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Introduction

Feeding and management practices during the first few weeks following arrival of new cattle at the feedlot can have a major influence on problems encountered, need for medication, weight gain and death loss during the period of feedlot adaptation and later performance during growing and finishing. Of primary importance are rations that will be consumed readily and furnish adequate amounts of energy and essential nutrients. Nutritional requirements and management practices, including medication, will vary with age and weight of the cattle. Previous nutritional history influences the general health of the animals and body stores of several nutrients and will, therefore, have an important bearing upon the initial ration and levels of supplementation needed. The amount of handling, time and distance shipped, weather conditions and degree of exposure to strange cattle and facilities are other factors affecting the degree of stress and thus the medication and dietary needs following arrival. Therefore, it is apparent that rations, type of supplementation and levels of various nutrients may vary somewhat for different groups of cattle.

Several factors to consider in feeding and management of new feedlot cattle are discussed in this report. Information is taken from our research where appropriate. Many shipments of cattle were used in research during past years to study various feeding and management systems during the first 3 to 4 weeks in the feedlot with data obtained on performance during this time and later growing and finishing in some instances.

Age and Weight

The ability of feeder cattle to withstand stresses of handling, shipping and changes in location and type of ration improves with age. Resistance to infections also improves with age and ration changes are generally more pronounced for newly weaned calves than for those weaned some time prior to shipping. One should expect less problem from disease and death loss and a faster adaptation to feedlot conditions and rations with calves that have been weaned for a month or more and consuming liberal amounts of a properly balanced ration prior to shipping than from calves sorted from their dams and shipped immediately thereafter. Problems also should be expected to be less for those weaned 6 months or more previously than for calves weaned for only about a month. Age and weight at weaning are also important considerations as to type of ration and its nutrient concentration. Our experience has been that calves weighing much less than 360 lb. present considerably different problems than those weighing 400 lb. or more at weaning. However, the relative effects of age, previous nutritional history and degree of shrink should be considered in evaluating importance of weight.

Feed capacity is less but nutrient concentration of rations needs to be greater for the lighter animals for similar rates of gain. The current National Research Council publication on Nutrient Requirements of Beef Cattle lists pounds of dry matter consumption, percent protein and Mcal/lb. of metabolizable energy at 8.4, 14.1 and 1.27, respectively, for a 330-lb. steer calf to gain 2.00 lb. daily. Corresponding values for a 440-lb. steer are 10.8, 12.3 and 1.22 and for a 660-lb. one, 17.9, 10.0 and 1.18. Rations should be approximately 70, 55 and 35% concentrates on a dry basis to meet these energy requirements. These requirements are for maintenance and growth at the rate specified which should be adequate to maintain a healthy and thrifty condition even though higher energy rations would likely support greater weight gains, especially for the older animals. It is quite evident from these requirements that weight and age of feedlot cattle have a major influence on the type of ration that should be offered upon arrival at the feedlot.

Weight for age and weighing conditions are important considerations for both the buyer and seller. An advantage for one may be a disadvantage for the other unless prices are adjusted accordingly. Reduction in weight from shrinkage may be recovered rapidly under proper feeding if resulting only from loss of fill of feed and water. Light weight for age because of restricted feed intake can result in improved gains and feed efficiency under later liberal intake of energy and adequate levels of other essential nutrients. On the other hand, both shrink and restricted feeding may be carried to the point where general health and resistance of the animal may be affected, resulting in greater risks as to disease problems and losses during early stages in the feedlot.

Previous Rations and Levels of Feeding

It is generally recommended that major changes in rations for cattle should be made gradually. Much of the nutrients available to the ruminant are the results of microbial degradation and synthesis. Most beneficial effects appear to be obtained when the microflora are adapted to the rumen conditions typical for the ration fed. The gradual changes pertain to sources and levels of protein and readily available energy. Any reasonable change in levels of minerals and vitamins in relation to requirements should be of no particular concern.

The time involved for ration changes should depend upon the nature of the changes to be made in kinds and amounts of feed. Changes from high levels of roughage to high levels of concentrates (80% or more) are commonly made over periods of about 2 to 3 weeks with minimum apparent digestive problems. Ration changes involving increases in roughage usually can be made abruptly without problems with the cattle.

Moisture content of feeds, especially those associated with bloat and digestive disorders, may be a factor to consider. A change from a high-moisture feed to a low-moisture one may result in a substantial increase in dry matter offered unless the amount is adjusted to account for differences in moisture. Sudden and large increases in amount of feed because of variations in moisture content and sudden changes from high moisture to dry feeds have been associated with digestive disorders and even death losses.

