FACT SHEET

L-916

SUPPLEMENTAL FEEDING OF BEEF CATTLE

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Feeds supplying low cost protein and low cost energy are of real economic concern in supplemental cattle feeding. Carbohydrate and fat feeds such as grain, molasses and fat are considered the cheapest energy sources. Choose protein supplements on the basis of percent crude protein content and cost. Management should give major consideration to increase forage species, improve grazing methods and permit cattle access to more top-quality forages.

PROTEIN FEEDS

Oil seed protein meals such as cottonseed, guar, peanut, soybean and linseed, if equal in percentage of crude protein, have much the same feeding value in cattle maintenance feeding. Mixtures of different meals have no feeding advantage over the single source since ruminants balance dietary protein through ruminal amino acid synthesis. Crude protein in the oil seeds is approximately 80 percent digestible as compared to about 50 percent for most dry roughages. Protein feed's chief function is to supplement grain and roughage, both comparatively low in protein. They provide balance and improve ration efficiency.

Individual preference determines form of protein supplements. Blocks, cakes, cubes and pellets offer the advantage of feeding directly on the ground, whereas meals, crumbles and liquids require equipment. Therefore, form plays an economic role since labor and equipment costs affect supplement selection.

Consider the supplement's percent crude protein compared to the crude protein content of other feeds being consumed. While this is being considered, include the supplement's energy value and that of the other feeds and their amount. For example, very young grasses, legumes and weeds contain 20 percent or more crude protein on a dry matter basis but are extremely low in total digestible nutrients (energy). These same plants increase in energy and decrease in percent crude protein as they grow toward maturity. Consider supplements high in energy and low in protein when sufficient, young growing forage is available. As a contrast, when forage is fully mature it is extremely low in crude protein and fair in energy value. The supplement could then be high in crude protein and low in energy. The mature bunch grasses in low rainfall areas of the state are considered fair in energy value and low in protein. Mature bermuda grass in the state's high rainfall areas are low in crude protein and energy.

Cows nursing calves require 28 pounds of dry feed daily with 8.3 percent or 2.3 pounds being crude protein (page 3).

Determine supplemental crude protein needs from forage chemical analysis (page 4) or by estimation of the forage's crude protein content. If pasture forage is 5 percent (.05) crude protein, the following procedure may be followed to aid in making a decision.

Given: Cow requirement — 2.3 pounds crude protein daily or 8.3 percent of daily feed.
Cow ration — 28 pounds dry feed.

Wanted: How much supplemental crude protein is needed and what percent crude protein should the supplement contain?

28 x .05 = 1.40 pounds of crude protein in pasture forage

2.3 — 1.40 = .9 pound of crude protein needed in supplement

Since a supplement's true physical form and percent crude protein make no difference to cattle, then it becomes a matter of individual preference and economics. Therefore, if 10 percent crude protein hay were fed it would take 9 pounds (.9 ÷ .10 = 9 pounds). Next multiply by the hay's cost per pound to arrive at the daily cost. If 20 percent range cubes, 41 percent cottonseed cake or other protein supplement are desired, then apply this same procedure.

MIXTURES CONTAINING PROTEIN AND OTHER NUTRIENTS

Most protein supplements contain some other essential nutrients such as carbohydrates, fats and minerals. The feed tag states the percent crude protein, fat and crude fiber content. The percent fat is the best guide to evaluate the feed's energy value. Fat supplies 2.25 times more energy than either protein or carbohydrate. Use fat analysis of protein supplements to evaluate differences in energy values of various supplements. There is no formula for calculating the total digestible nutrients in protein supplements containing several feeds unless the amount of each feed is known. Protein cost is usually higher on a per unit basis than energy cost. Generally, it is considered more economical to feed protein supplements strictly for the protein and not for energy, vitamins or minerals since these may be supplied from other feeds at more reasonable costs.

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CONTROLLING FEED CONSUMPTION

Use salt or gypsum to limit feed consumption, reduce some labor costs and permit each animal a more equitable share. Harmful results from salt feeding seldom occur with ample water and adequate forage. Salt-feed mixtures may range from 10 to 50 percent salt. The salt amount in the mixture regulates consumption level. The 10 percent salt mixes are fed principally to stocker cattle and limit feed intake to about 1 percent of body weight. A mixture of 25 percent salt and 75 percent cottonseed meal limits daily consumption by cattle to about 2 pounds of meal per head daily. Forage quantity and quality will influence consumption level. Consumption will be lessened when there is sufficient high-quality forage available. Mixtures of salt and ground grain and/or oil seed meals, ground grain and/or urea may be fed satisfactorily. Percent of each feed or combination in the mixture depends on feed prices and pasture conditions. With an ample supply of low-protein, fair-energy forage feed only salt and oil seed meals. Where the forage is low in both protein and energy, and in short supply, add grain to the meal and salt mixture. In such cases feed more supplement.

