LIQUID AND DRY SUPPLEMENTS FOR WINTERING RANGE BEEF CALVES

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LIQUID AND DRY SUPPLEMENTS FOR WINTERING RANGE BEEF CALVES

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The nutritive value of range plants decreases as they mature. When these plants are dormant, they are often deficient in certain nutrients, particularly protein and phosphorus. These deficiencies have been shown by many studies, including those at New Mexico State University (2,4,5,6,7,9,10,11).[2] To correct these deficiencies during the winter, supplemental nutrients may be provided in many forms, the most common being meals, pellets, and blocks. A relatively new practice is the use of liquid supplements. Such supplements have a liquid base, usually molasses, to which other ingredients are added. The most common addition is non-protein nitrogen, such as urea, next most common is phosphorus, and others are vitamins, minerals, and antibiotics.

Most liquid supplements are used in feedlot rations (12). Animals on pasture or range may also be offered liquid supplement free-choice, either *ad libitum* (at will) or restricted. With ad lib feeding, the supplement is placed in an open container with animal intake restricted only by formula modification. With restricted feeding, intake is controlled by mechanical feeders. The feeder is usually a covered container with one or more wheels extending down through the cover; the wheels turn as they are licked by the animals, and a fresh layer of liquid is picked up with each turn.

Decisions about supplements to feed to grazing cattle during the winter season should be based on what nutrients are lacking in the forage available for grazing. Many forms and formulations of supplements may be purchased and the increased availability of *liquid* supplements has raised many questions concerning their nutritive value. To answer these questions, the NMSU Agricultural Experimental Station compared weight gains and feed costs of range beef calves fed liquid and dry supplements.

The Studies

Liquid supplements were compared to dry supplements in four experiments. All comparisons were with beef calves weaned in October and allowed to graze in native grass pastures. The pastures contained adequate quantities of dry grass, although the number of acres required per head varied considerably.

Experiment I

Procedure. On the Fort Stanton Experimental Range, near Capitan, 66 weanling steer and heifer calves weighing an average of 394 pounds were divided on the basis of breed, sex, and weight into three groups of 22 head on December 19, 1969. Thirty calves were Angus x Hereford crossbreds, and 36 were grade Hereford. They were allowed to graze in native grass pastures, where much dry grass was available. The stocking rate was about 16 acres per head. The vegetation was pinyon-juniper woodland and open grassland. The major forage species were blue grama, *Bouteloua gracilis* (H.B.K.) Lag. Other abundant species were ring muhly, *Muhlenbergia torreyi* (Kunth.) Hitch.; hairy grama, *Bouteloua hirsuta* Lag.; sideoats grama, *Bouteloua curtipendula* (Michx.) Torr.; mat muhly, *Muhlenbergia richardsonis* (Trin.) Rybd.; galleta, *Hilaria jamesii* (Torr.) Benth.; and sand dropseed, *Sporobolus cryptandrus* (Torr.) A. Gray (1).

A mineral mixture consisting of 55 percent salt, 40 percent defluorinated rock phosphate, and 5 percent cottonseed meal was available ad lib in each pasture. One group was not fed any other supplement. A second group was fed 17.5 percent protein liquid supplement ad lib. A third group was fed pelleted cottonseed meal (41 percent protein) three times weekly at a rate equal to an average of one pound per head daily. These treatments were continued for 134 days, ending May 5, 1970.

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[2]Numbers in parentheses refer to literature cited.

Results. Calves not fed any supplement lost an average of 19 pounds per head in 134 days (table 1). Those fed a liquid supplement ad lib gained 34 pounds per head in the same period (0.25 pound daily). Those fed pelleted cottonseed meal gained 58 pounds (0.43 pound daily). These are differences of 53 and 67 pounds in weight change due to the supplements. The daily intake of supplemental protein was 0.41 pound for both the calves fed liquid supplement (2.3 pounds) and those fed pelleted cottonseed meal (1 pound).

