

APPROACHING A CONSULTATION WITH THE NIRS/NUTBAL PRO NUTRITIONAL MANAGEMENT SYSTEM

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The NUTBAL software allows the estimation of crude protein and net energy of maintenance/gain balance of cattle, sheep, goats and horses (DE only). When coupled with estimates of dietary crude protein and digestible organic matter of free-ranging animals via fecal scans using near infrared reflectance spectroscopy (NIRS), the user of the NIRS/NUTBAL nutritional management system will be afforded opportunities to offer consultations to livestock producers. The objective of this paper is to discuss some critical aspects of using the system in the context of a consultant working with an individual livestock producer seeking guidance on animal management of his cattle operations. Given the nature of the NIRS/NUTBAL system, the focus will be on nutrition, even though pasture management issues can emerge from use of the system.

Reconciling Livestock Breedtypes

Frame Score. NUTBAL calculates the requirement of an animal by first determining the standard reference weight of the animal adjusted to a body condition score 5, given its sex, age and frame score. Requirements are based on a proper age-weight-fatness relationship with fatness assumed to be 25% of body weight at BCS=5. The Animal Attribute database will allow assignment of a frame score to 15 for cattle even though a majority of breeds are between 1 and 6. If you have some feel for the weight of the animals at body condition score 5, look up the weight for the appropriate age class in table 1 below to get some indication of the hip height-weight relationships that best describes the frame score of the animal. In many cases, we find that producers estimate weight of the animals based on sales slips from animals sold over the year and then assign a body condition score that seems reasonable to them. Seldom do they actually body condition score culled or sold animals which would be helpful in developing a relationship between BCS and weight to assign them to a frame class. Another method is to actually gather a representative number of animals in a fairly uniform age class, measure their weight, hip height, and body condition score. The average weight at body condition score 5 could then be crossed referenced with table 1 below and average hip height of the animals verified to see if the frame scoring system in NUTBAL adequately depicted the client's animals.

Special consideration has to be used when dealing with young, growing animals, especially those in emaciated body condition (BCS<3). In order for the weight/body condition score relationship to be calibrated for these animals, a lower than normal frame score must be assigned to the breedtype. It is not uncommon to assign a 0.5 to 2 frame score for *corrientes* cattle imported from Mexico and be working with body condition scores of 1-3 for animals that

are 12-20 months old. Please refer to the zebu body condition score guide at GAN Lab's internet homepage for assistance in condition scoring emaciated animals (go to <http://cnrit.tamu.edu/ganlab>).

Table 1. Body weight (lbs) at body condition score 5 and associated hip height (inches) of cattle of different frame scores by major age class.

Frame	-----Inches/Pounds Basis-----					
	205 days		420 days		Mature	
Height	Weight	Height	Weight	Height	Weight	
1	35.1	357.2	41.0	582.1	44.1	882.0
2	37.0	374.9	43.0	619.6	46.1	954.8
3	39.0	396.9	44.9	654.9	48.1	1029.7
4	41.0	419.0	46.9	694.6	50.0	1102.5
5	43.0	438.8	48.9	729.9	52.0	1175.3
6	44.9	458.6	50.8	767.3	54.0	1250.2
7	46.9	480.7	52.8	804.8	56.0	1323.0
8	48.9	500.5	54.8	840.1	57.9	1395.8
9	51.2	522.6	56.7	882.0	59.9	1470.7

To determine if you have assigned the correct frame score to the client's breedtype, set up your case and select what you feel to be the most appropriate breedtype listed in the database and fill in the other supporting information until you get to the **WEIGHT PERFORMANCE** screen. Type in the weight or body condition score of the animal in question and determine if the resulting weight or body condition score seems reasonable. In many cases the client will provide only a weight or body condition score and you will have to show some judgement as to which one is most correct. If the client is available by phone, call them and ask some questions to clarify the body condition score. For instance, you say that the animals are in body condition score 5, can you see any of the last three ribs on the typical animals? Obviously if they say yes and the relatively lower weight seems reasonable, accept NUTBAL's projection of body condition score and ignore the client's assessment of fatness. If you find yourself not able to reconcile the weight and body condition score, you will have to go to the animal attribute database and modify or add a new breedtype with the frame score that yields the proper relationship. It is very helpful to go ahead and create a range of generic breeds with frame scores in 0.5 units if you are uncertain. Remember, as a rule of thumb, peak milk yields increase with increasing frame score and should be adjusted when frame scores are adjusted as well. You can simply select an existing breedtype similar to the one you are constructing, rename the breed with the frame score in the name, make the adjustment in frame score and peak milk yield and press the ADD button without losing the existing record, eg. British Cross FS3.5, British Cross FS4.0, etc. It is possible to have negative frame scores as well.

