Nutrition and Management of Newly-Arrived Cattle

Steve Armbruster, PhD
Armbruster Consulting
P.O. Box 2195
Stillwater, OK 74076

The key to success in starting new cattle is setting realistic goals and objectives. For most producers the primary goal is to maximize profit. With this goal, objectives are needed for death loss, morbidity, medical cost, weight gain, feed conversion and cost of gain.

One difficulty in setting goals and objectives in a starting program is the moving target. Each new group of cattle offers a unique challenge. Another problem is that valid objectives are often not compatible. For example, the ration that results in the best weight gain and feed conversion may not give the lowest morbidity and mortality.

Despite these difficulties, producers should define goals and objectives in writing. Then a detailed plan is needed for each group of new cattle. Plans will be similar in basic structure, yet flexible enough to suit each circumstance.

In a nutritional program, the fundamentals are easily defined. Simply stated, proper nutrition is 1) defining animal requirements, and 2) satisfying those needs with appropriate feedstuffs. Although the fundamentals are easily stated, they are challenging to implement because many variables influence animal needs and feed quality.

Feed Intake

To meet their nutritional requirements, new arrivals must eat. Many well-balanced rations fail in starting programs due to poor intake. Studies with calves show that intakes are often low for several weeks, particularly in morbid animals (table 1). Research also indicates some calves simply do not eat during the first few days after arrival (table 2).

Cattle stressed and fasted by the marketing process have greatly reduced microbial numbers and fermentative capacity in the rumen. Even after rest and alimentation, several days are required for calves to restore normal rumen function. Receiving rations must be formulated which facilitate, or at least do not interfere with, this recovery process.

Not only must new arrivals eat, but also their intake level must be correctly anticipated so rations can be formulated to appropriate nutrient densities. An axiom of nutrition often overlooked is that animals require amounts, not percentages, of nutrients.

An example of the relationship between feed intake and nutrient density is provided in table 3. A calf consuming 1.5% of body weight in dry matter requires a concentration of dietary protein nearly twice that of a calf eating 2.5% of body weight. Starting rations containing 20% crude protein are virtually nonexistent, yet intakes below 1.5% of body weight are common in calves the first week after arrival.

TABLE 1. Feed intake of newly arrived calves (% of mean body weight)

	Healthy	Morbid
Days 1-7	1.55	0.90
Days 1-28	2.71	1.84

Hutcheson, D.P. and N.A. Cole. 1986. Management of transit-stress syndrome in cattle: Nutritional and environmental effects. J. Anim. Sci, 62:555.

TABLE 2. Percent of newly arrived calves consuming feed

Day	Percent
1	24.4
2	44.4
3	60.0
4	81.4
5	82.9

Hutcheson, D.P. and J.M. Cummins. 1982. The use of decoquinate in the receiving diets of stressed feeder calves. Proc., Western Section, Amer. Soc. of Anim. Sce. 33:181.

TABLE 3. Importance of feed intake

NRC:	440 lb medium-frame steer calf gaining 1.75 lb daily requires 621 g protein		
	DM intake -		
	% of body weight	2.5	1.5
	lb/day	11.0	6.6
	Crude protein in diet, %	12.4	20.7

Energy

Energy is the most significant need, both quantitatively and cost-wise, of the new arrival. Cattle that have been fasted during marketing, transportation and other stresses have depleted their mobile energy stores. Consequently, the focus should be on providing dietary energy that is readily and safely digested.

Both concentrates and roughages contain energy. Compared to roughages, concentrates are more energy-dense, have energy that is more digestible, are lower in energy cost and have more potential to cause digestive dysfunction. Roughages are safer to feed, but as the sole diet are normally deficient in energy for new catle.

Combinations of concentrate and roughage are required to provide adequate energy intake in a safe manner. Mixed rations are preferred, but concentrate can be fed separately from roughage if done with caution.

Optimum energy density of a receiving diet depends on animal factors outlined in Table 4. As a rule, animals with low intake require diets with more digestible energy than those with high intake. Thus calves need a higher concentration of energy than yearlings. Sick and other highly stressed cattle require more energy than healthy ones. Since weight gain is directly affected by energy intake, cattle fed for higher gains need more energy.