The 308 pounds of liquid supplement per head cost five cents a pound or $15.41 per head delivered to the feeder in the pasture. The 134 pounds of pelleted cottonseed meal cost four cents a pound or $5.36 a head delivered to a storage area on the ranch. No estimates were made for the cost of *feeding* the dry supplement. (In addition to costs of the supplement, ranchers feeding a liquid supplement must consider cost of checking or observing the cattle, while those feeding a dry supplement must consider cost of feed storage, feeding, and simultaneous checking of the cattle.)

Experiment 2

Procedure. On the Jornada Experimental Range (USDA, Agricultural Research Service), 25 miles north of Las Cruces, 74 weanling heifer calves weighing an average of 370 pounds were divided into three groups on February 12, 1970. The calves were mostly Hereford and Santa Gertrudis-Hereford crossbreds, but some were Santa Gertrudis, Brangus–Hereford, and Brangus–Santa Gertrudis. They were allowed to graze in the native grass pastures. The stocking rate during the test was about 100 acres per heifer. The major forage species are burrograss, *Scleropogon brevifolius* Phil.; mesa dropseed, *Sporobolus flexuosus* (Thurb.) Rydb.; alkali sacaton, *Sporobolus airoides* (Torr.) Torr.; and black grama, *Bouteloua eriopoda* (Torr.) Torr. (3).

A group of 19 calves was placed in one pasture and fed a dry supplement consisting of 40 percent cottonseed meal, 40 percent ground milo, and 20 percent salt. This supplement, calculated to contain 20.4 percent protein, was fed once weekly at an average of two pounds per head daily. A second group of 18 calves was placed in another pasture but fed similarly to the first group. The third group of 37 calves was placed in a pasture in which 17.5 percent protein liquid supplement was fed ad lib. A commercial mineral mixture containing seven percent phosphorus and five percent calcium was available in each pasture. Supplemental feeding was continued for 123 days ending June 15.

Results. The gains in 123 days were 130 and 155 pounds (average of 142 pounds) for the two groups of calves fed an average of two pounds of the dry supplement per head daily (table 2). This average gain was 17 pounds more than the gain of 125 pounds per head for those fed a 17.5 percent protein liquid supplement ad lib. Average consumption was two pounds per head daily. Total supplemental feed was 246 pounds per head. The liquid feed cost five cents a pound and the dry feed cost three and a half cents per pound. The supplement cost per head was therefore $12.30 and $8.61 for the liquid and dry supplements, respectively.

Experiment 3.

Procedure. On the College Ranch, 20 miles north of Las Cruces, 80 weanling heifer calves weighing an average of 394 pounds were divided into groups of 40 head on December 16, 1969. In each group 10 calves were Hereford, 19 were Brangus, and 11 were Hereford-Brangus crossbreds. They were allowed to graze in the native grass pas-

Table 1. The effect of supplemental feed on weight gains of weanling calves at Fort Stanton, 134 days

Item	Supplement		
	None	Liquid 2.3 lb	Cottonseed meal pellets, 1 lb
Number of Calves	22	22	22
Average Weight per Head, lbs			
Initial, December 19, 1969	397	392	392
Final, May 5, 1970	378	426	450
Change	-19	34	58
Supplemental Feed per Head, lbs	0	308	134
Cost of Supplemental Feed per Head, dollars	0	15.41	5.36

Table 2. Weight gains of weanling calves fed a liquid or a dry supplement at the Jornada Experimental Range, 123 days

Item	Supplement		
	Dry[1]	Dry[1]	Liquid[2]
Number of Calves	19	18	37
Average Weight per Head, lbs			
Initial, February 12, 1970	368	377	361
Final, June 15, 1970	498	532	486
Gain	130	155	125
Cost of Supplemental Feed per Head, dollars	8.61	8.61	12.30

[1]A mixture of 40 percent cottonseed meal, 40 percent ground milo, and 20 percent salt. The mixture contained about 20 percent protein and was fed weekly at an average of 2 pounds per head daily.

[2]Liquid supplement (17.5 percent protein) fed ad lib. Average intake was two pounds per head daily.

tures (about 40 acres per head for four and one-half months). The vegetation consists largely of black grama, mesa dropseed, and spike dropseed, *Sporobolus contractus* Hitchc. (8).

