RECEIVING NUTRITION AND MANAGEMENT FOR FEEDLOTS[1,2]

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INTRODUCTION

Feeder calves encounter numerous physiological and psychological stressors during movement from one production point to another. Proper nutrition can help prepare the animal for a period of stress, reduce the adverse effects of stress, and enhance recovery from stressful periods. Additionally, inadequate nutrition can accentuate the adverse effects of stress.

PRETRANSPORT NUTRITION

Ruminants have a potentially large reserve of nutrients and water within the digestive tract. Improved performance and reduced morbidity/mortality can be realized if maximum use is made of this reserve (1). Hence, the diet fed to calves before and/or during a stress period is as important as the diet fed upon arrival at the feedyard.

The diet calves receive before leaving the ranch is highly variable, depending upon the quality and quantity of grass and milk available. One method to assure that calves are properly nourished upon leaving the farm is to wean them 4 weeks before sale and feed a balanced diet (preweaning). Practically, however, this procedure requires considerable extra labor, investment, risk and skills by the cow-calf producer. Except when grass conditions are very poor, preweaning does not benefit the cow herd. Research also indicates that preweaned calves do not have sufficient improvements in health or performance at the feedyard for the cattle feeder to pay a premium for the procedure (Table 1).

TABLE 1. EFFECTS OF PREWEANING ON FEEDER CALVES

Item	Trials	Control	Preweaned
On farm (last 30 d):			
Weight gain, kg	17	19.5	21.8
Weaning diet intake, kg	12	0	165
Feed/added gain	12	--	79.2
Transport shrink, %	10	8.75	9.00
Feedyard performance:			
Daily gain, kg	13	1.06	1.05
Feed/gain	7	7.17	7.48
Morbidity, %	15	38.6	30.5
Mortality, %	15	2.0	1.2

A second method to provide proper nutrition that requires less investment and time, is to limit-creep-feed calves during the last 60-90 days on the farm (Tables 2

[1]Presented at the 25th Annual Meeting of the American Association of Bovine Practitioners, St. Paul, MN, Sept. 2-5, 1992.

[2]Mention of a specific product or piece of equipment does not constitute an endorsement by the USDA and does not imply their approval to the exclusion of other products that may be suitable.

and 3). Providing calves with 0.5 to 1.5 kg/calf daily of a diet formulated to balance for grass conditions can yield a 0.1 to 0.25 kg/day increase in weight gain. Intakes of the creep diet can be limited via the use of salt. Limit-creep-feeding offers many advantages over a preweaning program under most circumstances.

TABLE 2. INFLUENCE OF LIMITED-CREEP-FEEDING ON FEEDLOT PERFORMANCE (2)

Item	Control	Creep	Preconditioned
Sale weight, kg	231	233	226
Daily gain, kg	0.86	1.00	0.93
Morbidity, %	26	2	10
Mortality, %	2	0	0

TABLE 3. INFLUENCE OF A LIMIT-FED (1.7 kg/hd/d), 16% PROTEIN CREEP DIET ON FEEDER CALVES (3)

Item	Control	Limit Creep	LC + Bovatec[a]
Preweaning ADG, kg	0.53[b]	0.65[c]	0.65[c]
Creep feed/added gain	--	5.5	5.2
Transport shrink, kg.	5.3[b]	9.0[c]	5.0[b]
Feedlot ADG, kg	0.95[b]	1.04[c]	1.06[c]
Treatments/calf	3.2	2.6	2.7

[a] Limited creep with Bovatec. [b,c] Means on same row with unlike superscripts are different ($P < .05$).

Most auction/order-buyer facilities provide calves with a diet of low quality hay; properly formulated diets and supplements are usually not provided. Compared to calves fed low-quality hay, calves fed a 50% concentrate pretransport diet will have less sickness and death loss at the feedyard (Table 4). However, because some calves will not eat a 50% concentrate diet at the auction/order-buyer facility, calves should be fed good quality hay plus a 50% concentrate diet. During the short stay in the auction/order-buyer barn, most freshly weaned calves will eat only enough feed to meet their maintenance energy requirements (4,5). The diet, therefore, should be formulated so that requirements for other nutrients are met with an intake of about 1% of body weight.