Feed-grade gypsum (calcium sulfate) controls feed consumption similarly to salt. The above suggested mixtures should contain one half the gypsum as called for in the mix's salt portion. A ratio of six parts feed by weight to one part gypsum are suggested for mature cattle. Feed yearling cattle an eight to one ratio.

UREA, GRAIN AND/OR OIL SEED MEALS

Urea is a nitrogenous compound through which bacterial action in the rumen and in presence of sufficient amounts of carbohydrate feed is converted into protein. Use this nitrogenous material to lower protein cost. It contains no energy. Feed either the feed-grade or fertilizer-grade (281 or 282). Mixtures containing urea require thorough mechanical mixing with molasses and ground grain. The grain to urea ratio should be no less than 8 pounds grain to 1 pound urea. Combinations of the grains and/or oil seed meals may be fed. Prepare these mixes with salt or feed-grade gypsum (calcium sulfate) to control intake. Mix with 25 percent salt to limit consumption to about 2 pounds per head daily. Use one half as much gypsum as salt (12.5 percent) to limit to about the same intake. Feed stocker cattle a mixture of 90 percent concentrates and 10 percent salt to control the intake to 1 percent of body weight permitting growth gain on fair pasturage. Control dusty, ground grains with 5 percent molasses. Feed such mixes in weather protected troughs. They also may be pelleted.

Allow cattle an adjustment period when starting on feeds containing urea. If 4 pounds of supplement is to be fed daily, feed 2 pounds daily for the first week and begin the 4-pound ration at the beginning of the second week. Toxic symptoms may occur when feeds containing urea are fed to starved animals or upon rapid consumption. Urea toxicity causes a staggering or wobbly gait in animals. If such is observed, administer orally ½ to 1 gallon of a 5 percent acetic acid solution or household vinegar.

COTTONSEED MAY BE FED AS A SOURCE OF PROTEIN AND ENERGY

Cottonseed is a 20 percent crude protein feed. Four pounds of cottonseed furnishes as much protein and more than twice as much energy as 2 pounds of 41 percent cottonseed meal. From the standpoint of the protein and energy cost, one could consider cottonseed as a feed when the price of 1 pound of cottonseed does not exceed the cost of 2/5 pound of cottonseed meal and 3/5 pound of ground sorghum grain. Not more than 4 to 5 pounds of cottonseed should be fed daily per head to mature cattle.

SOYBEANS AS A SUPPLEMENT

Soybeans are 38.9 percent crude protein and 18 percent fat. Feeding beans in excess of desired protein needs causes scours. The bean oil becomes rancid and palatability is affected upon exposure to heat and aging. Beans are difficult to grind alone but grain or roughage will reduce the gum condition. They may also be fed as whole beans.

LIQUID SUPPLEMENTS

Liquid feeds may contain urea, molasses, minerals, vitamins and other materials. They usually contain 30 percent or more equivalent crude protein, vitamins A, D and E, .05 to 3 percent phosphorus and some trace elements with molasses serving as the carrier and principal ingredient. They are considered safe to feed free choice and cattle will consume from 2 to 4 pounds daily per head depending upon the product and the available forage quality and quantity. Molasses is the mixture's principal energy feed containing 54 percent total digestible nutrients (TDN) compared to sorghum grains with 79 percent TDN. From an energy value standpoint, molasses is worth about 70 percent as much as sorghum grain. The equivalent crude protein in these feeds is equally as good as the vegetable source of crude protein for range cattle performance. Use of liquid supplement is a convenient feeding method and may reduce labor and some equipment costs. Consider these items when comparing with other methods of feeding. Compare cost per pound of protein with protein cost in other protein supplements in selecting a supplement. The cost per pound of total digestible nutrients may also be used to aid in making a selection decision.

FREQUENCY OF FEEDING PROTEIN

Three groups of wintering Hereford heifers and cows were supplementally fed cottonseed cake on pasture in the Davis Mountain area of Texas during four winters, 1958-62. The accompanying feeding schedules were used.

- Two pounds per head daily the first year and 3 pounds daily the last 3 years.
- Seven pounds per head on Tuesdays and Saturdays during the first year and 10.5 pounds the last 3 years.

- Four and two-thirds pounds per head on Tuesdays, Thursdays and Saturdays the first year and 7 pounds the last 3 years.