Previous rations may impose some restriction on the amount of energy and protein that should be offered. However, the restriction should not be serious and only temporary under good management. The gradual changes to more concentrated rations probably can be accomplished best by initial liberal feeding of roughages and limited concentrates with a gradual reduction in roughages and appropriate increases in concentrates to the desired level. This early limitation on concentrates offered and the possibility of initial low feed intake, especially with calves just weaned and not creep-fed, means that higher than normal concentrations of protein, minerals and vitamins may be needed in supplements, concentrates or total rations. While concentrations are often expressed per unit of feed, it is the total amount consumed by the animal that is important and feed intake has to be taken into account.

Animals previously accustomed to grain adapt more readily and at a faster rate to high-concentrate rations. Effects of previous ration on the response to a rapid increase in amount of corn grain are illustrated from one of our studies during a drylot finishing phase for cattle fed various levels of corn grain when grazing alfalfa-brome pasture. Drylot rations consisted of 2 lb. of 40% protein pelleted supplement and whole corn grain. All treatment groups were started at 2 lb. protein supplement and 3 lb. corn per head daily. The corn was increased by 3 lb. per head daily until grain remained in the feed bunk at the next feeding. Thereafter, corn was fed in amounts to be available at all times for each group of cattle. Abbreviated results of the experiment are shown in table 1.

Table 1. Previous Level of Grain Feeding and Response to Rapid Increases in Grain

	Previous level of corn			
	0	3 lb.	6 lb.	FF[a]
Number	32	32	32	32
Initial wt., lb.	714	745	762	818
Avg. daily gain to date, lb.				
4 weeks	1.66	1.82	2.29	2.92
8 weeks	2.87	2.85	3.07	3.14
Avg. daily feed to date, lb.				
4 weeks	14.1	14.6	14.4	17.0
8 weeks	17.8	17.8	17.9	19.2

[a] FF = full-fed.

While the increases in corn offered were higher than usually recommended, no problems of illness were evident and no founder occurred during the course of the experiment to final slaughter weights. The cattle were on full feed in 4 to 6 days. The 0, 3- and 6-lb. corn groups consumed about the same amount of grain. However, weight gains were higher during the first 4 weeks for cattle previously fed 3 lb. corn than for the no corn group and higher for the 6-lb. group than for those previously fed at the 3-lb. level. Highest rate of gain during the first 4-week period was obtained with steers previously full-fed (avg. about 14 lb.) and they also consumed more feed. After the initial 4-week period, rates of gain were improved for all treatment groups with more improvement noted for those on the previous lower levels of grain.

Results of this experiment show that previous level of concentrate feeding is a factor to take into consideration in the rate at which new feedlot cattle should be raised to a full feed of a high-concentrate ration. In this experiment, cattle previously fed at the higher levels of concentrates and making faster rates of gain continued to gain at higher rates when increased rapidly to a full feed of an all-concentrate ration. The large improvement in weight gains during the second 4-week period for groups fed limited grain on pasture in comparison to the full-fed group indicates that a more gradual increase to the all- o concentrate ration would have been more desirable.

Energy Levels and Types of Rations

Much has been said and written as to how new feedlot cattle should be handled and the best kind of rations to feed. Many recommendations have emphasized a need for going slow on high-energy and high-protein feeds. It is evident that age, weight and previous nutritional history are factors to consider. Therefore, procedures and rations may vary considerably between various groups of cattle.

Energy requirements of an animal have to be stated on basis of maintenance plus a specific type and rate of production. Necessary energy concentration of rations may be estimated rather accurately for specific rates of gain during various stages of growing and finishing. On the other hand, a number of factors become involved in selecting the proper level of energy in rations for newly arrived feedlot cattle. The concern is not so much in furnishing energy to support a specific rate of gain. It is mainly a matter of furnishing energy above maintenance at a level to rapidly recover shrink resulting from handling and transit and to support body weight gains at levels indicative of healthy and thrifty cattle.

In one of our experiments, we compared a high-energy ration of 4 lb. chopped alfalfa, 1 lb. protein supplement and a full feed of corn grain with one composed of corn silage and 2 lb. of protein supplement. The calves had been fed a high-roughage ration for about 4 weeks from weaning until the start of the experiment. The group fed the high-energy ration was raised to a full feed of corn over a period of 2 weeks by a gradual reduction in hay to the 4-lb. level with an increase in the amount of corn. Corn silage was essentially full-fed from the beginning of the experiment for the group fed silage.

A summary of the results through 12 weeks is shown in table 2.

Average daily gain was about the same after 4 weeks for calves full-fed corn grain and for those full-fed corn silage. Daily corn intake with high-energy and limited amount of hay reached about 11 lb. per head by 2 weeks and remained at approximately this level for the remainder of the first 4-week period. Intake of corn silage reached about 29 lb. by the end of the first week for the group full-fed corn silage and remained at about this level for the remainder of the first 4-week period. However, weight gains were improved somewhat for the higher energy group after the initial 4-week period. No problems were encountered with shipping fever or other illness during the 12 weeks of the experiment.

