

Practical Application.... Where Theory Meets the Real World

Donna M. Amaral-Phillips, Ph.D.
Extension Dairy Nutritionist, University of Kentucky
859-257-7542, damaral@uky.edu

Ration Balancing

Testing forages and balancing rations are the foundation upon which nutritionists build sound, nutritionally-complete feeding programs. As we learn more about rumen fermentation, use of nutrients within the mammary gland, liver, and other tissues, and the interactions between the rumen environment and cow's metabolism, specifications for nutrients used when formulating rations have changed and become more sophisticated. To take advantage of these advances, more complicated ration balancing models are utilized which often require more nutrient composition data to be entered for each feedstuff. Often we use "book values" which may or may not describe the nutrient composition of the feedstuff actually being fed. These inadequacies and gaps in our knowledge of rumen fermentation and nutrient metabolism can lead to performance which may not meet our and, more important, the farmer's expectations.

From a practical standpoint when rations do not perform as well as expected, the most common problem is not the ration formulation, but rather, the interpretation and feeding of the ration and the amount and composition of the ration actually consumed by the cows.

Table 1. Rations fed to the Dairy Herd

- 1) Ration formulated by a nutritionist
- 2) Ration fed to the cows
- 3) Ration consumed by the cows
- 4) Ration digested by rumen bacteria and the cow

Thus, highlighting the statement describing the four different rations which are fed to cows or heifers (Table 1). When troubleshooting performance problems, these areas often offer at least a partial explanation. Table 2 illustrates the various areas that should be evaluated when formulated rations are not performing as expected.

Table 2. Possible reasons why formulated rations may not be work as expected.

Inconsistencies in rations formulated by nutritionist

- 1) Ration formulation does not use forages currently being fed (i.e. type of hay and/or silage, pasture incorporated but not utilized as forage source by cows)
- 2) Ration being fed does not utilize analysis of forages or feeds currently being fed
- 3) Ration does not reflect actual dry matter intake for the herd
- 4) Ration formulation does not account for inclusion or variability of by-products being fed

Inconsistencies in rations actually fed

- 1) Ration offered to cows does not reflect amounts on formulated ration
 - a) Formulated ration does not reflect types and *amounts* of forages and other feeds currently available
 - b) Formulated ration can not be fed through the farmer's feeding system (i.e. Amount and type of hay included in TMR's, forages or concentrate to be fed)
 - c) Formulated ration does not reflect farmer's feeding goals (i.e. types and amount of forages to feed)
- 2) Consistency of ration being fed especially TMR's
 - a) Amount fed reflect changes in dry matter of forages and other wet feeds
 - b) Dry matter proportions of each feed remain relatively constant from feeding to feeding (i.e. as fed amounts of forages change to adjust for varying feed intakes)
 - c) Transition between different forages (i.e. type of forages and silos)
 - d) Too small quantities of ingredients being added that they can not be weighed accurately and/or be adequately mixed within the diet (i.e. Rumensin 80 (not mixed with an additional carrier) being added to a TMR)
- 3) Feed bunk Management
 - a) Ad lib versus limit feeding
 - b) Provide adequate bunk space
 - c) Access to feed 20 hours per day
 - d) Feeding surface (height and smoothness) and location
- 4) Communication between the nutritionist, farmer and the person (s) actually feeding the cows

Inconsistencies in rations actually consumed by dairy cows

- 1) Sorting of offered TMR or silage by cows
- 2) Selective consumption of forages especially long stem hay - i.e. location relative to traffic patterns, quality of hay offered, and quantity consumed relative to feed space)
- 3) Inability to consume feeds within the constraints of the feeding system

Resolving Nutritional Problems

Often the formulated ration (and the nutritionist who formulated the ration) gets blamed when cows do not milk as well as expected or health issues arise in the herd. The formulated ration can be the problem but other management-related factors can contribute to the problem. Often, changes in management practices are needed to resolve the problem in addition to formulation changes or refinements. Most nutritional problems are often a combination of several factors that have changed which result in a decrease in milk production, growth or health problems. Table 3 highlights some of the areas that should be investigated to resolve some of the common problems seen in dairy herds.