The three groups were rotated among the pastures during the winter to minimize pasture differences as much as possible. All cattle were pastured together during the balance of the year.

Although slight but nonsignificant differences in weight changes were observed among the three groups of cows, the difference in frequency of feeding cottonseed cake had no significant effect upon percent calf crop weaned, weaning weight of calves or weaned calf weight produced per cow. At the end of the fourth year the females fed twice weekly showed slight advantage in weight and in percent calf crop weaned. They also tended to graze more widely over the pasture without waiting for supplemental feed than did those fed more frequently.

Feeding twice per week was as satisfactory as more frequent feeding and resulted in savings of approximately 60 percent in labor and travel as compared with daily feeding.

Quality and quantity of forage being consumed influences performance. Cattle receiving low-quality forage and insufficient amounts need both protein and energy more frequently.

VITAMIN A

Vitamin A is required for normal development of bones, maintenance of tissues and vision. Vitamin A deficiency in the early stages is characterized by night blindness. In later stages, cattle become less alert and lose their appetites. They may develop other symptoms such as watering eyes, swelling joints, rapid breathing and staggering gait. Or they may have a nasal discharge, suffer convulsions or develop complete blindness. Night-blind cattle bump into objects and those only partially night-blind walk about cautiously when driven after dark. Other symptoms previously mentioned may vary in order of occurrence, but watering eyes with some swelling joints may be noted soon after night-blindness occurs. Some watering at the eyes; however, may result from conditions other than vitamin A deficiency. Sluggishness is characteristic, as is appetite loss. Staggering gait also has been noted while the animals still had sufficient energy to pitch and frolic when out of the lot. If the condition is not remedied, the cattle will become unmarketable and eventually die.

Vitamin A deficiency in bulls of breeding age results in decreased breeding efficiency. Spermatozoa decrease in numbers and motility, and there is a marked increase of abnormal forms.

In vitamin A deficient breeding cows, estrus may continue, but fewer cows become pregnant. Deficiency in the pregnant animal, if severe enough, may cause abortion and birth of dead, weak or blind calves.

Cattle can store vitamin A and use this reserve when needed. The time in which cattle become vitamin A deficient varies. Young animals become affected in less time than older ones. There are marked differences also among individuals of the same age who receive the same treatment.

Calves weighing 250 to 400 pounds on a ration deficient in cartotene may show symptoms of deficiency in 40 to 80 days. Those above 400 pounds show symptoms of deficiency in 80 to 140 days and older cattle in 100 to 150 days.

Calves at birth have practically no body storage of vitamin A and depend on a supply from the colostrum or milk. If the cows are depleted and are on a carotene deficient ration, calves will be affected by vitamin A deficiency. In order to save the calves, cows must have good green hay, ample silage or vitamin A fortified concentrates or supply the synthetic vitamin A in some manner.

DAILY DRY FEED CRUDE AND DIGESTIBLE PROTEIN REQUIREMENTS

Purpose	Body weight, lb.	Daily feed, lb.	Crude protein, lb.	Digestible protein, lb.
Normal growth	400	12	1.4	.8
Heifers and steers	600	16	1.5	.9
	800	19	1.5	.9
	1,000	21	1.6	1.0
Wintering weanling	400	11	1.1	.7
calves	500	13	1.3	.8
	600	15	1.4	.8
Wintering yearling	600	16	1.3	.8
cattle	800	18	1.4	.8
	900	18	1.4	.8
Wintering pregnant	700	20	1.5	.9
heifers	1,000	18	1.4	.8
Wintering pregnant cows	800	22	1.6	1.0
	1,000	18	1.4	.8
	1,200	18	1.4	.8
Cows nursing calves up to 4 months after partuation	900-1,100	28	2.3	1.4
Bull, growth & maintenance	600	16	2.0	1.2
Moderate activity	1,000	20	2.4	1.4
	1,400	24	2.4	1.4
	1,800	26	2.4	1.5
Fattening calves	400	12	1.3	1.0
	600	16	1.8	1.3
	800	20	2.0	1.5
	1,000	22	2.2	1.6
Fattening 2-year-old	800	24	2.4	1.8
cattle	1,000	27	2.7	2.0
	1,200	29	2.9	2.2

Synthetic vitamin A may be mixed with feed, injected intramuscularly and/or administered in controlled drinking water. Cows require 40,000; yearling cattle 15,000; and calves 5,000 international units daily per head. Vitamin A loses its potency when exposed to sunlight, air and heat. Use a dark, cool place for storage of products containing vitamin A. It is available in different strengths. Administer according to manufacturer's recommendations.