Table 2. Corn Silage vs High-Grain Rations

	Alfalfa hay corn grain[a]		Corn silage[b]	
Number	24		24	
Initial shrunk wt., lb.	424		424	
12-week wt., lb.	637		594	
Avg. daily gain, lb.	last period	to date	last period	to date
4 weeks	1.48	--	1.49	--
8 weeks	3.26	2.37	2.66	2.08
12 weeks	2.85	2.53	1.91	2.02
Avg. daily feed, lb.				
4 weeks	15.6[c]	--	27.7	--
8 weeks	18.4	17.0	33.0	30.4
12 weeks	22.2	17.5	37.7	32.8
Feed/100 lb. gain to date, lb.				
4 weeks	1053		1857	
8 weeks	715		1463	
12 weeks	691		1635	

[a] Four lb. alfalfa hay, 1 lb. protein supplement and corn grain full-fed.
[b] Two lb. protein supplement and corn silage full-fed.
[c] Includes 3.7 lb. corn silage for this period.

Results of the experiment show properly supplemented corn silage to be a satisfactory feed for weaned calves weighing slightly over 400 lb. during early stages in the feedlot. There was no advantage during the first month on basis of weight gain or general health for a higher energy ration of alfalfa hay and corn grain.

Rations with about 35% concentrates and adequate levels of protein, vitamins and minerals should support weight gains in the order of 1.5 to 2.0 lb. daily for 400- to 450-lb. calves. Well-eared corn silage properly supplemented should meet these requirements. It is also a palatable feed and readily consumed by calves after weaning, especially if fed with a small quantity of hay for two or three feedings. Body weight gains of this order should be indicative of thrifty and healthy cattle. Higher levels of concentrates during the first month of feedlot adaptation have not appeared to offer much advantage in our experiments over rations with about 35% concentrates for calves or yearlings. In view of likely problems from too rapid adjustment to high-concentrate rations for new feedlot cattle, a level of about 35% concentrates or a ration composed largely of well-eared corn silage would appear to be appropriate during the first month of feedlot adaptation.

Protein Level

The daily intake of protein is of major importance for new feedlot cattle. It is required in relatively large amounts in relation to other nutrients. While there is evidence of a protein reserve in the body, it can become depleted in a short time when intake is deficient, especially during periods of stress

and when animals are suffering from various infections. Protein-depleted animals are also more susceptible to infections than those receiving an adequate intake and having adequate protein reserves. For these reasons, it would appear to be a sound management practice to provide new feedlot cattle with a liberal intake of protein. In view of the general uncertainties as to previous nutrition and feed intake by individual animals during early stages in the feedlot, supplementation in excess of requirements for maintenance and growth expected from the ration would appear to be a desirable practice.

We have tested various levels of protein in rations during feedlot adaptation for both calves and yearlings. In one experiment, calves were weaned, shipped and started on a ration of 3 lb. alfalfa-brome hay, 3 lb. of supplement and a full feed of corn silage. The supplements were formulated to contain 8, 20, 32 and 44% protein by varying the ratios of corn and high-protein soybean meal. The objective was to determine the effects of protein intake during feedlot adaptation and the experiment was terminated after 4 weeks.

Some results from this experiment are shown in table 3. Good rates of gain were obtained from all treatments. Handling conditions were such that the initial shrink was likely greater than that resulting from the overnight stand without feed and water at the end of the experiment.

Table 3. Levels of Protein Supplementation During Feedlot Adaptation of Calves
(Heifer Calves--Oct. 23 to Nov. 21--29 days)

	Percent protein in supplement[a]			
	8	20	32	44
Number	19	19	19	19
Initial wt., lb.	374	374	373	375
Final wt., lb.	422	431	424	434
Avg. daily gain to date, lb.				
7 days	1.90	2.78	2.47	2.71
14 days	1.93	2.50	2.26	2.66
21 days	2.40	2.72	2.59	2.95
28 days (filled basis)	2.24	2.45	2.31	2.52
28 days (shrunk basis)	1.67	1.95	1.75	2.01
Avg. daily feed to date, lb.				
7 days	10.4	10.2	10.1	10.9
14 days	10.7	10.8	10.9	11.1
21 days	12.1	12.3	12.3	12.6
28 days	13.7	14.0	13.0	14.4

[a] Fed at 3 lb. per head daily.

The ration for the low-protein control group was estimated to contain about 10.5% protein, dry basis. Each increment increase amounted to about 3 percentage units. Calves fed the ration with 3 lb. of 20% protein supplement gained at a faster rate than the low-protein control group. The advantage was especially pronounced during the first and second weeks of the experiment. There was only a small change in feed consumption from the higher levels of protein supplementation.