Table 3 . Troubleshooting Nutrition Problems for the Dairy Herd

Nutritional Problem	Areas to Investigate to Resolve Problem
Cows not milking as well as expected	<ul style="list-style-type: none"> a) Evaluate feeding management program for milking cows (ration and feeding and management practices) b) Evaluate changes in quality of forages being fed c) When was the last time a ration was balanced for the milking herd? d) Has their local veterinarian evaluated the overall health of the herd e) How many cows are recently fresh (average number of days in milk)? f) Evaluate water availability and quality issues
Low butterfat content (less than 3.2% for Holsteins)	<ul style="list-style-type: none"> a) Re-evaluate ration actually being fed (and consumed) to see that it meets the nutrient requirement of cows b) How many pounds of grain are fed at each feeding- (Want less than 8 lbs per feeding period of 4 hrs) c) Evaluate amount of effective fiber (chew factor) fed 1) Are cows fed long stem hay? 2) Are cows sorting the TMR being fed? 3) Is the TMR mix overmixed and particle size reduced?
Feet problems- Laminitis (other than hairy heel warts and foot rot)	<ul style="list-style-type: none"> a) Evaluate ration fed and consumed by cows (Specifically look at NSC content of diet) b) Evaluate diet consumed by cows for adequate amounts of effective fiber (chew factor to stimulate cud chewing)

Table 3. Troubleshooting Nutrition Problems for the Dairy Herd

Nutritional Problems	Areas to Investigate to Resolve Problem
High MUN's (Milk Urea Nitrogen content of milk) (Greater than 14-16 mg/dl)	a) Evaluate the diet consumed by the cows (specifically protein fractions and NSC content)
Diarrhea	a) Is this a herd problem or does it affect individual cows? b) Has their local veterinarian evaluated the health of these cows affected? (ie. Winter Dysentery, Salmonella, Johne's Disease) c) Evaluate specs of ration actually consumed by cows
Displaced abomasums (twisted stomachs) in mid-lactation cows	a) Evaluate effective fiber of the diet consumed by the milking herd (length of time TMR mixed, amount of grain fed in 4 hr time period) b) Evaluate amount of sorting done by the cows c) Evaluate macro-mineral (Calcium) content of the milking cow diet
Displaced abomasums (twisted stomachs) in cows within 45 days after calving	Evaluate transition of cows onto the milking cow ration as well as feeding management program 21 days prior to calving
Milk fever in fresh cows	Evaluate macromineral (potassium, sodium, sulfur, and chlorine – not calcium) content of diet fed 21 days prior to calving
Retained placenta in fresh cows (cows do not clean after calving)	Review mineral/vitamin feeding program during the dry period (ie. Selenium content as well as DCAD balance - potassium, sodium, chlorine, sulfur content of diet)
Low body condition of cows less than 60 days in milk	a) Evaluate transition into the milking herd b) Evaluate dry cow and close-up dry cow programs (Are cows adjusted to the forages and increased grain amounts prior to calving?) c) Evaluate feedbunk management for the milking herd to make sure adequate bunk space and feed is provided for fresh cows to eat
Dry cows losing weight	Evaluate feeding program for dry cows– quality of forages being fed, pasture availability, heat stress, and amount of grain being fed relative to forage quality

Table 3. Troubleshooting Nutrition Problems for the Dairy Herd

Nutritional Problem	Areas to Investigate to Resolve Problem
Calving problems in heifers	a) Evaluate body condition of heifers prior to calving– Are they over conditioned? b) Evaluate feeding program for heifers
Heifers calving too small	Evaluate feeding program for heifers– Are rations balanced for heifers after forages are tested for their quality? Review pasture management as it relates to quality and quantity
Feet problems in first-calf heifers seen shortly after calving	Evaluate heifer feeding problem to make sure heifers are getting a properly balanced diet

Trace Mineral Nutrition

Proper mineral and vitamin nutrition impacts milk production, growth, reproductive performance, and the health of cattle. From a health standpoint, proper mineral and vitamin nutrition can help prevent several common metabolic disorders, such as retained placenta and clinical milk fever, and improve the immunity of cattle to fight off diseases, such as mastitis. Also, proper mineral and vitamin nutrition can help improve immunity from vaccines administered to prevent various diseases.

Minerals and vitamins need to be provided in adequate amounts in forms which are readily absorbed (bioavailable). The amount of minerals provided by forages, concentrates or grains, *mineral sources*, and *water* need to be taken into account when evaluating the mineral adequacy of diets for growing heifers and lactating cows. Forages and concentrate mixes should be analyzed via wet chemistry methods to determine their mineral content and the results used to assess whether the proper amount of each mineral is provided. Often we forget that cattle need a certain amount of each nutrient, not concentrations of a nutrient. The mineral content of water needs to be taken into account when evaluating the adequacy or excesses of a trace mineral and vitamin program.

