

RANGE SUPPLEMENTS - WHAT WE HAVE LEARNED ¹¹

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Important questions regarding supplemental feeding of range cows revolve around several issues such as: (1) what specific supplemental nutrient(s) are limiting; (2) how much supplement should be fed; (3) how frequent the supplement should be fed, and (4) when supplemental feeding should begin and when it should stop. This report summarizes several studies which provide at least partial answers to some of the above questions.

PROCEDURES

The Study Area

All trials discussed in this report were conducted at the Fort Stanton Experimental Ranch in southcentral New Mexico. This ranch was formerly leased from BLM by New Mexico State University specifically for conducting research with range livestock, wildlife and the range resource. The ranch is in a mountain foothill region similar to large areas of rangeland in the Southwest. Vegetation in the area is dominated by blue grama; other important grasses are sideoats grama, sand dropseed and various muhly species. Dominant forbs and shrubs are carruth sagewart, scarlet globemallow and fourwing saltbush. An overstory of piñon pine and juniper is prevalent throughout much of the area and wavyleaf oak forms a dense cover on some slopes.

Research Animals

Most studies were conducted with Angus x Hereford F₁ females ranging in age from short yearlings to mature cows. In a few instances, some females used were 1/2 Simmental, 1/4 Angus, 1/4 Hereford. Breeding was carried out in multiple-sire groups for spring calving; the number females per bull ranged from 12 to 18.

Individual records were kept on all females used in the different studies. Calving usually started in mid-January for 2 yr-olds and in February for older cows. Birth date and mid-October weaning weights were recorded for each calf; birth weights were taken only on calves from 2-yr-olds. Weaning weights of heifer calves were adjusted to a steer equivalent. All females exposed to breeding were pregnancy tested by rectal palpation each fall at weaning time.

Throughout all studies, cow productivity traits considered most important were weaning weight of calves produced and conception rate or percent calf crop. Reproductive response and growth rate were the main criteria evaluated for younger females.

Supplemental Feeding Periods and Costs

Length of supplementation periods for individual studies was governed by a number of factors including cow condition, severity of winter, carry-over of old forage, and availability of new growth in the spring. Generally, supplemental feeding periods were completed before the breeding season, and females assigned to different treatment groups were exposed to breeding in a common pasture. All supplements were group-fed. Stocking rate varied some from year to year but averaged 40 acres/cow and 29.6 acres/yearling annually. During supplemental

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feeding periods females assigned to different groups were kept in separate but similar pastures. Groups were rotated between pastures at periodic intervals when it appeared that erratic precipitation patterns might cause variation in forage availability or diet composition. Only one trial summarized in this report includes females that received no supplement (and reproductive performance could not be assessed in that study). Reasons for exclusion of unsupplemented treatments in the other trials are that expected performance from such females had, in our opinion, been adequately established in earlier trials. Normally, in previous studies with yearlings and 2 yr-olds given no winter supplement before exposure to breeding, conception rates were less than 50% and, with lactating 2 yr-olds, calf weaning weights were also substantially reduced. In recent years, income from research animals has played a more important role in maintaining experimental herds.

Where possible, cost of supplements are included in the data presented. In some cases, supplement costs may be averaged over 2 or more years. The price of supplements used were those paid at the time individual studies were conducted.

Companion Studies on Cattle Diet Composition

Other research carried out on the Fort Stanton Ranch characterized the chemical and botanical composition of diets selected by grazing cattle. A summary of 10 trials conducted during winter dormancy indicated that cattle diets averaged 9.6% crude protein, 76% neutral detergent fiber, 11% lignin and 48% in vitro organic matter digestibility. Further chemical analyses of these diets revealed that about one-third of the total protein was unavailable, thus leaving the available portion at about 6.5%. Diets below 7% useful protein often do not provide sufficient protein for growing heifers or lactating cows. Botanical analyses of cattle diets showed that they contained only about 20% grasses during winter dormancy with the balance being made up of forb and shrub species.