Feeding supplements with more than 20% protein (about 13.5% ration protein, dry basis) in this experiment did not appear to offer any additional improvement in weight gain or feed utilization. No problems were encountered from shipping fever or other diseases during the 4-week experiment.

An experiment was also conducted with yearling cattle at about the same time, at the same location and using the same ration treatments as for the calves. The yearlings had grazed native prairie pasture the previous pasture season and had not been fed grain prior to the experiment. Results of this experiment are presented in table 4. The high initial rates of gain no doubt reflect the recovery of shrink from shipping and the overnight stand without feed and water.

Table 4. Levels of Protein Supplementation During Feedlot Adaptation of Yearlings
(Yearling Steers and Heifers--Oct. 23 to Nov. 21--29 days)

	Percent protein in supplement[a]			
	8	20	32	44
Number	16	16	16	16
Initial wt., lb.	666	667	669	668
Final shrunk wt., lb.	717	720	735	735
Avg. daily gain to date, lb.				
7 days	2.56	3.13	5.04	4.88
14 days	3.05	2.97	3.38	4.47
21 days	2.71	2.74	3.16	3.76
28 days (filled basis)	2.58	2.60	3.28	3.09
29 days (shrunk basis)	1.76	1.84	2.31	2.32
Avg. daily feed to date, lb.				
7 days	20.9	21.3	22.8	23.2
14 days	24.8	24.8	24.9	27.0
21 days	26.1	26.5	27.9	29.0
28 days	27.2	27.5	29.3	30.4

[a] Fed at 3 lb. per head daily.

Rations with 3 lb. of the 8% protein supplement were estimated to contain about 10% total protein, dry basis. Because of the higher intake of corn silage in comparison to that for the calves, each increment increase in protein amounted to about 1.7 percentage units in total ration protein.

Rates of gain were improved by increasing the level of protein in the ration. Maximum improvement appeared to be obtained with 3 lb. of 32% protein supplement (about 13.4% total ration protein, dry basis). This is about the same level of protein in the ration that resulted in maximum performance for calves during the 4-week adaptation period. Results with yearlings differed from calves in that feed consumption was increased with the higher levels of protein. However, feed efficiency was also improved.

Results of other experiments with calves fed a variety of rations also indicate a need for protein of about the levels used (13.5%, dry basis) in these experiments for maximum weight gains during the first few weeks following weaning and shipping.

Nonprotein Nitrogen Supplements

The widespread use of nonprotein nitrogen compounds (primarily urea) as replacements for preformed protein in growing and finishing rations for cattle raises questions regarding the advisability of including these compounds in rations for feedlot cattle upon arrival. Cattle unaccustomed to urea frequently show a lower rate of gain when fed urea-containing rations in comparison to those fed conventional high-protein ingredients such as soybean meal. This lower rate of gain is generally evident during the first month in the feedlot, but it may be influenced in length and severity by the age of cattle, previous feeding, nature of ration and level of urea.

We have studied the effects of feeding rations containing urea under a variety of conditions in some of our research on feedlot adaptation of cattle. Comparisons of weight gains and feed consumption where calves were weaned, shipped and offered a ration of prairie hay and 2 lb. of a 40% protein supplement are shown in table 5. One supplement was composed of soybean meal with minerals, vitamin A and chlortetracycline. In the other one, 4% urea and corn grain replaced part of the soybean meal to give the same amount of protein.

Rate of gain was at a lower rate (0.27 lb. daily) with urea during the adaptation period of 37 days. Feed intake was only slightly lower for the cattle fed urea. Results show a reduction in weight gains of the calves even though urea furnished only about 28% of the protein in the supplement.

Table 5. Urea Utilization with Prairie Hay--
Adaptation Phase (Nov. 20 to Dec. 27--37 days)

	Type of supplement	
	4% urea	SBOM control
Number	32	32
Avg. initial wt., lb.	422	422
Avg. final wt., lb.	473	482
Avg. daily gain, lb.	1.34	1.61
Avg. daily ration, lb.	12.9	13.2

After this initial period, the calves were fed supplements with either 4 or 8% urea along with a full feed of prairie hay. Allotment was on basis of the previous supplements. Results of weight gain for the first 2 months and for the 126-day wintering experiment are shown in table 6.

Results show that offering urea after the calves had been on feed 1 month depressed weight gain initially in comparison to calves previously fed urea. There was a pronounced recovery by the end of the second month, and there were little differences between groups at the end of the experiment except for a lower gain for calves fed the supplement with 8% urea without a period of adaptation at a lower level. Starting calves on the supplements with urea or introducing it 1 month later had only a small effect on total winter gain. However, one might expect that the later date would be at a less critical time and be more advisable from the standpoint of likely problems with the calves.

