energy intake should be evaluated, similar to the example given in Table 3. The decision must be made whether the cattle need to maintain body weight and condition, gain weight and condition, or whether they can be allowed to lose some weight and condition. This decision will dictate how much supplemental energy should be provided. See ANSI-3283, "Body Condition Scoring of Beef Cows" for information on body condition scoring cows and how body condition scores influence reproductive performance.

Lastly, vitamin and mineral requirements should be compared to expected intake, potential deficiencies identified, and supplemental alternatives evaluated. This is not to say that vitamins and minerals are not important. Priority is given to protein and energy nutrition first because these items are needed in much greater quantities and they have the potential to have much greater impact on animal performance and efficiency of forage utilization. Vitamin and mineral nutrition of grazing cattle is discussed in detail in E-861.

Table 5. Influence of winter protein supplementation on performance of beef cows grazing native range.

Item	2 lb per Day of 40% Protein Supplement	No Supplement
Cow weight change during late gestation, lb	23	-153
Units of BCS* change during late gestation	-.33	-1.61
Calf birth weight	88.5	77.5
Calf weaning weight	484	448

Source: Steele.

* Body Condition Score

Table 4. Common supplementation strategies for cows grazing native warm-season pasture during winter.

Month	Spring Calving Cows		Fall Calving Cows	
	Good Cow Condition and (or) Moderate Weather	Marginal Cow Condition and (or) Severe Weather	Good to Moderate Cow Condition and (or) Moderate Weather	Thin Cow Condition and (or) Severe Weather
	October	None	None	1 lb HP
November	1 lb HP ^b	1 lb HP	2 lb HP	2 lb HP
December	2 lb HP	2 lb HP	3 lb HP	3 lb HP
January	3 lb HP	3 lb HP	3 lb HP	6 lb MP
February	3 lb HP	5 lb MP ^c	3 lb HP	7 lb MP
March	3 lb HP	6 lb MP	3 lb HP	7 lb MP
April	2 lb HP	5 lb MP	2 lb HP	6 lb MP

^a Forage protein declines to a low of around 3-4% during mid-winter.

^b HP = high protein supplement, such as 38% protein range cubes or cotton seed meal.

^c MP = moderate protein supplement, such as 20% protein range cubes, or corn gluten feed.

Table 1. Typical composition of feeds and forages.