Effective starting rations typically contain from 30% to 70% concentrate, with a 50% level optimum for many starting programs. When the roughage is low quality, rations below 30% concentrate are deficient in energy. Rations above 70% concentrate can result in lactic acidosis in the rumen, thus increasing the potential for respiratory disease.

TABLE 4. Factors affecting energy requirement

Animal -			
Age:	Yearling	-->	Calf
Weight:	600 lb	-->	300 lb
Gain:	1.5 lb	-->	2.5 lb
Status:	Healthy	-->	Sick
Diet -			
Concentrate, %	30	-->	70
NEg, Mcal/cwt:	35	-->	55

Research confirming the detrimental effects of receiving diets excessively low or high in energy is shown in table 5. Calves fed 20% concentrate had very poor gains and feed conversions and more sickness than those fed 55% concentrate. Calves fed 72% concentrate gained and converted well but experienced more illness than those on the moderate level of energy.

Suitable concentrates for starting rations include corn (whole or processed), oats and barley. Dry rolled corn is preferred to flaked corn due to less potential for digestive disorders. Sorghum grain is adequate, but when finely ground is less palatable than other grains. Ensiled grains and wheat should be avoided due to greater potential for lactic acidosis.

Molasses products are good sources of energy that reduce dust and enhance feed intake. Suitable alternatives include cane or beet molasses, fed singularly or blended with distillers solubles or corn steep liquor. Fats and oils are very high in energy density. However, they should not be included in starting rations because they are not readily accepted by new cattle and depress fiber digestibility.

TABLE 5. Concentrate level and calf performance

	20%	55%	72%
Daily gain, lb	0.19	0.76	0.82
Feed/gain	59.9	15.9	13.7
Percent treated	88	78	92
Treatment/sick calf	5.1	4.6	5.4

Lofgreen, G.P. 1977. Energy level and Rumensin in receiving rations for yearling cattle. California Cattle Feeders Day, p. 19.

Starch in grain and sugar in molasses are forms of energy that are readily digested in the rumen. This feature can be a blessing or curse. When consumed they provide the new arrival with essential "quick" energy, but excessively high or rapid intake results in ruminal acidosis. Consequently, fibrous concentrates such as wheat midds and corn gluten feed are good substitutes for grain. These by-products are relatively high in energy, but most of the energy is from digestible fiber. Digestible fiber is less prone to cause lactic acidosis than starch or sugar.

Roughages are included in starting rations because they are safe and consumed readily by new cattle. Furthermore, they can contribute energy directly by providing digestible energy or indirectly by stimulating consumption of concentrate. For example, cottonseed hulls are low in digestible energy compared to alfalfa. Yet hulls are an excellent roughage for starting rations because they are very palatable, thus stimulating intake of concentrate.

Other roughages that are suitable for starting rations include high quality hays (either legume or grass) and soybean hulls. Silages should be avoided in starting rations. Ensiled feeds tend to be poorly accepted by new arrivals. Although well-grained silage is energy dense, initial dry matter intakes can be low resulting in energy deficiency.

Because hays are inherently variable, their composi-

tion should be profiled by laboratory analysis. Energy density can be estimated by ADF/NDF assays. Crude protein content is easily measured, and reliable tests exist for estimating digestibility of protein. Also, potentially toxic compounds such as nitrates in sorghum hay can be evaluated in the laboratory.

Protein

Protein is second only to energy in receiving diets in terms of amount required and cost incurred. Animals that are energy-deficient catabolize tissue protein to serve as an energy source. With rumen function reduced by fasting, the quantity and/or quality of protein entering the lower gut for digestion is likely diminished. Furthermore, many common feedstuffs are inherently low in protein. Consequently large amounts of supplemental protein are often required by newly-arrived cattle.

As previously illustrated in table 3, protein levels in starting rations depend on feed intake. As shown in table 6, additional factors include age, body weight, health status and weight gain. Dietary protein requirements are higher in calves than yearlings, in sick animals than healthy ones, and in animals with greater weight gains. Crude protein requirements in starting rations on a dry matter basis range from 12% to 18%, with typical values in the 14% to 15% range.