Table 6. Urea Utilization with Prairie Hay--
Wintering Phase (Dec. 27 to May 2--126 days)

	Type of supplement			
Adaptation supplement	4% urea	4% urea	SBOM	SBOM
Wintering supplement	4% urea	8% urea	4% urea	8% urea
Number	16	16	16	16
Avg. initial wt., lb.	471	465	476	475
Avg. final wt., lb.	601	594	602	583
Avg. daily gain, lb.				
First month	0.81	0.71	0.02	0.32
Second month	1.16	1.06	1.37	1.10
126-day experiment	1.04	1.03	1.00	0.86
Avg. daily ration, lb.				
Prairie hay	12.8	13.0	12.9	13.1
Supplement	2.0	2.0	2.0	2.0
Feed/100 lb. gain, lb.				
Prairie hay	1240	1269	1288	1534
Supplement	194	195	200	235

Other experiments with low energy rations and urea supplements have not been consistent in the initial depression in weight gains with 2 lb. of about 40% protein supplements containing 4% urea. However, the depression has occurred often enough to question the practice of using this much more before newly weaned calves have adjusted to feedlot conditions, appear healthy and are consuming adequate amounts of feed. A corn-urea supplement with 8% or more urea has presented problems in feed consumption and resulted in more reduction in weight gains than supplements with only 4% urea.

Older cattle fed rations with higher amounts of energy show a somewhat different response to urea than do newly weaned calves fed low-energy diets. Results of such an experiment where corn silage was full-fed with 2 lb. of 40% supplement are shown in table 7. Urea comprised 11.8% of the supplement and was the only supplemental protein to the corn silage and corn grain.

Results of this experiment show that urea as the major supplemental protein to the corn silage was fully equal to soybean meal. Previous ration was corn grain and alfalfa hay. Previous adaptation to feedlot conditions resulting in older and heavier cattle and a high level of protein may have had effects on the results obtained. In other experiments, urea as the major supplemental protein to high-moisture ground ear corn rations has been fully equal to soybean meal. Under these conditions with cattle fed for periods of 3 to 4 months prior to use in the experiments, there frequently was no evidence of a period of adaptation to urea.

Table 7. Periodic Weight Gains of Steers Fed Corn Silage Supplemented With Soybean Meal or Urea (April 8 to December 9--245 days)

	SBOM	Urea
Number	60	60
Initial wt., lb.	640	639
Weight gain per head		
1 to 29 days, lb.	46	50
% of SBOM		109
29 to 85 days, lb.	136	126
% of SBOM to date		97
85 to 113 days, lb.	58	54
% of SBOM to date		96
113 to 141 days, lb.	60	62
% of SBOM to date		97
141 to 183 days, lb.	103	108
% of SBOM to date		99
183 to 215 days, lb.	87	87
% of SBOM to date		99
215 to 245 days, lb.	14	15
Total for 254 days, lb.	504	502
% of SBOM to date		100

We have also found no advantage in delaying urea supplementation for 2 or 4 weeks in comparison to feeding it from the beginning of the experiment for cattle weaned for 3 to 4 months and offered a full feed of corn silage or higher energy rations. Weight gains were similar to those when feeding a soybean meal supplement. Age, weight, previous treatment and type of ration offered are no doubt factors having important effects on results obtained with urea supplements. Older cattle are more resistant to stresses of shipping and adaptation to a new location and rations than are calves weaned and immediately subjected to these stresses. Under such conditions with older cattle and liberal quantities of energy, it would appear unnecessary to avoid urea as the major supplemental protein for periods of 2 to 4 weeks after arrival of the cattle. Adaptation to urea under these conditions may be accomplished with less evident depression in feedlot performance at the same time as adaptation to a new location and ration changes than at a later date.

Minerals

Requirements for most essential mineral elements for cattle are given in tables of nutrient requirements. In several instances, requirements are based on a meager amount of experimental data. However, stated levels are probably on the liberal side for most of the mineral elements. Cattle consuming adequate levels of feed should present no problems as to deficiencies or a need for special supplementation other than requirement levels for maintenance and growth.

New feeder cattle may require some special consideration as to mineral supplementation. However, little research data are available upon which to base recommendations for use of electrolytes for forced mineral supplementation at levels greater than those required for maintenance and growth. Obviously, conditions may vary greatly because of the nature of minerals as to body storage, age of cattle, previous nutrition and disease problems encountered. Sick animals not eating or drinking certainly require different levels and methods of supplementation than apparent healthy ones consuming adequate amounts of feed and water.

Animals subjected to stress and inadequate water intake become dehydrated because of a negative water balance. When accompanied by disease resulting in elevated body temperature and/or diarrhea, water loss is more severe and it becomes important that the water balance be corrected. Water loss, especially from diarrhea, results in losses of several minerals from the body. Since body reserves for several are quite low, special supplementation under such conditions may be indicated either on a group or individual basis depending on the magnitude of the conditions encountered.