Feed No.	Type of Feed	Dry Matter Basis															
		Dry Matter %	NDF %	eNDF % of NDF	CP %	DIP ^b % of CP	TDN %	NEM Mcal/cwt	NEG Mcal/cwt	EE %	Ca %	P %	K %	S %	Cu ppm	Mn ppm	Zn ppm
Roughage																	
1	Alfalfa Hay, early bloom	90	39	92	25	88	60	59	33	2.9	1.41	0.22	2.51	0.30	13	36	30
2	Alfalfa Hay, mid bloom	90	47	92	22	84	58	56	31	2.6	1.37	0.22	1.56	0.28	11	28	31
3	Alfalfa Hay, full bloom	90	49	92	17	82	55	52	26	2.3	1.19	0.24	1.56	0.27	10	28	26
4	Alfalfa Cubes	91	46	40	18	70	57	55	29	2.0	1.30	0.23	1.90	0.35	9	32	18
5	Alfalfa, Dehydrated 17% CP	92	45	6	19	41	61	61	35	3.0	1.42	0.25	2.50	0.24	9	34	21
6	Bermuda Hay, vegetative	90	69	80	15	80	57	55	29	2.3	0.59	0.28	1.90	0.30	12	170	36
7	Bermuda Hay, early bloom	90	75	90	10	72	53	49	24	1.9	0.51	0.20	1.60	0.25	10	140	31
8	Bermuda Hay, full bloom	90	79	98	8	68	47	39	15	1.8	0.43	0.18	1.40	0.21	8	110	26
9	Corn silage	35	46	70	8	72	72	77	49	3.1	0.28	0.23	1.10	0.12	4	24	22
10	Cotton Seed Hulls	90	87	100	4	55	45	45	3	1.9	0.15	0.09	1.10	0.05	13	119	10
11	Fescue Hay, early bloom	87	68	98	13	72	57	55	29	4.8	0.45	0.37	2.50	0.21	11	200	34
12	Fescue Hay, full bloom	88	73	98	9	68	50	52	16	3.5	0.40	0.26	1.70	0.17	7	100	23
13	Peanut Hulls	91	74	98	8	40	22	36	0	1.5	0.20	0.07	0.90				
14	Prairie Hay	91	73	98	6	63	52	50	12	2.0	0.40	0.15	1.10	0.06	4	59	34
15	Rice Hulls	92	81	90	3	45	13	35	0	0.9	0.14	0.07	0.50	0.08	3	320	24
16	Sorghum Silage	32	59	70	9	71	59	58	32	2.7	0.49	0.22	1.72	0.12	9	69	30
17	Sudan Grass Silage	31	64	61	10	72	58	56	31	3.0	0.58	0.27	2.40	0.14	37	99	29
18	Sunflower Seed Hulls	90	73	90	4	35	40	42	0	2.2	0.00	0.11	0.20	0.19			200
19	Wheat Silage	33	62	61	13	79	59	58	32	3.2	0.40	0.28	2.10	0.21	9	80	27
20	Wheat Straw	91	81	98	3	40	42	43	0	1.8	0.16	0.05	1.30	0.17	5	35	6
21	Wheat Straw, ammoniated	85	76	98	9	75	50	50	12	1.5	0.15	0.05	1.30	0.16	5	35	6
Grazed Forage																	
27	Bermuda, vegetative	30	68	80	16	85	65	67	40	3.0	0.46	0.31	1.90	0.33	13	185	32
28	Bermuda, boot stage	35	72	100	13	75	60	59	33	2.7	0.59	0.28	1.90	0.30	12	160	36
29	Bermuda, fall, mature	80	77	100	8	60	48	41	16	2.1	0.26	0.18	1.30	0.21	9	140	20
30	Bermuda, winter, mature	90	80	100	5	55	44	34	10	1.5	0.30	0.15	1.00	0.15	7	45	15
31	Bermuda, stockpiled, Sept.-Oct.	35	70	100	13	70	57	55	29	2.5	0.66	0.24	0.88	0.26	6	151	27
32	Bermuda, stockpiled, Nov.-Dec.	85	74	100	11	65	54	50	25	2.1	0.52	0.22	0.55	0.27	5	117	26
33	Bermuda, stockpiled, Jan.-Feb.	90	77	100	7	60	47	39	15	1.5	0.48	0.18	0.32	0.25	4	116	26
34	Fescue, vegetative	29	60	40	18	80	64	65	39	4.5	0.50	0.40	2.50	0.24	13	175	36
35	Fescue, boot stage	33	65	100	12	75	57	55	29	3.8	0.45	0.30	1.80	0.21	10	150	32
36	Fescue, mature	70	74	100	8	70	49	42	18	3.2	0.38	0.20	1.40	0.18	7	120	26
37	Fescue, stockpiled, Nov.-Dec.	40	72	100	13	75	52	47	22	2.7	0.45	0.30	1.80	0.21	12	150	32
38	Fescue, stockpiled, Jan.-Feb.	60	75	100	11	68	40	27	3	2.2	0.38	0.20	1.40	0.18	7	120	26
39	Native Range, April-June	30	68	100	14	75	70	74	47	3.2	0.30	0.20	1.60	0.15	11		
40	Native Range, July-August	35	71	100	10	70	64	65	39	3.0	0.33	0.15	1.50				