TABLE 4. ORDER-BUYER BARN DIET AND FEEDLOT PERFORMANCE (5,6,7)

Item	Hay	50% Grain	Improvement
Daily gain, kg	1.14	1.22	6.8%
Morbidity, %	44.5	39.3	13.2%
Mortality, %	6.15	2.99	
Feed/gain	5.57	5.41	2.9%

RECEIVING NUTRITION

The diet fed during the first 2 to 4 weeks after arrival at the feedyard can significantly affect morbidity, mortality, performance, and cost of gain. There is probably no-single-best receiving program for the newly arrived stressed calf. The

optimum program for each load of calves depends on the background of the calves, the amount of stress encountered during marketing, feed costs, and cattle costs.

A major problem in feeding the market/transport stressed calf is poor feed intakes. Feed intake of stressed calves is highly variable and many calves do not obtain adequate intakes until the second or third week after arrival, which makes proper formulation of the diets difficult.

ENERGY. In general, as the energy concentration of the receiving diet increases morbidity and mortality increase, performance improves and costs of gain decline. Adverse health effects of feeding higher energy (60 to 75% concentrate) diets to stressed calves can be overcome by providing free-choice good quality hay along with the concentrate diet for the first 3 to 7 days after arrival (Table 5).

TABLE 5. INFLUENCE OF FEEDING ALFALFA OR NATIVE HAY WITH A 75% CONCENTRATE RECEIVING DIET ON FEEDER CALVES (8)

Item	75% Conc.	+ Alfalfa	+ Native
Morbidity, %	41	37	30
Mortality, %	0.9	0.0	0.9
Daily gain, kg	0.46	0.51	0.41
Feed/gain	7.99	8.04	9.64
Relative cost/kg. gain	1.00	0.84	0.89

Adding 4% fat to the receiving diet of stressed calves improved animal performance but increased the percentage of sick calves that died (9). This suggests that fat can be used in the receiving diet, but it should not be added to hospital pen diets.

Stressed calves prefer a dry diet over a diet high in corn silage but appear to adapt to a corn silage based ration within 7 to 14 days (10-15). Type of grain in the receiving diet appears to have little effect on calf health or performance. However, best results appear to be obtained when a mixture of grains is fed (16-18).

PROTEIN. The crude protein requirements of stressed calves (g/day) do not appear to be appreciably increased over those of non-stressed calves. However, because of low feed intakes, the concentration of protein in the diet must be increased to meet the calves requirements. We currently recommend a crude protein concentration of 13 to 14% in receiving rations (19-23). Urea intakes should be limited to less than 30 g/head daily during the first 2 weeks after arrival (24-26).

In general, feeding high "ruminal escape" (bypass) proteins to stressed calves has produced favorable results (12, 20, 25, 27-29). Best results are obtained when about 60% of supplemental protein (i.e. 45% of total protein or 5.4% of diet dry matter) is composed of ruminal escape protein (30).

MINERALS. Data with most minerals suggests that the actual requirements (g or mg/day) of stressed calves are not appreciably increased compared to non-stressed calves, however, the concentrations in the receiving diet must be increased to compensate for reduced feed intakes. One exception is potassium. The K requirement of stressed calves appears to be about 20% greater than non-stressed calves (7).

Studies on the requirements of trace minerals (Cu, Fe, Zn, Se) for stressed calves have been inconclusive. In addition, studies using chelated forms of these minerals compared to inorganic forms have yielded variable results.

VITAMINS. Studies testing the effects of injecting or feeding vitamins to stressed calves have also yielded variable results (Table 6). Some studies have shown dramatic improvements in health and performance while others have shown no effect.