Mineral supplementation for new feedlot cattle may be accomplished by usual mineral ingredients such as calcium supplements, phosphorus supplements and salt containing trace minerals or a separate trace mineral premix except under those cases where special forced treatment may be indicated. Forced feeding through the supplement or in the mixed ration should be preferred to offering free choice to insure adequate and uniform consumption. Concentrations in excess of require-ments for maintenance and growth in the feed would appear in order during early stages in the feedlot because of the uncertainties as to previous nutrition, likely disease problems and feed consumption. We have followed a practice of approximately doubling recommended feeding levels for calcium, phosphorus and salt with trace elements during the first month for new feedlot cattle. While we have no controlled tests as to the effectiveness of such a practice, sick animals and death losses have been quite low with most groups of cattle.

Vitamins

Vitamin supplementation must be considered in any feeding program for new feedlot cattle. As mentioned for other nutrients, supplemental needs depend upon age and weight of cattle, previous nutrition and nature of the ration.

The young calf has been shown to have a dietary requirement for the B-complex vitamins. However, those of typical weaning age have not been shown to benefit from supplementing with B vitamins when fed common types of rations. If supplementation is indicated, it would most likely be for those not eating or drinking with treatment on an individual basis, which often and probably should include B vitamins.

In view of the apparent wide distribution of vitamins E and K in feeds and vitamin D from sun-cured forages and exposure to sunlight, no special supplementation of these vitamins would appear needed. Experimental evidence for any beneficial effect is lacking with common type rations.

The need for supplemental vitamin A has received considerable attention during past years. The liver serves as a major storehouse for vitamin A, but liver storage does not reach a high level in young cattle. This fact along with the uncertainty of previous intake and an accelerated rate of depletion under conditions of stress and disease have been used to justify relatively high rates of vitamin A supplementation for new feedlot cattle.

The requirement of vitamin A for maintenance and growth by cattle has been shown to be about 2000 IU per 100 lb. of body weight or 1000 IU per pound of ration. These levels appear ample for optimum growth with absence of deficiency symptoms. However, levels need to be some three times higher to allow for significant liver storage of the vitamin over a period of 2 to 3 months. While the amount of liver storage may be important during times when there may be an increase in demand or during periods of low intake, there is no evidence of a specific need for liver storage when the requirements are met through daily intake. However, this cannot be counted on for new feedlot cattle, and supplementation in excess of requirements for maintenance and growth during early stages in the feedlot is indicated.

Vitamin A may be administered in the feed, water, capsule or injected. It is absorbed readily from the digestive tract. Therefore, adequate levels in the feed should be sufficient except for animals not consuming feed. If not consuming adequate amounts of feed, supplementation with nutrients other than vitamin A as well as other medication are likely to be needed. In these cases, administration of vitamin A along with other medication would appear to be a sound practice.

Carotene from feeds is a satisfactory source of vitamin A for cattle with 1 mg of carotene equal to about 400 IU of vitamin A. Only good quality green, leafy forages contain appreciable quantities with dehydrated forages being the richest sources. Even with these, a considerable quantity of the carotene may be lost during storage. For these reasons, it is commonly recommended that the total need for vitamin A be supplied as the vitamin, especially for feedlot cattle.

One major function of vitamin A is in the maintenance of healthy epithelial tissues. In a deficiency, these tissues do not function properly in normal secretion, excretion and absorption. The tissues are more susceptible to invasion by bacteria. The animal is thus less resistant to infections of the respiratory and digestive tracts frequently associated with new feedlot cattle. While proper vitamin A supplementation is necessary for resistance to these infections, large surpluses do not increase the resistance. However, in view of

the several factors mentioned in determining a proper level of supplementation for new feedlot cattle, levels in excess of the requirement for maintenance and growth are deemed advisable during early stages in the feedlot. Levels about twice these requirement levels in the feed would not appear out of order for a period of about 1 month following arrival of new cattle. This has been a practice we have followed. The response as evidenced by blood levels has been prompt indicative of adequate vitamin A supplementation.

Antibacterials

Disease problems associated with shipment of cattle may result in the need for extensive medication, slow rates of gain during early stages in the feedlot and death losses. Problems are generally greater with calves weaned and shipped than for older cattle with only shipping involved. However, considerable variation may be encountered between shipments of cattle because of great variation in health prior to shipping, stress in handling, contact with other cattle and distances shipped.