TABLE 6. Factors affecting protein requirement

Animal-				
	Age:	Yearling	-->	Calf
	Weight:	600 lb	-->	300 lb
	Gain:	1.5 lb	-->	2.5 lb
	Status:	Healthy	-->	Sick
Diet -				
	Crude protein, %	12	-->	18

It is important to consider not only the concentration of protein in the diet, but also the forms of protein (nitrogen) present. Normally, rumen bacteria degrade significant amounts of dietary protein and non-protein nitrogen (NPN) to synthesize microbial protein. Microbes, together with feed protein that bypasses rumen degradation, provide protein for digestion and absorption in the lower gut.

With fermentative capacity in the rumen greatly reduced in fasted animals, microbial protein likely serves a diminished role in meeting requirements. Thus new cattle are more dependent than normal on bypass feed protein to meet their needs.

Supplemental protein in receiving diets should be predominantly from natural (preformed) sources and relatively high in rumen bypass. Combinations of plant and animal sources are probably warranted to provide a complementary balance of amino acids in the bypass fraction. With reduced microbial activity and low energy intake, new arrivals have limited capability to utilize NPN sources such as urea. If used at all, urea should be limited to higher-energy receiving rations fed to yearlings. Then urea should be limited to a maximum of 0.3% of the dietary dry matter.

Appropriate plant sources of protein include soybean meal, cottonseed meal, peanut meal, sunflower meal, distillers grains, corn gluten feed and wheat midds. Because cottonseed meal is occasionally high in gossypol, it should not be used in rations for young calves. Both peanut meal and cottonseed meal should be screened for aflatoxin. With aflatoxin, as with gossypol, young calves are most susceptible. Suitable animal sources of protein include rendered meat and bone meal and hydrolyzed feather meal, both of which must be processed properly.

Minerals

Minerals required by new cattle are in two basic categories -- macro minerals and trace minerals. These categories describe relative amounts required, rather than importance nutritionally.

Macro minerals frequently required in supplemental form are phosphorus, potassium and sodium. Calcium and magnesium are occasionally deficient. Other macro minerals are essential, but levels are typically adequate in the diet without supplementation. Suggested levels for macro minerals frequently supplemented in receiving diets are shown in table 7. Levels shown exceed NRC recommendations because they include consideration for low feed intake and excessive mineral excretion during stress.

Although research on trace minerals in receiving diets is limited, recent data suggest benefit from supplemental selenium, zinc and/or copper. These elements are involved in immune response. Their roles are not fully elucidated; consequently requirements have not been precisely quantitated. Suggested levels for these elements in starting rations are shown in table 7.

TABLE 7. Suggested levels of minerals in receiving diets

	Level in Diet Dry Matter
Phosphorus	0.35 - 0.45%
Potassium	1.0 - 1.25%
Calcium	0.6 - 0.8%
Sodium	0.2 - 0.3%
Magnesium	0.2 - 0.25%
Selenium	0.1 - 0.3 ppm (added)
Zinc	100 - 150 ppm
Copper	10 - 20 ppm
Manganese	50 - 75 ppm

In addition to the trace elements mentioned above, premixes frequently contain other essential minerals such as manganese, iron, cobalt and iodine. There are geographical variances in concentration of trace minerals in feeds. Consequently, an element that is adequate in one region can be deficient or perhaps toxic in another.

To further complicate the issue, the bioavailability of trace elements varies among feeds and mineral supplements. The prudent approach with trace minerals is probably to analyze common feeds in a region, then supplement accordingly. Radical supplementation is unwise.

Vitamins

From the standpoint of sustaining health and supporting recovery in new cattle, the roles of vitamins A and E are documented. Because the vitamin A status of feed and cattle is usually unknown and it is inexpensive, starting rations should be fortified to provide 50,000 to 100,000 IU of vitamin A per animal daily.

The vitamin E status of new arrivals is often uncertain, although cattle from selenium-deficient regions and dry forages benefit most from supplementation. As with vitamin A, disease and other stresses increase requirements for vitamin E. Receiving diets should be fortified to furnish 100 to 400 IU per animal daily.

Regarding B-vitamins, the ruminant's needs are normally satisfied by microbial synthesis. Given the unstable environment and reduced efficiency of the rumen in new arrivals, it is not suprising that studies have shown responses to supplementation. Because the data are inconsistent and some B-vitamins are costly, routine and liberal use of B-vitamins in receiving diets is economically infeasible. On a limited and selective basis, their use is justified.