A mixture consisting of 50 percent defluorinated rock phosphate, 40 percent salt, and 10 percent cottonseed meal was available in each pasture. The calves in one pasture were fed ad lib a mixture consisting of 45 percent milo, 35 percent cottonseed meal, and 20 percent salt (calculated to contain 18.8 percent protein), except for 14 days in late January, when the salt was decreased to 15 percent with a corresponding 5 percent increase in milo. As this change resulted in a greater supplement intake than was desired, the salt content was changed back to 20 percent after 14 days. During these 14 days, the intake of the dry supplement exceeded three pounds per head daily. The second group was fed 17.5 percent protein liquid supplement ad lib. Supplemental feeding was continued for 140 days ending May 5.

Results. Average daily supplement intake was 1.73 pounds for the liquid supplement and 1.90 pounds for the dry supplement. The weight gains (109 and 107 pounds) were nearly equal for the two groups (table 3). As in Experiment 2, the supplement costs were five cents and three and one-half cents per pound for the liquid and dry supplements, respectively. With respective intakes of 242 and 266 pounds, the supplement costs per head were $12.10 for the liquid and $9.31 for the dry supplement.

Experiment 4.

Procedure. On the Jornada Experimental Range, seven pastures of about 40 acres each, which were predominantly tobosa, *Hilaria mutica* (Buckl.) Benth., were stocked with weanling Hereford-Santa Gertrudis crossbred steers on December 22, 1969. They weighed an average of 405 pounds and the number of steers varied from five to seven head per pasture.

A mineral mixture consisting of 55 percent salt, 40 percent defluorinated rock phosphate, and 5 percent cottonseed was available in each pasture.

Table 3. Weight gains of weanling calves fed a liquid or a dry supplement at the College Ranch, 140 days

Item	Supplement	
	Dry[1], 1.90 lb	Liquid[2], 1.73 lb
Number of Calves	40	40
Average Weight per Head, lbs		
Initial, December 16, 1969	412	416
Final, May 5, 1970	521	523
Gain	109	107
Supplemental Feed per Head, lbs	266	242
Cost of Supplemental Feed per Head, dollars	9.31	12.10

[1]A mixture of 45 percent milo, 35 percent cottonseed meal, and 20 percent salt. The mixture contained about 18 percent protein and was fed ad lib.

[2]Liquid supplement (17.5 percent protein) fed ad lib.

One group was not fed any other supplement. The calves in two other groups were fed cottonseed meal pellets once weekly at an average of one pound per head daily. Two groups were fed a 30 percent protein liquid supplement ad lib, and two groups were fed cane molasses. The intake of molasses was limited to that of the liquid supplement. The ad lib consumption of the liquid supplement by one group was measured weekly, and a like quantity of molasses was fed to another group. A second pair of liquid supplement and molasses groups was treated similarly. Treatments were continued until June 9.

Results. Calves not fed any supplement gained 41 pounds in 169 days (table 4). Feeding an average of one pound of pelleted cottonseed meal per head daily resulted in an average gain of 74 pounds, an increase of 33 pounds compared to those not receiving any supplement. The total supplement was 169 pounds per head at a cost of $6.76 as the feed cost four cents per pound.

The average ad lib consumption of liquid supplement was two pounds, with 1.8 pounds consumed per head daily by one group and 2.2 pounds by the second group. The respective gains for these groups were 84 and 103 pounds (average of 94 pounds). This is 53 pounds more than the gain of those not fed supplement and 20 pounds more than the gain of those fed one pound of pelleted cottonseed meal. The 338 pounds of liquid supplement per head cost $16.90 (five cents per pound). When the intake of molasses was limited to that of the 30 percent protein liquid supplement the average weight gain of the steers was 68 pounds. This was six pounds less than the gains of those fed the liquid supplement. The cost of the 338 pounds of molasses per head was $8.45 (two and a half cents per pound).