Of primary concern following the shipment of cattle is avoiding death losses. This period may still be an expensive one to the feeder and may have an effect on later performance of the cattle. Therefore, preventative methods have received considerable attention in handling new feedlot cattle. First consideration should be given to an ample intake of energy and liberal amounts of other essential nutrients. The liberal amounts should include the requirements for maintenance and growth plus a reasonable surplus to take care of any necessary repletion of body reserves and any increase in needs that may result from stresses at this stage.

Disease prevention through medicated feeds should be based upon the incidence and severity of diseases likely to be encountered and the costs in relation to probable benefits. Such feeds would be indicated where problems are frequently encountered, incidence among animals is high and treatment of observed sick animals costly and late for most successful results. Often times animals may not show outward signs of any effects of shipping and adaptation to new environments. However, effects may be evident through a low rate of gain not detectable without comparing weight gains of a test group of cattle with untreated controls. Weight gain is a sensitive measure of the overall effects of treatments. Higher weight gains are indicative of healthy and more thrifty cattle.

Antibiotics and more recently antibiotics in combination with a sulfa drug have been the most widely used compounds in feeds for new feedlot cattle to control disease and to improve early feedlot performance. We have conducted a number of experiments employing these drugs under various conditions. Results of several experiments are summarized in table 8.

Calves weaned in the fall and fed prairie hay and protein supplement or corn silage and protein supplement with 300 to 350 mg chlortetracycline (CTC) daily consistently gained at a faster rate than control calves in 11 experiments shown in the table. The average improvement in rate of gain during the first month in the feedlot amounted to 18.6%. While differences in feed consumption were small, feed intake was generally slightly higher for the calves fed the antibiotic.

Table 8. Antibacterials During Feedlot Adaptation of Cattle (3 to 5 weeks for various groups)

Expt. no.	Cattle per treatment group	Init. wt., lb.	Avg. daily gain		Avg. daily feed	
			Lb.	% over control	Lb.	% over control
	Calves weaned and shipped. Fed prairie hay and protein supplement with 300 to 350 mg CTC daily.					
1	40	365	1.06	34.2	10.3	4.9
2	20	390	1.32	34.7	9.3	0.9
3	24	371	1.38	0	9.5	-1.6
4	23	388	1.12	9.8	10.5	5.0
5	12	427	0.38	8.6	10.9	7.9
6	12	394	0.77	16.7	9.1	-2.2
7	23	399	1.56	52.9	10.4	4.0
8	12	413	0.74	11.4	10.8	6.9
9	12	413	0.87	31.8	9.5	2.2
	Calves weaned and shipped. Fed corn silage and protein supplement.					
10	34	359	1.83	5.8	22.3	3.0
11	32	362	2.24	0.4	25.5	-1.5
Weighted average 11 experiments		381	1.35	18.6	13.8	2.5
	Calves wintered and shipped. Fed corn silage and protein supplement with 250 to 350 mg CTC daily.					
1	19	376	2.72	15.7	22.9	6.5
2	27	549	2.87	23.7	26.7	11.3
3	25	507	2.32	38.9	23.3	-1.7
4	20	416	3.09	24.2	26.0	-1.6
Weighted average 4 experiments		472	2.74	26.3	24.8	3.9
	Calves weaned and shipped. Fed prairie hay and protein supplement with 350 mg daily each of CTC and sulfamethazine.					
1	48	384	1.42	89.3	11.0	7.8
2	24	406	1.28	19.6	--	--
3	24	436	0.82	12.3	11.2	0
4	32	471	1.48	6.5	17.1	0.6
5	32	406	1.34	11.7	14.1	1.4

Table 8 Continued

Expt. no.	Cattle per treatment group	Init. wt., lb.	Avg. daily gain		Avg. daily feed	
			Lb.	% over control	Lb.	% over control
Calves weaned and shipped. Fed corn silage and protein supplement with 350 mg daily each of CTC and sulfamethazine.						
6	34	360	1.89	9.2	23.1	0.4
7	32	362	2.42	8.5	26.4	1.9
Weighted average 7 experiments		401	1.55	27.5	15.2	2.3
Calves wintered and shipped. Fed corn silage with 350 mg each of CTC and sulfamethazine.						
1	20	418	2.98	16.9	26.9	5.1

In five experiments where calves were shipped following wintering without an antibiotic, improvement in weight gain for antibiotic-supplemented calves amounted to 26.3%. Again, there were only small differences in feed consumption but favoring calves fed the antibiotic.

Calves were fed a combination of CTC and sulfamethazine each at 350 mg daily following weaning and shipping in seven experients and in one experiment following shipping in the spring. The improvement in weight gain for those fed the antibacterials was in general of about the same magnitude as in the experiments for calves fed CTC except for a high response in one experiment. The average amounted to 27.5% with similar feed consumption. For the experiment with cattle shipped in the spring, the improvement in weight gain amounted to 16.9%.