For example, studies with niacin have shown a consistent response, and niacin is inexpensive. A response to thiamine is observed in diets where thiamine antagonism exists, such as excessive sulfur, prolonged use of amprolium and persistent lactic acidosis. Suggested levels for supplementation of niacin and thiamine are 100 ppm and 200 ppm, respectively, of the ration dry matter.

Decisions to supplement receiving rations with nutrients must be justified on a benefit/cost basis. Table 8 illustrates the typical cost of several supplemental nutrients. For some nutrients the cost is nominal, so only a small response is required for inclusion to be profitable. With other nutrients, cost can be great but so can animal response. Often the tendency is to rely on costly drugs, while ignoring the potential for a balanced diet and proper feed management.

TABLE 8. Approximate cost of supplemental nutrients and feed additives

	$/Head Daily
Phosphorus, 5 g	.007
Selenium, 0.3 ppm	.00006
Zinc, 100 ppm	
Sulfate	.0009
Proteinate	.029
Copper, 10 ppm	.0002
Vitamin A, 80,000 IU	.007
Vitamin E, 400 IU	.014
Niacin, 100 ppm	.003
Thiamine, 200 ppm	.038
Decoquinate, 113.5 mg	.028
Tetracycline, 1 g	.048
Probiotic	.025

Feed Management

Much can be written about feed management due to its profound influence on nutrition and health of new cattle. The purpose of this discussion is not to be comprehensive on the subject, but to acknowledge the importance of management by outlining key practices.

Since an objective for new cattle is ample feed consumption, every effort should be made to keep them comfortable and quiet. Patience is a virtue, but seldom greater than when new cattle are moved and handled. Frequent moves are detrimental to feed intake. New cattle need to be situated in a permanent home soon after arrival and disturbed minimally. Home pens should be spacious to minimize competition, but small enough so cattle are close to feed and water and don't roam, wasting energy.

On arrival cattle should have convenient access to long hay and fresh water. Type of hay is not so important as quality. Either grass or legume hay is suitable. Offering both is beneficial since cattle differ in preferences. Concentrates should be withheld until all animals have an opportunity to fill with hay. Withholding water until cattle have eaten is not recommended because most new arrivals are dehydrated.

Long hay is an excellent tool in a starting program but it must be managed well. Feeding limited amounts frequently in bunks is preferred to free-choice feeding in large bales. In bunks; intake can be monitored, and hay can be used to stimulate or curb consumption of concentrates. In bales, consumption is hard to quantitate and impossible to control. Unlimited access to hay discourages cattle from coming to bunks. Rarely is hay alone an adequate diet for new arrivals.

Procedures for feeding long hay depend on cattle cir-

cumstances. Healthy yearlings require large quantities (3-7 lb/head daily) for a few days to prevent overindulgence of concentrate. Conversely stressed calves should be offered hay in lesser amounts (1-2 lb/head daily) for a week or more as an encouragement to consume concentrate.

When bunks are empty, new cattle should be partially satisfied with hay before concentrate is fed. When feed intake is low, it is often beneficial to top-dress hay with concentrate. Under most circumstances, hay should be fed at least twice daily and offered whenever sickness is prevalent.

After new arrivals have an initial fill of hay, concentrates should be introduced gradually. Starting at 0.5% to 0.75% of body weight with concentrate is usually safe, provided cattle have been previously satiated with hay and most come to the bunk.

Extrapolated to a starting ration with 50% concentrate, this guideline means that the ration can be offered initially at 1% to 1.5% of body weight. Increases in amount can usually be made at the rate of 2-3 lb/head daily for yearlings and 1-2 lb/head daily for calves, when the starting ration contains about 50% concentrate. If cattle are not satisfied with a normal increase, they should be appeased with long hay.

For the same reasons that hay should be limited rather than offered free-choice, rations should be fed in bunks rather than self-feeders. In bunks, ration intake can be regulated and monitored carefully.

The daily allocation of ration should be divided into at least two feedings, although more feedings are preferred. Frequent feeding reduces the potential for digestive dysfunction, stimulates cattle to eat and permits earlier detection of sick individuals in a pen.

Pens of new cattle should be walked daily so gut fill and character of stools can be evaluated. Animals that are not eating and those with acidosis should be moved to other pens where the environment is less competitive and where their unique dietary needs can be met. When pens of new arrivals are walked, it is often beneficial to quietly ease cattle to the bunk.