OBSERVATIONS

Frequency of Protein Supplementation

During 1985 and 1986, two trials were conducted which compared the performance of yearling heifers fed a cottonseed cake supplement (41% crude protein - CP) 3 times weekly with similar heifers fed the same total amount of supplement once per week (Table 1). During 1985 supplemental feeding started January 4 and lasted for 130 days to May 14. For the second trial, supplementation was carried out from December 4, 1985 to April 29, 1986 for a 146-day period. Heifers supplemented 3 times weekly were fed Monday, Wednesday and Friday each week while those fed once weekly were given their supplement on Tuesdays.

The lower winter gains observed during the second trial (although heifers were supplemented at a higher level than during the first trial, Table 1) reflect lower forage quality and more severe weather in 1986 compared with 1985. Based on both trials, frequency of supplementation did not affect growth rate of heifers and it did not influence their subsequent reproductive performance. Feeding cottonseed once rather than 3 times weekly reduced transportation and labor costs involved in supplement distribution by approximately 60%. Similar findings have been reported from studies carried in Texas and Oklahoma.

Alfalfa Hay as a Protein Supplement

In early January of 1983, 102 Angus x Hereford yearling heifers were assigned randomly to 3 supplement treatments (control = no supplement; alfalfa hay fed @ 9 lb per head on alternate days; cottonseed cake fed @ 3.7 lb per head on alternate days). Supplemented heifers received the same amount of CP per feeding, i.e., 1.5 lb/head (Table 2). The study lasted for 107 days from January 12 to April 29, 1983.

Growth performance between heifers in the 2 supplemented treatments was practically the same (Table 2). A related phase of this experiment showed that supplemented heifers tended to consume slightly less forage but had a greater total (forage plus supplement) intake when compared with unsupplemented, control heifers. Following the supplemental feeding period, all heifers were exposed to natural breeding with Jersey bulls but fertility problems with these bulls were subsequently discovered, thus, meaningful conception data could not be obtained.

Grain Cubes vs Cottonseed Cake When Fed on an Equal Dry Matter or Protein Basis

Two levels of a grain cube supplement (3.1 and 6.2 lb/hd per feeding) were compared with cottonseed cake (3.1 lb/hd per feeding) as supplements for Angus x Hereford heifers (average initial weight = 504 lb) during a 150-day trial in 1976 (Table 3). The cottonseed cake contained 41% CP and 1.1% phosphorus; grain cubes contained 20.5% CP and 1.1% phosphorus and were a mixture of ingredients including corn, cottonseed meal, cane molasses, rock phosphate and pellet binder. All supplements were group-fed 3 times weekly.

Gains made by heifers in all treatment groups were modest but proportional to supplemental protein intake (Table 3). Heifers fed the higher level of grain cubes and those fed cottonseed cake gained about the same, and both of these treatment groups gained roughly twice that of heifers fed the low level of grain cubes. This result was interpreted as further verification that protein was the first limiting forage nutrient.

Grain Cubes vs Cottonseed Cake When Fed on an Equal TDN Basis to Yearling Heifers

A low protein (9.4% CP) grain cube was compared with cottonseed cake (41% CP) as a supplement for yearling Angus x Hereford heifers (avg. initial weight = 499 lb) over a 156 day winter-spring period. The grain cubes and cottonseed cake had calculated TDN contents of 83 and 76%, respectively; both supplements were fed twice weekly to supply 5.32 lb TDN/head per feeding (Table 4).

Heifers fed the grain cube lost weight during the study while those fed cottonseed cake gained about .5 lb per day (Table 4). Conception rates were 68% for heifers fed grain cubes and 100% for those receiving cottonseed cake. In this trial, the greater cost of cottonseed cake (\$35.83/head) over grain cubes (\$22.84/head) was clearly justified.

Frequency of Energy Supplementation

The trial summarized in Table 4 also shows a comparison between daily and twice weekly feeding of the low-protein, high-energy grain cube. On a weekly basis, heifers in both treatments received an equal quantity of total supplement (12.8 lb) as well as an equal amount of TDN (10.64 lb). Heifers fed the grain supplement daily gained more (.14 vs -.03 lb/day) and had a considerably higher conception rate (94 vs 68%) than those given the same supplement twice/week. These results verify the need for feeding grain type (high energy) supplements frequently and in smaller quantities per feeding.