41	Native Range, Sept.-Oct.	46	75	100	7	65	59	58	32	2.5	0.28	0.12	1.10						
42	Native Range, Nov.-Dec.	75	78	100	5	65	55	52	26	2.2	0.25	0.09	0.80						
43	Native Range, Jan.-March	85	80	100	4	55	49	42	18	1.7	0.23	0.07	0.60						
44	Wheat Forage, vegetative	21	50	41	22	84	71	76	48	4.0	0.35	0.36	3.10	0.22	10	85	35		
By-product Feeds																			
47	Barley Malt Pellets with Hulls	90	50	34	18	64	68	71	44	1.4	0.19	0.68	0.27	0.85	6	32	61		
48	Corn Gluten Feed	90	40	36	24	75	80	88	59	3.2	0.07	0.15	0.27	0.43	7	22	73		
49	Distillers Grains with Solubles, corn	90	46	4	30	27	92	104	73	10.6	0.32	0.83	1.10	0.40	11	28	80		
50	Distillers Grains with Solubles, sorghum	92	46	4	31	47	88	99	68	10.0	0.25	0.65	0.50	0.40			68		
51	Grain Screenings	90			14	65	65	67	40	5.5	0.25	0.34					30		
52	Rice Bran, full fat	91	23	0	14	70	72	77	49	19.0	0.07	1.70	1.80	0.19	12	396	40		
53	Rice Mill By-product	91	60	0	7	60	42	43	0	5.7	0.40	0.31	2.20	0.30			31		
54	Soybean Hulls	90	64	28	12	72	77	84	55	2.6	0.53	0.18	1.40	0.12	18	10	38		
55	Wheat Bran	89	46	4	17	72	70	74	47	4.5	0.13	1.29	1.40	0.24	14		96		
56	Wheat Middlings	89	36	2	19	78	79	87	58	4.6	0.15	1.00	1.40	0.24	11	128	96		
57	Wheat Mill Run	90	37	0	17	72	75	81	53	4.4	0.12	1.00	1.20	0.22	21		90		
58	Wheat Shorts	89	30	0	20	75	80	88	59	5.4	0.10	0.95	1.10	0.20	13		118		
Feed Grains																			
64	Corn Grain, whole	88	9	60	10	42	88	99	68	4.3	0.02	0.30	0.40	0.12	3	8	18		
65	Corn Grain, steam flaked	85	9	40	10	41	93	106	74	4.1	0.02	0.27	0.40	0.12	3	8	18		
66	Wheat, cracked, rolled, or ground	89	12	0	14	77	89	100	69	2.3	0.05	0.44	0.40	0.14	6	37	40		
67	Milo, cracked, rolled, or ground	89	16	5	11	45	82	91	61	3.1	0.04	0.32	0.40	0.14	5	15	18		
68	Milo, steam flaked	82	20	38	11	38	90	102	70	3.1	0.04	0.28	0.40	0.14	5	15	18		
High Protein Meals and Seeds																			
69	Cottonseed, whole	91	47	100	23	62	95	108	76	17.8	0.16	0.62	1.22	0.26	8	12	38		
70	Cottonseed Meal, 41%	90	25	23	48	58	77	84	55	1.8	0.22	1.25	1.70	0.44	17	57	66		
71	Peanut Meal, solvent	91	27	23	50	73	77	84	55	3.6	0.24	0.58	1.00	0.30	16	29	38		
72	Soybean Meal, 48%	91	9	23	54	64	87	98	67	1.2	0.28	0.71	2.20	0.47	23	41	61		
73	Soybeans, whole	88	15	100	40	72	93	106	74	18.8	0.27	0.64	2.00	0.34	15	35	59		
74	Sunflower Seeds, high oil	91	24	80	19	75	122	142	103	42	.71	.51	1.06	0.21	20	35	53		
75	Sunflower Seed Meal with Hulls	91	40	23	26	80	60	68	42	2.9	0.45	1.02	1.27	0.33	4	20	105		
76	Mung Beans	90			23	25	79	87	58	1.19	0.68								
77	Feather Meal	92	44	23	86	27	69	73	45	6.5	0.60	0.62	0.20	1.85	14	12	95		

^a Effective neutral detergent insoluble fiber.

^b Degradable intake protein.

Protein Sources

Protein from plant origin (such as soybean meal, cottonseed meal, corn gluten feed, wheat middlings, or alfalfa hay) generally results in better utilization of low quality roughages compared to non-protein nitrogen sources such as urea and biuret. This is particularly true when a small amount of supplement is fed (0.5% of body weight or less). Non-protein nitrogen sources are more effective in stimulating diet utilization and animal performance under one or more of the following conditions:

- When greater than 0.5% of body weight concentrate is being fed
- When larger, more mature animals are being supplemented (greater than 600 lb)
- When the protein deficiency in the diet is marginal (1 to 3% more protein needed in diet compared to 4 to 8% needed)
- When a blend of plant protein and non-protein nitrogen sources are used
- When it is provided in a form for animals to access more than one time per day

Generally, when three or more of these conditions exist, studies have shown that non-protein nitrogen sources are from 75 to 95% as effective compared to an all-natural plant protein source.

Alfalfa hay and alfalfa pellets are excellent supplements for moderate to low quality roughage growing programs. Alfalfa has long been known to have very favorable effects on rumen fermentation, and is so common in most regions of Oklahoma that it is often overlooked as an ingredient or stand-alone supplement. Recent studies at Kansas State University show that alfalfa is equal to mixtures of grain and soybean meal containing the same percent of protein when used to supplement roughages.