Energy Adjustment Factor. NUTBAL allows adjustments in net basal metabolism of a breedtype based on the relative amount of *Bos indicus* and *Bos taurus* bloodlines, amount of dairy breed influence and level of dual purpose bloodlines. These differences are due to varying proportions of soft tissue relative to body weight in the various breeds. Higher proportions of soft tissue increases the net metabolism of the animal, especially the liver and digestive tract. There are several breed examples in the NUTBAL animal attribute database but the range in values used are depicted below. NUTBAL assumes that the animal in question is a beef breed and requires that a breed's net basal metabolism be adjusted relative to that standard.

<u>Breed Class</u>	<u>Energy Adjustment Factor</u>
Beef Breeds	+ 0.00
Dual Purpose Breeds	+ 0.15
Dairy Breeds	+ 0.20
<i>Bos indicus</i> Breeds	- 0.20

To compute an energy adjustment factor, you must know the relative composition of the four breed classes above. The example below provides you a mechanism to assign an energy adjustment factor to a breedtype.

<u>Breedtype</u>	<u>Proportion</u>	<u>Factor</u>	<u>Fraction</u>
Hereford	0.50	+ 0.00	+ 0.0000
Brahman	0.25	- 0.20	- 0.0500
Brown Swiss	0.25	+ 0.15	+ 0.0375

		Total	- 0.0125 or -0.01 in NUTBAL

Peak Milk Yields. Many of the primary breeds have been assigned peak milk yields in NUTBAL. However, you will find that due to breeding programs of a given client, milk yield has been increased. Generally, this is the case when producers are selecting replacement heifers from their own herd or from special sales based on percent of the dam's weight when weaned, especially when good nutrition programs are in place. There is a chart in the NUTBAL manual that provides a calf age-weight to dam frame score relationship that estimates peak milk yield of the dam. The utility program installed when you set up NUTBAL called PKMILK can be used to estimate peak milk yield from the average age and weight of a group of calves. Our experience shows that these utilities are best used with known calf weaning weight and age data. You can work backwards with the problem by using the CALFWT utility which estimates the weight of a calf at a specified age using the dam's frame score and estimated peak milk yield.

Maximum Hair Length. It does not hurt to glance at the maximum hair length value of the breed in the database to check if it seems adequate for your region, especially if you are in very cold climates. Maximum hair length (extended from the skin to hair tip) is measured at the edge of the rear rib cage just off the spine approximately 10 cm down during the peak of the cold season, eg. crest of the 13th rib.

Assessing the Client Performance Goals

NUTBAL PRO now calculates the nutritional status of the current animal plus one day. Always run the first case with zero gain goal to establish baseline performance of the animals before imposing any gain goals. Try to understand where the client is wanting to go with these animals in terms of desired calf crop percentages or target body condition score by a certain date, particularly at calving, breeding and weaning. For instance, the mature cows are in body condition score 4 and the person wants them to be in body condition score 5+ in 60 days and on a positive plane of nutrition. The animals are lactating with approximately 30-day old calves. You can go to the herd profile screen in NUTBAL and select the U for the GAINCALC utility and input current body condition and weight, type in 60 days duration and set a target of BCS=5.5. The resulting average daily gain would provide you with the needed performance to meet the goal of the individual. In this case the animal would have to gain 2.25 lb/d (FS 4) to meet the goal during peak lactation. The major issue is whether it is biologically possible given that the animal is on an increasing demand for nutrients and the level of input may be economically prohibitive. Establishing performance goals is critical to an on-going process of keeping the actions focused on a target relative to market and financial conditions of the client.

Representing Feedstuff in NUTBAL

If a client is using a given feedstuff or considering an array of potential feeds prior to feeding season, it is critical to properly represent those feeds in the feedstuff dictionary of NUTBAL on a dry matter basis. You must assign a unique name to the feedstuff. Remember that all commercial feeds are reported on an AS FED basis and NUTBAL needs inputs on a "DRY MATTER" basis. Most tag values provide ash and crude protein values but seldom provide TDN or caloric value. Many companies today will provide average quality values on an as-fed or dry matter basis upon request, particularly if you know the lot number of the feed under consideration which is printed on the tag. In many cases these will include TDN values. However, if you have major ingredient values but no TDN values and the feed dealer cannot provide you the information, you can use the TDNCALC. The TDNCALC utility will calculate the values for you on a dry matter basis in a manner ready for entry into the NUTBAL feedstuff dictionary. The utility was written in cooperation with feed industry nutritionists. The digestibility coefficients for the components can be modified if the information is available from the various companies. Do not attempt to represent a commercial feed in a manner different from those advertised or provided to you by a company representative. If the necessary supporting ingredient information is not available, use only generic ingredients and NRC book values to work with the client until they can obtain the company's values for a given feed. It is important to help the client ask the right questions of the feed dealer to get the necessary information. Sometimes, it is helpful to request permission from the client to contact the feed representative on their behalf and talk to them about what you are doing and why you need more detailed information on the feedstuff. GAN Lab maintains a database of typical feedstuff values reported to them by feed companies and can be found on the world wide web at their homepage mentioned previously.