Alfalfa hay is one of the better natural feed sources for supplying this vitamin. Any hay; however, may or may not contain carotene (vitamin A) depending upon

age, time exposed to sunlight and air and the amount of heat created in the curing process and storage. Bright, pea-green color is an indicator of vitamin A potency in hay but is not 100 percent reliable. Hays which contain mold from the result of heating have lost some or all of their vitamin A potency. Chemical testing is the most reliable method for determining this essential nutrient. Silage is considered a good source of vitamin A. See page 4 for vitamin A in other feeds.

MINERALS

Have granular salt available as a lick at all times, except when salt is being fed to limit feed consumption. In most instances, it is preferable to feed as a separate mineral supplement except where it is used in combination with bonemeal to control blowing.

Phosphorus is the major mineral deficiency. Keep supplements available at all times. Bonemeal, spent bone black, dicalcium phosphate or monosodium phosphate are good free-choice phosphorus supplements. Monosodium phosphate may be added to the drinking water and is an excellent method of supplying this mineral. Commercial mixtures containing no more than ratios of one or two parts calcium to one part phosphorus are considered good supplements. See Extension bulletin B-174, *Minerals for Beef Cattle.*

PERCENTAGE CHEMICAL COMPOSITION OF VARIOUS FEEDING MATERIALS

Feed	Protein Crude	Protein Digestible	Digestible Energy [1]	Calcium	Phosphorus	Vitamin A
	%	%	Megcal/lb.[2]	%	%	1000 I.U./lb.
Alfalfa hay	15.2	10.6	.99	1.20	.20	22
Beargrass, Yucca	6.6	2.4	1.02			
Bermudagrass hay	8.1	4.1	.88	.42	.18	45
Bonemeal	25.3			30.00	13.90	
Corn, grain	8.9	6.9	1.60	.02	.31	1
Corn cob	2.9	—0.7	.92	.11	.04	
Corn husks	3.4	0.4	.78	.15	.12	
Corn grain and cob	7.4	5.4	1.46	.04	.22	
Corn silage	2.3	1.5	.40			7
Cottonseed	23.1	17.1	1.81	.14	.68	
Cotton gin trash	7.7					
Cottonseed hulls	3.9	0.2	.88	.14	.09	
Cottonseed meal, solvent	41.1	32.5	1.26	.21	1.19	
Digester tankage	59.8	50.8	1.32	5.94	3.17	
Guar meal	35.0					
Johnsongrass hay	7.0	3.1	1.00	.74	.28	26
Liveoak acorns	2.7		.47			
Liveoak leaves	9.2	2.7	.34			
Mesquite beans and pod	13.0	11.7	14.30			
Mesquite, ground wood	5.9			.42	.06	4
Mistletoe	9.0					
Molasses, blackstrap	3.0		1.07	.66	.08	
Oats	11.8	8.8	1.30	1.00	.35	
Oat hay	6.4	3.8	.90	.23	.21	67
Peanut hay, good	10.0	5.4	.94	1.12	.13	13
Peanut hulls	6.7	1.6	.37	.25	.06	
Peanut hay, with nuts	13.4	10.2	1.43	1.13	.15	13
Prairie hay	5.1	2.0	.91	.37	.11	22
Prickly pear	0.8	0.4	.19	1.52	.02	
Pear, finger	2.6					
Rice, rough	7.9	6.0	1.40	.08	.32	
Rice bran	13.5	8.5	1.36	.06	1.82	
Rice hulls	3.0	.1	.20	.08	.08	
Rice straw	3.9	.6	.83	.19	.07	
Salt, cord grass	4.3					
Sesame, meal	43.3	39.4	1.42	2.02	1.61	
Spanish moss	1.9		.48			
Sorghum grain	11.0	8.6	1.42			
Sotol heads	2.2	.9	.49			
Soybean meal, solvent	45.8	43.1	1.56	.32	.67	Trace
Sorghum hay	8.0					
Sorghum silage	2.3	0.6	.30	.10	.06	7
Sudangrass hay	11.3	4.3	.98	.50	.28	
Wheat grain	11.1	8.3	1.56	.09	.30	
Wheat bran	16.0	12.2	1.16	.14	1.17	

[1]Digestible Energy (DE) is the feed intake gross energy minus fecal energy.
[2]A megacalorie (megcal) is a term used to measure the energy in feeds. One pound of total digestible nutrients is approximately 2 megacalories of digestible energy. To obtain percent TDN divide the megacalories by 2 and multiply the quotient by 100 to get percentage.

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