Interval Feeding

Significant costs in wintering cows and stockers on dry grass are the labor and transportation required to feed supplements. Adequate research has shown that cows do not need to receive protein supplements every day. In one experiment using cottonseed meal as the protein source, cows were fed the same weekly amount of supplement on two-, four-, and six-day intervals (Table 6). Although cow weight loss was slightly less when cows were fed on four-day intervals, there was no difference in cow weight loss between two and six-day intervals. Calf weaning weights were similar among all treatments. In a more recent study, cows were fed the same amount of cottonseed meal-based protein supplement weekly, although the feeding intervals were three times per week or six times per week (Table 7). In this study, there was no difference in cow weight loss, body condition score, or pregnancy rate due to supplement feeding interval. Many ranchers follow the practice of feeding twice the daily allowance on alternate days or feeding three times per week to eliminate Sunday feeding. With interval feeding, timid cows are more likely to receive their share of supplement. Even if cows are not fed daily, they should be observed as often as necessary, especially during the calving season.

It should be noted that these results were obtained using dry supplements formulated with oilseed meals. These supplements had a high concentration of plant-based protein, which has a slower rate of degradation compared to supplements containing significant amounts of non-protein nitrogen. Cows would not be expected to perform as well if dry supplements containing significant amounts of non-protein nitrogen were fed at extended intervals, similar to these experiments.

Table 6. Performance of beef cows fed supplement at different time intervals.

	Interval between feeding, days		
	2	4	6
Supplement, lb/feeding (41% cottonseed meal)	5	10	15
Cow weight change, lb	-185	-148	-170
Calf weaning weight, lb	433	440	428

Source: Pope.

Table 7. Performance of beef cows fed supplement three or six times per week.

	Days supplement fed per week	
	3	6
Cow weight in Nov., lb	1187	1211
Cow weight loss, Nov. to Apr., lb	242	255
Body condition score, Nov.	5.4	5.4
Body condition score, Apr.	4.4	4.3
Pregnancy rate, %	98	94

Source: Wettemann and Lusby.

Energy-type supplements (20% protein or less) that require 1% of body weight or more per feeding (11 lb or more per feeding for 1,100 lb cows) need to be fed daily. If a group of 1,100 lb cows can only be fed 3 times per week, the maximum recommended daily equivalent would be 4.7 lb (11 lb x 3 times per week = 33 lb per week or an average of 4.7 lb per day).

Using High Quality Pastures to Supplement Low Quality Forage

In many parts of Oklahoma, small grains pastures can be used to supplement cow herds in winter. Because these are high quality forages, full time grazing by beef cows results in considerable waste of valuable nutrients. A dry cow grazing continuously on small grain pasture consumes up to 10 times her requirement in protein. More efficient use of these forages is accomplished by limit-grazing, restricting access to green pasture to a few days or hours each week, and providing low quality harvested or standing forage during the remaining time.

Small grain forages such as wheat pasture are high in protein, containing 15 to 30% digestible protein on a dry matter basis. Recent work at the Noble Foundation indicated that mature steers consumed an average of 2.7 lb of wheat forage dry matter in a 45-minute period. Since the wheat forage contained 30% crude protein, the steers consumed 0.8 lb of crude protein during this short period of time. This would be approximately equivalent to 4 lb of a 20% protein supplement. Other research suggested that beef cows consume between 0.5 to 1.0% of their body weight in rye forage dry matter during one "fill-up" grazing bout (Table 8). The fill-up period was approximately four hours in this study. In fact, data from this work suggests that small grains forage dry matter intake is at the lower end of this range during the first few days of limit-grazing. Eventually, small grains forage intake increases substantially during the "fill-up" grazing bout after the cows have adjusted to the limit-grazing program. After about three weeks, these cows were consuming enough forage to supply about 3 lb of crude protein; the equivalent of 7.5 lb of 40% protein supplement or 15 lb of 20% protein supplement.

Labor availability, location of the small grains pasture and the low quality forage resource, and weather conditions frequently limit the use of limit-grazing systems. For these reasons pro-

Table 8. Beef cow rye forage intake during one fill-up period (approximately 4 hours).