Determining Negative Associative Effects of Feedstuff

The use of high-starch grains such as corn introduces another problem that must be dealt with in NUTBAL. When you enter a given feedstuff, NUTBAL assumes that the animal assimilates the nutrients at the specified concentration with no impact on the desire to eat or availability of nutrients from other feedstuff on offer to the animal. High starch diets suppresses appetite due to high rumen pH and elevated VFA's and reduces the availability of energy and protein in associated feedstuff such as roughages. There is a threshold where these grains cease to be additive and begin to impact the animal negatively, eventually negating the value of the grain to the animal (law of diminishing returns). If the animal is consuming more than 0.15% of its fat corrected body weight (BCS=5) of a high starch grain, it is best to run the GRAIN program to determine if the level fed is benefiting the animal. Typically, you will have to adjust DOM value of the forage/roughage base of the diet and reduce fecal output in the Intake Adjustment field of RESPONSE ADJUSTMENT screen in the case section of NUTBAL PRO. GRAIN provides you the values to use in NUTBAL. However, you will have to run NUTBAL with no grain, noting values for fecal output, BCS 5 weight, diet CP and DOM. It is strongly advised to have the grains tested by a certified lab to better understand dry matter, crude protein and metabolizable energy content of the grain (see default values below in table 2). Book values can be found in the feedstuff dictionary in NUTBAL or in a NRC chart. You should not confuse highly fermentable structural carbohydrates, such as wheat mids or beet pulp, with starch effects of grain.

Table 2 . Metabolizable energy (mcal/lb) and crude protein values of common, high starch grains on a dry matter basis (100% DM) for use in the GRAIN utility.

Grain	Dry Matter Basis Values	
	ME (mcal/lb)	Crude Protein (%)
Corn	1.48	8.5 - 10.2
Ground Corn	1.39	10.0
Corn, Flaked	1.56	10.0
Barley	1.38-1.41	13.5
Oats	1.26	13.3
Rice	1.15	7.9
Rye	1.38	13.8
Grain Sorghum	1.38	10.1
Spelt	1.23	13.3
Triticale	1.38	17.6
Hard Winter Wheat	1.44	17.2
Soft Wheat	1.46	13.0

Special Issues to Consider for Case Information

How Detailed Should the Analysis Be? It is not uncommon for a sample to be sent in for analysis that is representing a complex herd in terms of breedtypes, age classes, physiological stages and body condition. In some cases the information is represented as an average but you know the herd structure to be diverse. In other cases you are not familiar with the herd but have the producer fill in the form with either the classes broke out and(or) a range in weights, ages, and body condition scores written on the form. However, in this case you only have one diet CP and DOM analysis from GAN Lab for that group of animals. Finally, there are cases where the producer has represented the herd properly and the analysis is reasonably straight forward. The question that arises is to how best to represent these different situations in a case analysis? When information is limited, you may want to ask the client to take a picture of their cow herd close enough to see the diversity of individuals, take another picture of a typical cows in the herd, and then take a picture of forage availability in a typical spot in the ranch. This allows you to see the data written down on the form.

The most important factors are an assessment of the managerial capability of the client, their ability to take action such as separate out animals of significantly different requirements and the quality of the information provided. Generally, if a range in values are presented, a call to the client is warranted to determine if that range is skewed one way or the other. Conduct at least two cases representing the bulk of the dominant set of conditions and that group in the herd that has the highest requirements. When a client can separate out individuals for special treatment, I would recommend identifying 2 or more groups for the analysis that would result in significantly different feeding regimes (type and amount) to alleviate the problem. In many cases these separations occur for young cows versus older cows in lower and higher body conditions. In growing animals, a difference in one month of age can be significant to the outcome of the analysis. Therefore, I suggest that you get some assessment of age range and run analyses on the dominant age groups within the herd. By representing these differences, you are communicating valuable information for the client that could lead to greater efficiencies of production if the anticipated benefits are not offset by the costs to separate the animals. It is more time consuming for the consultant to conduct these multiple analyses per sample but the action should be considered a value-added activity not more work.

Labeling the Case Name and Description. The name of the case should make reference to the month/year, animal class and laboratory id number. We have found the sample id number to be an effective mechanism to help store the data.