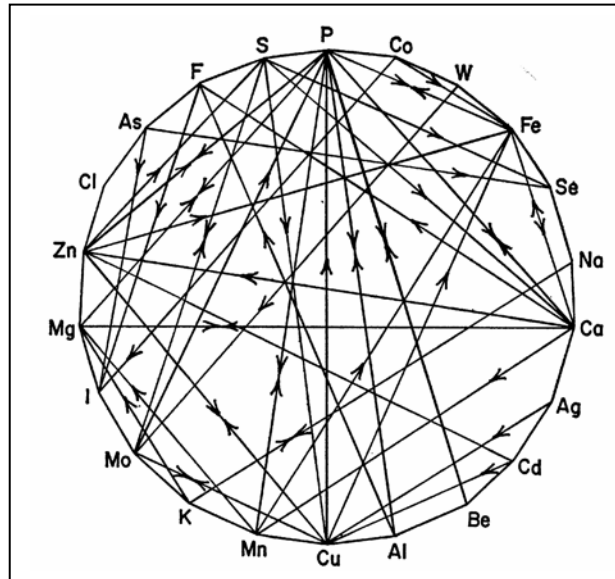


Figure 1. Mineral interactions

Interactions with other minerals

Various minerals have been shown to interfere with the absorption or metabolism of other trace minerals (Figure 1). Table 4 lists some of the common mineral interactions which can decrease the effective levels of copper and selenium and result in health-related problems in dairy and beef herds. Higher concentrations of iron, sulfur, zinc or molybdenum can be found in not only forages (Table 5) but also water sources and mineral sources, such as dicalcium phosphate (Table 5). For example, some sources of dicalcium phosphate contain higher concentrations of iron than other sources. To counter these interactions often organic sources of copper or selenium are added to the diet.

Table 4. Common Mineral Interactions

Fe	↔	Cu
S	↔	Cu
Zn	↔	Cu
Mo	↔	Cu
S	↔	Se

Table 5. Selected mineral concentration in alfalfa haylage and dicalcium phosphate.

	Sample			
	1	2	3	4
<u>Alfalfa haylage</u> ¹				
Iron (ppm)				
crop year – 2004	461	1,370	664	1,350
crop year – 2003	1,320	761	2,230	
crop year – 2000	181	347	380	678
<u>Dicalcium Phosphate</u> ²				
Iron (ppm)	2,632	15,093	12,157	5,026
Magnesium (%)	0.32	0.43	1.73	0.98
Sulfur (%)	0.47	0.99	0.86	0.72

¹ Samples collected at University of Kentucky Coldstream Dairy Research Facility

² Adapted from Wendlandt, Ron. 1997. Field Observations of Mineral Supplements. Proceeding for Kentucky Nutrition Workshop. Pg. 51-53

Implementing a Close-up Dry Cow Program

Properly-implemented close-up dry cow programs have been shown to improve production (+/- 2000 lbs milk) and health of cows after calving. Several additives, such as anionic salts and other B vitamins (i.e., niacin), have been shown to minimize health problems when added to diets 3 weeks prior to calving. Implementing close-up dry cow programs with our smaller herd sizes has presented some challenges and problems. These difficulties may include (1) providing facilities that provide adequate cow comfort and hygiene for both groups of dry cows; (2) mixing and storing another grain mix specially formulated for the forages being fed which can be fed out within a reasonable time frame; and (3) small numbers of cows in this group makes mixing small batches of

TMR, especially those incorporating long hay, a challenge. With the research showing that we may be able to shorten dry periods from the classic 60-days , we may again be able to house dry cows in a single group fed a common diet which will help eliminate some of the reluctance by farmers to implement these management practices.

Communication...

Establishing true communication lines *between* you, the farmer's other consultants, the farmer, and his/her staff are critical when designing and implementing feeding programs that work. Communication needs to flow to and from all parties which are involved in the feeding program. Often the greatest misunderstandings could have been avoided or quickly corrected if communication lines have been established and all parties truly communicate, with one another. To accomplish these objectives, both sides need to listen to each others' needs and concerns raised.