Days relative to initiation of limit-grazing	Forage dry matter intake, lb	Crude protein intake, lb
1 st Day	5.0	1.25
2 nd Day	7.2	1.80
23 rd Day	11.9	2.98

Source: Altom and Schmedt.

ducers frequently use an interval limit-grazing approach. Rather than giving cows access to small grains pasture for a few hours each day, cows are provided access to small grains pasture for one “fill-up” grazing bout (3 to 5 hours) for every two to six days grazing the low quality forage or consuming the low quality harvested forage. A 3 to 5 hour grazing bout limits the loss of valuable forage due to trampling, bedding down, and manure deposits.

The limit-grazing schedule shown in Table 9 is provided as a guideline for limit-grazing intervals necessary to provide adequate supplemental protein and energy to beef cows at different stages of production. For example, in January spring calving cows would graze native range or consume hay with low protein content for three days, followed by one day (3 to 5 hours) grazing small grains pasture before being returned to the low quality forage source.

Replacement heifers will require approximately one day shorter intervals between small grains grazing bouts in order to continue growing, maintain or improve body condition, and have a reasonable chance of rebreeding for their second calf.

Remember that the appropriate time spent grazing the small grains pasture is likely to vary considerably depending on the situation. Factors such as low quality forage protein and content and digestibility (energy content), small grains forage standing crop, cow size, stage of production, genetic potential for milk production, body condition score, and age will have a substantial impact on this decision.

Under average weather conditions in Central and Western Oklahoma, enough small grains forage should be accumulated by early December to supply the protein needs of about 1 to 1.5 cows per acre through the middle of February, assuming that a limit-grazing program is used. After the small grains forage be-

Table 9. Approximate interval between small grains grazing bouts necessary to meet supplemental protein and energy needs of beef cows^{a,b}.

Month	Number of days consuming low quality forage per “fill-up” grazing bout	
	Spring calving cows	Fall calving cows ^c
December	4	2
January	3	2
February	3	3
March	2	3
April	2	3
Total days grazing small grains pasture (12/1 – 4/15)	38	42

^a These suggested intervals assume that abundant low quality forage is provided at all times when the cows are not grazing small grains forage.

^b Reduce the suggested interval by 1 day for 1st-calf heifers.

^c Calves should be provided free-choice access to the small grains forage using creep gates.

gins to grow rapidly during late February or early March, protein needs can be met for 1.5 to 3 cows per acre, again, assuming that a limit-grazing program is used.

While not as abundant in protein as small grain forage, tall fescue in winter will meet the protein needs of a dry cow with less than full time grazing. An efficient system for wintering cows on fescue is to accumulate fall growth in the pasture for grazing after December 1. When pastures are adequately fertilized with nitrogen, the accumulated forage contains from 9 to 14% protein. Similarly, fertilized, stockpiled bermudagrass pasture can contain 9 to 14% protein through the month of December.

Limiting Feed Intake with Salt

Occasionally, it is desirable to self-feed supplements to cows in winter. For example, rough and inaccessible pastures limit a producer’s ability to deliver supplements on a timely basis. In these situations, salt can be used to control intake of the supplement. The ratio of salt to supplement can be varied to achieve any desired intake of supplement.

Self-feeding of supplement tends to allow timid, slow eating cows to get their share. Vitamin A, minerals, and other feed additives can be provided through the supplements.

There are disadvantages to feeding salt-concentrate mixes. Salt is not a precise regulator of intake since certain individuals will tolerate more salt than others. Additionally, salt is destructive to metal storage bins, feeders, and farm vehicles.

Daily salt requirement for mature cattle is less than 1 oz/head/day; however, voluntary intake often exceeds minimum needs. Maximum daily voluntary intake of salt will approximate 0.1 lb salt/100 lb body weight for most classes of cattle.

Effects of High Salt Intake

Salt toxicity is seldom seen in cattle because of their high tolerance for salt. The one-time lethal dose for mature cattle is 4 to 5 lb salt. Salt is rapidly absorbed from the intestinal tract into the bloodstream. It is then excreted by the kidneys through urine. However, the animal is able to eliminate excess salt only when adequate clean water is available. Therefore, an abundant, clean water supply is a must when this method is used.

Salt toxicities are most likely to occur: (1) where cattle have been deprived of salt for extended periods of time and suddenly have readily available salt, (2) cattle are forced to eat excessive salt with an inadequate water supply, or (3) when cattle are forced to drink water containing a high concentration of salt.