Grain Cubes vs Cottonseed Cake When Fed on an Equal TDN Basis to Young Cows

A 93-day trial similar to that described earlier for yearling heifers was conducted using 2 and 3 yr-old cows (Table 5). In this case, cows received either a grain cube (10% CP) or cottonseed cake (41% Cp) at levels which supplied an equal amount of supplemental TDN per head weekly (i.e., 10.64 lb). In viewing the response criteria for this trial, it is apparent that young cows fed the high protein supplement had some advantage over those given grain cubes. Cows fed cottonseed cake bred back a few days sooner and their calves averaged 16 lb heavier at weaning compared with grain-supplemented cows. The higher supplement cost for cottonseed cake over the grain cubes (\$4.60/head) was more than offset by the value of the increased weaning weight for calves from cows fed cottonseed cake.

Starting Winter Protein Supplementation in Late Gestation vs. Starting at Calving for 2 yr-olds and Mature Cows

Studies involving both 2 yr-old as well as mature cows were used to compare the starting of winter protein supplementation (cottonseed cake; 41% CP) about one month before calving vs starting just after calving (Table 6). The study with 2 yr-olds was carried out over two years (1982 and 1983) using about 85 different cows each year. The mature cow study lasted 4 years (1984 - 1987) with repeated measures on the same cows over years. The latter study started with 99 cows (4-6 year-olds) permanently assigned to supplemental treatments but, in the final year, only 71 cows remained; over the 4-yr period, 335 cow/calf data sets were used. Cows within both age groups were F₁ crossbred Angus x Herefords.

It is evident in Table 6 that, for cows of both ages, seasonal weight fluctuations (spring weight loss and summer weight gain) were greater for cows that received supplemental feeding starting at calving. Also, it is evident that beginning supplementation at the earlier date increased body condition of cows at the start of breeding over that observed for cows started on supplementation at the later date. In spite of the above differences noted, cows within each age group had similar reproductive performance regardless of supplemental treatment. Starting the supplementation during late gestation (vs at calving) apparently increased weaning weights of calves from mature cows and, perhaps, slightly improved conception rates in 2 yr-olds.

CONCLUSIONS

For yearling heifers and 2 yr-old cows, protein was the first limiting forage nutrient in diets selected during the dormant season. Growth and reproductive response to high-protein supplements far exceeded those from grain-based, high-energy supplements. Alfalfa hay was equal to cottonseed cake when both were fed as supplements on an equivalent protein basis to yearling heifers. High protein supplements can be fed as infrequently as once/week without decreasing performance, but grain supplements should be fed frequently (daily) and in small quantities/feeding.

Starting winter protein supplementation before calving (about one month) vs just after calving reduced spring weight loss and improved prebreeding body condition in 2 yr-old and mature cows. The earlier starting of supplementation also improved calf weaning weights from mature cows (but not from 2 yr-olds) and slightly increased conception rate in 2 yr-olds (but not in mature cows).

Table 1. Comparison of supplementing the same amount of cottonseed cake (41% CP) to yearling heifers once weekly vs three times weekly during two trials.

	Trial 1 - 1985 (130 days)		Trial 2 - 1986 (146 days)	
	Times fed/wk	1	3	1
Amount fed/feeding, lb/hd	6.9	2.3	10.5	3.5
Protein fed/feeding, lb/hd	2.8	.95	4.3	1.43
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Number of heifers/trmt	43	40	27	18
Avg initial weight, lb	495	495	502	491
Avg daily gain during suppl. period, lb/d	.50	.47	.34	.37
Conception rate, %	93	90	89	89
Supplement cost ¹ , \$/hd	14.10	14.10	24.09	24.09

¹Based on cost of cottonseed cake @ \$220/t.

Table 2. Alfalfa hay and no supplement compared with cottonseed cake when fed to yearling heifers on an equal protein¹ basis over a 107-day period

	No supplement	Alfalfa hay	Cottonseed cake
Times fed/wk	0	Alternate days	Alternate days
Amount fed/feeding, lb/hd	0	9	3.7
Crude protein ¹ /feeding, lb/hd	0	1.5	1.5
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Number of heifers/trmt	33	35	34
Avg. initial weight, lb	534	528	534
Avg 107 day total gain, lb	-6	54	57
Avg daily gain, lb/d	-.06	.50	.53
Supplement cost ² , \$/hd	0	24.30	21.00

¹Based on crude protein contents of 17 and 41% for alfalfa hay and cottonseed cake, respectively.