Results of these experiments show that high levels of supplementation with chlortetracycline (300 to 350 mg daily) to calves following weaning and shipping resulted in consistent improvements in weight gains during the first month in the feedlot. Antibiotic supplementation was started promptly upon arrival. Calves shipped following a period of wintering on low energy rations also appeared to respond to antibiotic supplementation.

Chlortetracycline in combination with sulfamethazine each at 350 mg daily for periods of about 1 month following weaning and shipping also resulted in a consistent improvement in weight gains. Animal response appeared to be similar as for chlortetracycline alone in previous experiments.

Disease problems with the calves in these experiments were minor in most instances. They had received no special previous treatments and were in transit only a few hours. When problems were encountered, they generally occurred early in the experiment. No major differences between control calves and those supplemented with the antibacterials were evident as to signs of disease and number requiring individual medication. However, the higher rates of gain for those supplemented with the antibacterials would indicate more healthy and thrifty animals.

Only results for feedlot adaptation periods of about 1 month were presented. Weight gains during this period are important only as they may reflect general health of the cattle and effects they may have on later performance. These high levels of supplementation were followed with a low level of supplementation (70 mg daily) and compared to control animals in several growing and finishing trials. Most beneficial effects were obtained when the initial high level was followed by the continuous low level. Improvements during the subsequent low level supplementation were at lower rates than during the initial high level phase. However, they were obtained over a longer period of time, and total benefits from both phases appeared large enough to be of considerable economic importance.

Adaptation Periods for Rumensin

Research has shown that monensin in the form of the sodium salt (Rumensin) is a product which improves feed utilization by cattle. It appears to be widely used in the cattle feeding industry.

When cattle are first placed on feeds which contain Rumensin, there may be a substantial initial reduction in feed intake. This effect will be influenced by the size of cattle and level of Rumensin. It is of a temporary nature, but feed intake will be about 10% less throughout the feeding period. Feed efficiency is improved by about the same amount as the reduction in feed intake since there is no appreciable effect on weight gain.

The optimum level of Rumensin in a complete feed appears to be 30 grams per ton of air-dry feed. Since feed intake is related to body weight, the amount of Rumensin consumed from complete feeds increases as the cattle gain in weight and consume more feed. Under this system of feeding, there is a gradual increase in intake of Rumensin with increasing intake of feed. However, it is recommended that the level of Rumensin in a complete feed should be reduced to 10 or 20 grams per ton for the first 2 to 3 weeks.

When Rumensin is offered in a supplement, suggested rates of supplementation are based on feed intake as follows:

Feed Intake	Daily Levels of Rumensin
Less than 14 pounds	150 mg per head
More than 14 pounds	200 mg per head
More than 20 pounds	300 mg per head

Overfeeding of Rumensin to lightweight calves during periods of stress could reduce feed intake during a critical time and add additional stress. Since a supplement fed at a constant daily level will make up a larger percentage of the total ration during early stages in the feedlot but decreases as feeding progresses, it would be advisable to follow the suggested levels in a daily supplement. It is recommended that no cattle receive more than 360 mg of Rumensin daily.

It is well established that Rumensin reduces feed intake. Levels as low as 10 grams per ton of feed appear to cause this effect, especially during early periods of feeding. However, it would seem reasonable to expect the effect would become more evident with increasing levels of Rumensin. The importance of a temporary period of substantial reduction in feed intake will depend upon size of cattle, general health, weather conditions and nutritional adequacy of rations. Deviations from suggested procedures should be made only when giving due consideration to factors listed which may affect early performance of the cattle.

Diethylstilbestrol (DES), Zeranol (Ralgro), Synovex and Melengestrol Acetate (MGA)

These hormone or hormone-like compounds have been shown by numerous experiments and feedlot results to improve weight gain and feed efficiency. DES is available as a feed additive and an implant for steers and heifers, Ralgro as an implant for steers and heifers, Synovex-S as an implant for steers and Synovex-H as an implant for heifers and MGA as a feed additive for heifers. The products are for feedlot (not breeding) cattle and directions should be followed as to dosage levels and withdrawal times.

Growth response from DES, Ralgro and Synovex has been reported under a wide variety of conditions as to type of rations and age of cattle. Improvement in weight gain and feed efficiency results with growing rations as well as finishing rations. However, greatest benefits come during finishing because of the greater rate of production. Similar comments can be made for MGA except it is for intact heifers only. A growth promoting effect has been reported with heifers before puberty, but a greater effect is obtained after this stage.

Since these products result in increased weight gains and feed intake, they present no special considerations as to time of administration in relation to feedlot adaptation. Initial supplements may contain DES or MGA for appropriate cattle. Implanting may be done along with other processing operations. Reimplanting should be considered when the total feeding period is of sufficient length to receive benefits from the reimplant yet abide by required withdrawal periods.