Discussion

The value of the liquid supplements was quite variable in the four experiments. The average differences in weight gain were 2, 17, and 24 pounds in favor of dry supplements in three experiments and 20 pounds in favor of a liquid supplement in one experiment. The quantities of supplement eaten were not considered in these comparisons, e.g., in the latter experiment, the intake of liquid supplement was two pounds per head daily, while the intake of the dry supplement was one pound per head daily. There apparently was not any consistent relationship between kind of range or amount of rainfall and the value of the supplements.

Costs of liquid feeds usually include delivery to the feeder in the pasture. No estimates were made for the costs of feeding and inspecting cattle when dry supplements were fed, nor for costs of only inspecting cattle when liquid supplements were fed. In all four experiments, the feed cost per head for the liquid supplements was higher than for the dry supplements. In the only experiment where gains were greater for the liquid supplement than for the dry supplement, the increased gain was 20 pounds. At a selling price of $35 per 100 pounds for cattle, the increased value of $7 per head was $3.14 less than the increased cost of supplement. Local costs must be considered in determining the relative merits of the two types of supplements.

Table 4. Supplement consumption and weight gains of weanling steers grazing dormant tobosa on the Jornada Experimental Range, 169 days[1]

Item	Supplemental Feed per Steer			Gain per Steer
	Daily	169 days	Cost	
	pounds	pounds	dollars	pounds
No Supplement	0	0	0	41
Pelleted Cottonseed Meal	1.0	169	6.76	92
Pelleted Cottonseed Meal	1.0	169	6.76	56
Average	1.0	169	6.76	74
Liquid Supplement	1.8	304	15.20	84
Liquid Supplement	2.2	372	18.60	103
Average	2.0	338	16.90	94
Molasses	1.8	304	7.60	72
Molasses	2.2	372	9.30	74
Average	2.0	338	8.45	73

[1]Average initial weight was 405 pounds.

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Appendix

The following commercial liquid supplement was fed in Experiments 1, 2, and 3:

Liquid Stock Supplement[1]
(for ruminants only)

Guaranteed Analysis

Crude protein, not less than	17.5%
Equivalent crude protein from non-protein nitrogen, not more than	8.7%
Crude fat, not less than	0.0%
Crude fiber, not more than	0.0%
Ash, not more than	12.0%
Salt (NaCl), not more than	3.2%
Phosphorus, not less than	1.1%
Vitamin A, USP Units per lb.	20,000
Vitamin D, USP Units per lb.	2,000

Ingredients

Condensed extracted glutamic acid fermentation product, condensed beet solubles, cane molasses, phosphoric acid, urea, stabilized vitamin A palmitate, copper sulfate, cobalt sulfate, potassium iodine, zinc sulfate, manganese sulfate.

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[1]Manufactured by Loomix Incorporated, Farwell, Texas and furnished by Arrow Loomix, Roswell, New Mexico.

The following commercial liquid feed was fed in Experiment 4.

Liquid Feed Supplement
(for ruminants only)

Guaranteed Analysis[2]

Crude protein, not less than	30%
(This includes not more than 28.5% equivalent crude protein from non-protein nitrogen)	
Crude fiber, not more than	0.1%
Crude fat, not less than	0.1%
Phosphorus, not less than	1.2%
Vitamin A, USP Units per lb.	15,000
Vitamin D, USP Units per lb.	3,750
Vitamin E, USP Units per lb.	7.5
Calcium, not less than	0.5%
Calcium, not more than	1.5%
Cobalt, not less than	0.0003%
Copper, not less than	0.003%
Iodine, not less than	0.0004%
Iron, not less than	0.004%
Manganese, not less than	0.006%
Zinc, not less than	0.02%

Ingredients

Cane molasses
Urea
Phosphoric acid
Zinc sulfate
Copper sulfate
Ammonium polyphosphate
Liquid corn distillers solubles
Condensed fermented corn extractives
Vitamin A supplement (stability improved)
D-activated animal sterol (source of Vitamin D_3)
Ethylene diamine dihydroidodide
Vitamin E supplement
Ferrous sulfate
Manganese sulfate
Cobalt sulfate
Sodium sulfate

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[2]Manufactured and furnished by National Molasses Company, Willow Grove, Pennsylvania.