OTHER NUTRITIONAL FACTORS. The use of feed additives in receiving rations must be based on factors such as need, efficacy, cost, and legality of combinations. Antibiotics (e.g. AS-700) in receiving diets have generally shown good results when

morbidity and mortality were not high (31,38). When morbidity and mortality were high, use of antibiotics in the feed has been less promising, probably simply because calves did not eat the ration containing the antibiotic. Lofgreen (8) and Hicks (36) have reported excellent results with administration of "long-acting" antibiotics upon arrival, however, other results have been less favorable (Cole; Galyean, unpublished data).

TABLE 6. INFLUENCE OF VITAMIN SUPPLEMENTATION ON FEEDER CALVES (4,5,31-37)

Vitamin(s) given	Method of Administ.	% change with supplementation		
		Morbidity	ADG	Gain/feed
A & D	Inject	-3.0	+4.1	-1.1
A, D & B_{12}	Inject	+3.0	+1.6	+2.4
Thiamine (1 g/hd)	Fed	-17.0	+2.0	---
Niacin (250 ppm)	Fed	-4.0	+29.0	+45.0
B complex	Fed	-3.0	+4.2	+5.1
E (400 IU/hd/d)	Fed	-2.6	+5.2	+5.0
E + B complex	Fed	-0.5	+10.9	+10.9
E (1600 IU/hd/d)	Fed	-11.7	+22.2	+28.5
E (2000 IU)	Inject	0.0	0.0	+7.6

Many stressed feeder calves excrete coccidia oocysts and studies have indicated that the feeding of a coccidiostat upon arrival can improve daily gains 5 to 17%, reduce feed/gain ratio 14 to 34% and reduce mortality 14 to 58% (39,40).

Most calves that enter feedyards carry a parasite burden, even if given an anthelmintic 30 days before shipment (41; Cole & Hutcheson, unpublished data). Parasites can have a marked effect on energy requirements (42,43), therefore, all calves should be treated for internal and external parasites even if they were "preconditioned."

Some studies have shown beneficial effects of feeding (or dosing) Lactobacillus, yeast, and other microbial cultures upon arrival (44-47). In general, the results have been variable and dose dependent. The use of these products in sick calves appears to be more promising than mass use in all incoming calves.

TABLE 7. RECOMMENDED NUTRIENT CONTENT OF A RECEIVING DIET FOR MARKET-TRANSPORT STRESSED FEEDER CALVES

Nutrient	Suggested Range	Nutrient	Suggested range
Dry matter, %	82-90	Sulfur, %	0.15-0.25
NEm, mcal/kg	1.3-1.9[a]	Manganese, ppm	40-70
NEg, mcal/kg	0.8-1.1[a]	Copper, ppm	10-15
Concentrate, %	50-70	Iron, ppm	100-150
Crude protein,%	13.0-14.5	Zinc, ppm	75-100
Calcium, %	0.5-0.7	Selenium, ppm	0.1-0.2
Phosphorus, %	0.4-0.5	Cobalt, ppm	0.1-0.2
Potassium, %	1.0-1.3	Vitamin A, IU/lb	1000-2000[b]
Sodium, %	0.2-0.3	Vitamin E, IU/lb	20-50[b]
Magnesium, %	0.2-0.3		

[a] For calves weighing 200 kg or less use the greater value, for 250 kg calves use an intermediate value and for 300 kg calves and yearlings use the lower value. Ration should be fed with free-choice hay for the first 3-7 days.

[b] If supplement is pelleted, double value to compensate for loss during pelleting.

A number of commercial products have been sold over the years which report to improve ruminal function and thus improve feed intake, health and performance. In general, however, the stress of administering these products is often greater than the benefits received (31,48). Our studies indicate that metabolic, rather than ruminal, factors have a more important role in the control of feed intake in stressed calves (49,50).

Suggested nutrient concentrations in a receiving diet for stressed feeder calves are presented in Table 7. As a general rule of thumb, receiving diets should be formulated so that the calf receives at least maintenance requirements of protein, vitamins and minerals when feed consumption is 1% to 1.5% of body weight.