As a rule of thumb, cattle on salt mixtures drink 50 to 75% more water than normal or approximately five gallons of additional water for each pound of salt. If only salty water is available, cattle will often refuse the supplement or may be forced into a toxicity situation. Salt content of water is usually measured by total dissolved solids (TDS) which includes calcium, magnesium, sodium chlorides, sulfates, and bicarbonates. In general, caution is necessary in using salt-limited supplements when water contains above 5,000 ppm TDS. This analysis can usually be obtained through the analytical laboratories of your state university (check with your local county educator).

Salt used in self-fed supplements should be coarse, plain white salt. Cost alone prohibits the use of trace-mineralized salt; however, this should be avoided since force feeding high levels of trace-mineralized salt could result in toxicity or mineral imbalances due to excessive intake of certain trace elements. If cattle need trace-mineralized salt, the amount consumed daily should not exceed 0.02% of the animal’s body weight.

Controlled experiments in several states have failed to show any harmful effects upon cattle production from proper use of salt-concentrate mixes. High salt intake with adequate water has had no effect on fertility, calf crop percentage, weaning weight,

or appearance of animals.

Adjusting Salt Levels

Several factors influence the concentration of salt required in a mix to achieve a certain feed intake. Where large amounts of salt are naturally present in drinking water or forage, the amount of salt in the mix must be reduced in order to get satisfactory feed intake. On the other hand, it usually is necessary to increase the salt content of the mix over a period of time as cattle become accustomed to the high salt level. Cattle also tend to consume more of a salt-limited supplement when forage is scarce or unpalatable. Extra precautions should be taken under these and other emergency conditions to ensure that water supplies are adequate.

Estimates of salt needed to limit feed intake are shown in Table 10. Actual salt intake occasionally varies from the indicated values. Forage intake, palatability of supplement ingredients, salt content of the water, and animal adaptation influence salt intake.

When cattle are accustomed to eating supplements but unaccustomed to self-feeding, overeating can be prevented by starting with a high salt level (50:50 or even 60:40 salt to meal). Then, the salt level should be reduced to obtain the desired level of intake. If cattle have not eaten concentrates before, a training period of a week or more of daily hand feeding of meal without added salt may be necessary.

If grain is included in a self-fed supplement, it should be cracked or coarsely ground and mixed with salt of similar particle size. This prevents separation of the salt from the grain and aids in preventing "overeating." Adequate grass or hay must be available so that the cattle are not forced to eat a salt-limited supplement to survive.

Example: A producer desires to self-feed cottonseed meal at the rate of 2 lb per head per day to a group of 1,100 lb cows. Table 16.7 indicates that the daily salt consumption of 1,100 lb cattle averages 1.1 lb when salt is used to limit supplement intake. Therefore, the producer's feed blend should include 1.1

Table 10. Estimated salt intake of cattle fed salt limited supplements^a.

Body weight, lb	Salt consumption, lb/day		
	Low	Average	High
300	0.3	0.5	0.6
500	0.5	0.6	0.7
700	0.6	0.7	0.9
900	0.7	0.9	1.1
1,100	0.8	1.1	1.3
1,300	0.9	1.3	1.5

^a Assumes drinking water is low in total dissolved solids (TDS).

parts salt and 2 parts cottonseed meal. Total intake would be approximately 3.1 lb per day and the blend would contain 35% salt. The producer will need to monitor intake and adjust these percentages slightly to achieve the desired feed intake.

Assume that in addition to 2 lb protein supplement, it is desired that the cow also consume 3 lb of grain (corn, milo, etc.) for a total non-salt consumption of 5 lb; in this case, the blend would contain 1.1 parts salt, 2 parts cottonseed meal, and 3 parts corn grain for a total of 6.1 lb intake per day. This blend would contain 18% salt.

Conclusion

Reducing feed costs, while maintaining performance is a must for Oklahoma cow-calf producers. By using a systematic approach to evaluating beef cow nutritional requirements, forage nutrient contribution, and evaluating alternative supplemental sources; an optimal winter nutrition program can be designed. The lowest cost alternative will not always be the best program, due to the relative value of convenience, labor availability, and feeding system. The most effective way to evaluate alternatives is to first determine the cost of the total supplementation program, then compare differences in cost with other factors.

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