²Based on prices of \$100/t for alfalfa hay and \$210/t for cottonseed cake.

Table 3. Comparison of grain cubes with cottonseed cake on an equal dry matter or protein basis for supplementing yearling heifers (150-day trial)

	Grain cube (20.5% CP)		Cottonseed cake (41% CP)
Times fed/wk	3	3	3
Dry matter fed/feeding, lb/hd	3.1	6.2	3.1
Crude protein fed/feeding, lb/hd	.64	1.27	1.27

Number of heifers/trmt	20	21	20
Avg initial weight, lb	501	507	501
Avg daily gain during suppl. period, lb/d	.17	.33	.31
Conception rate, %	95	95	100
Supplement cost ¹ , \$/hd	15.60	31.20	15.60

¹Based on cost of \$160/t for both grain cubes and cottonseed cake.

Table 4. Comparison of grain cubes with cottonseed cake for supplementing yearling heifers on an equal TDN¹ basis and daily versus twice weekly feeding of grain cubes over a 156-day period

	Grain cube (9.4% CP)		Cottonseed cake (41% CP)
Times fed/wk	2	7	2
Dry matter fed/feeding, lb/hd	6.40	1.83	7.00
TDN fed/feeding, lb/hd	5.32	1.52	5.32

Number of heifers/trmt	32	32	32
Avg initial weight, lb	544	539	545
Avg daily gain during suppl. period, lb/d	-.03	.14	.51
Conception rate, %	68	94	100
Supplement cost ² , \$/hd	22.84	22.84	35.88

¹Based on TDN values of 83 and 76% for grain cubes and cottonseed cake, respectively.

²Based on cost of grain cubes @ \$160/t and cottonseed cake @ \$230/t.

Table 5. Comparison of grain cubes with cottonseed cake for supplementing young cows¹ on an equal TDN² basis over a 93-day period

	Grain cube (10% CP)	Cottonseed cake (41% CP)
Times fed/wk	7	2
Amount fed/feeding, lb/hd	1.83	7.00
TDN fed/feeding ² , lb/hd	1.52	5.32
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Number of cows/treatment	56	57
Avg. initial weight, lb	932	927
Winter/Spring weight loss, lb	-170	-80
Condition score at breeding	4.12	4.75
Conception rate, %	94	91
Days from calving to rebreeding	82	77
Adj. 205 d calf weaning wt., lb	472	488
Supplement cost ³ , \$/hd	15.86	20.46

¹Performance data presented represent the average response from 2 and 3 yr-old cows.

²Based on TDN contents of 83 and 76% for the grain cube and cottonseed cake, respectively. At levels fed, both supplements provided 10.64 lb of TDN per head weekly.

³Based on cost of grain cubes @ \$186.40/t and cottonseed cake @ \$220/t.

Table 6. Comparison of starting winter protein supplementation one month before calving (prepartum) vs immediately after calving (postpartum) with 2 yr-old and mature cows¹

	Cow age			
	2 yr-olds		Mature cows	
Start of supplement	Prepartum	Postpartum	Prepartum	Postpartum
Times fed/wk	7	7	3	3
Suppl. fed/feeding, lb/hd	2.00	2.00	3.5	3.5
Number of cows/trmt	84	85	50	49
Avg. initial wt., lb	887	895	1052	1043
Avg. spring wt. loss, lb	-165	-198	-154	-187
Avg. summer wt. gain, lb	154	176	172	194
Supplement cost ² , \$/hd	33.28	31.68	12.10	6.05
Calf data ³ :				
Avg birth wt., lb	63	62	(not measured)	
Avg. weaning wt., lb	447	447	596	583
Repro. data:				
Cow cond. at breeding	4.3	4.1	4.9	4.5
Fall pregnancy rate, %	92	89	92	92
Calving interval, d	(not measured)		362	364

¹The study with 2 yr-olds was conducted over two years using different cows each year. The mature cow study lasted 4 years with repeated measures on the same cows.

²Based on a supplement cost of \$220/t.

³Calves from 2 yr-olds were sired by Jersey or Longhorn bulls and those from mature cows were sired by Simmental bulls.