MANAGEMENT PRACTICES

GENETICS. Livestock can be selected for their ability to develop an immune response to a specific antigen, however, selection for resistance to one antigen does not assure improved resistance to other antigens. Selection for disease resistance appears to adversely affect animal performance (51). Selection for resistance to various stressors can have beneficial effects on animal performance, but only when they are exposed to those stressors (52).

SURGERY. Castration and dehorning have adverse effects on animal health and performance; however, these effects do not appear to be additive (34). Castrating and/or dehorning calves at the farm 30 days before sale will result in a net loss in weaning weight of about 3%. For each month earlier, this effect on weaning weight will be reduced about 0.5% (for example, castration at 3 months before sale will reduce weaning weight 2%, etc). Calves that are castrated and/or dehorned upon arrival at the feedyard will have more sickness, poorer daily gain, and poorer feed conversion compared to polled steers (Table 8). Tipping horns has little effect on weight gains, if bleeding is kept to a minimum (53).

TABLE 8. INFLUENCE OF CONDUCTING PROCEDURES ON THE FARM vs AT THE FEEDYARD ON FEEDER CALF HEALTH AND PERFORMANCE (% change)

Item	Vaccinate	Surgery[a]	Prewean	Limit-creep
Farm gains	- 3	- 6	+ 2	+ 2
Shrink	NE[b]	?	+ 14	- 5
Feedlot gain	NE	+ 2	- 1	+ 2
Gain/feed	NE	+ 2	- 4	+ 2
Morbidity	NE	- 25	-20	-25

[a] Castration and dehorning. [b] No effect. Vaccine data does not include some of the newer Pasteurella haemolytica vaccines.

IMPLANTS. Studies have indicated that prestress implanting with zeranol (Ralgro) will reduce heat or cold stress in calves (54,55) and reduce disease problems in veal calves (56). Studies in feeder calves have failed to demonstrate a reduced incidence of BRD in calves implanted 30 days before transport to the feedyard, although animal performance was improved compared with non-implanted calves (26,57).

TRANSPORT. The major stressors associated with transport are loading and noise (58). With hauls of 24 hours or less, the length of transport does not appear to be related to the incidence of BRD (59). The location of calves within the transport trailer does not appear to be related to subsequent health or performance (60-62).

PRECONDITIONING. In this context preconditioning consists of an intensive management and nutritional regimen conducted by the cow-calf producer. In general, the practice appears to offer few true economic advantages to the cow-calf producer or feeder (Table 1; 63,64). However, certain segments of the program, castration

for example, can offer significant economic advantages (Table 8). Replacement of the preweaning period with a limited-creep-feeding period appears to offer significant economic advantages (Table 2).

PRESTRESS/POSTSTRESS INTERACTIONS.

Management and nutritional factors which occur before the stress of marketing/transport can markedly influence the optimum management and nutritional practices needed after arrival at the feedyard. If calves have been consuming a high-protein diet (ie. lush grass) before transport, higher protein concentrations are required in the receiving diet (22). Calves that have been accustomed to concentrate diets at the farm of origin will eat more of a concentrate based receiving diet than calves unaccustomed to concentrates but will eat about the same amount of high roughage diets (Cole et al., unpublished data). The "best" post-shipment management procedures will be dependent upon the pre-shipment management.

Galyean, (37) reported an interaction between a commercial Pasteurella haemolytica vaccine and injections of vitamin E. The Ph vaccine reduced morbidity when calves were not injected with vitamin E but had no effect on morbidity when calves were injected with vitamin E. This suggests there may be interactions between vaccination and other processing procedures calves receive on arrival at the feedyard.

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SUMMARY

Although general recommendations can be made concerning the preshipment and postshipment nutrition and management of stressed feeder calves, research data and practical experience indicate that no one best program can be devised for every load of calves. The practitioner, consultant and cattle feeder must be prepared to adjust management to fit each load of calves.