Selecting the Correct Breedtype. Be sure to select the breedtype that best reflects frame score, body condition for the sex and age of the animal and peak milk yield. In many cases, you are faced with a herd of mixed breeds. Look over the situation and classify them according to the four broad breed classes discussed earlier. Determine if the individual wants to correct nutritional problems of the group with the highest nutrient requirement, feed on the average or is willing to separate out the different breedtypes/classes/body condition with differing

requirements. In many cases, you may have to run 2 or more cases for the same herd depicting the different groups of animals to properly communicate the problem to your client.

Getting the Age Correct. It is critical to properly represent the age of the herd of animals in question that are less than 60 months of age as this affects body condition/weight relationships, milk yield, nutrient requirements and increases sensitivity of fecal output to DOM/CP ratio of the diet, especially if they are less than 18 months old or less than the puberty threshold weight (55% of BCS5 weight at 60 months for dairy cattle, 60% for standard beef cattle, and 65% for *Bos indicus*). When cow herds are composed of multiple age groups with diverse body condition score classes, the consultation can get complicated if the client wants a detailed analysis. NUTBAL PRO allows representation of many profiles for a single set of case conditions. Again, you must go back to the needs, capability and flexibility of your client to determine the level of analysis used to advise them on nutritional issues.

Getting the Activity Level Properly Represented. For most conditions, terrain and water will not be major constraints and selection of the second option (<15% slope and well watered) will be your most common activity item. Do not get confused and confuse your view of the terrain which may be steep but the animals grazing only those areas <15% slope. Well watered conditions are generally associated with pastures where most of the grazing is occurring within a mile of water sources and forage supply is adequate. The marsh conditions are for cattle who spend a majority of their time grazing in standing water. Snow conditions are situations where the animals are forced to graze in snow deep enough to hinder normal leg flexibility and required pawing action to seek out forage buried in the snow. Do not select snow if it involves allocated roughages.

Representing Physiology Properly. It is good to get a feel for the age classes and number of head in those age classes (21-30 day intervals) to determine how best to represent the lactating cows. In a 60 day breeding season, we recommend only doing one average age unless the herd is skewed one way or the other. If over 60 days, break the analysis into at least 2 age groups and take the mean age within those groups for your analysis. A call to your client will help alleviate this decision as they can determine if they want to analyze only the highest requirement group or want to determine the different needs within the herd to formulate a different feeding strategy.

Setting Environmental Conditions. The NUTBAL PRO program has a new set of science to represent the impact of environmental conditions on the thermal status of the animal. The CETI (Current Environmental Temperature Index) concept was developed by Dr. Danny Fox at Cornell for the Cornell model. We have adapted the algorithm to grazingland conditions requiring somewhat less inputs than the original algorithm developed at Cornell. The primary inputs are maximum temperature, minimum temperature, relative humidity, windspeed and sun exposure. As temperature rises above the upper critical temperature relative humidity will have an increasing negative impact. Wind mediates the effects of heat and increases the negative impact of cold temperatures below the lower critical temperature. Sun exposure during the day is not sensitive above 12 hours but does not increase sensitivity until you are below 8 hours.

Night-time cooling is a difficult item for most consultants to assess. We generally recommend to answer "YES" for night-time cooling of body temperature because many mechanisms are in place for animals to restabilize their body temperature before sunrise the next day. Access to shade, a good water supply, and ample forage supply to allow localized grazing at night all contribute to allowing animals such as the *Bos taurus* breeds to minimize afternoon grazing and shift to substantial night time grazing. The *Bos indicus* breeds have the additional advantage of sweating to alleviate the heat build-up as well. If early morning temperatures are not substantially different from temperatures at sun down, and the animals had limited access to shade, you might consider invoking the "NO" night-time cooling option, especially if humidity is high as well. The only way to tell is determine if night-time cooling is occurring is to take rectal temperatures at sunrise to determine if they are higher than normal, an impractical solution.

The Standing Crop Issue. Perhaps one of the most frustrating aspects of nutritional management is determining where forage supply is preventing the animals from acquiring enough dry matter or nutrients. In the original version of NUTBAL, we used a stand alone FORAGE utility. The new NUTBAL PRO has the both the FORAGE utility and the same relationships embedded the FORAGE CONDITIONS screen in the CASE module.

The table below provides you with a set of intake reduction values for various stock densities and standing crops. The values were computed assuming no growth, 25% harvest efficiency and 150 lb/ac residual standing crop. You are strongly urged to run FORAGE and get values more closely related to your situation and then input the intake adjustment values.

Table 3. Percent of non-restricted intake of forage derived from the FORAGE utility assuming no growth, 25% harvest efficiency, 1-day graze period and 150 lb/ac minimum forage residue.

Standing Crop (lb/a)	Stock Density (ac/au)						
	0.1	0.25	0.5	1	1.5	2	3
300	0.1	60.9	72	92.5	96	97.3	99.5
500	39.9	87.8	90.4	96.7	98.8	99.8	0
700	51.9	85	94	98.5	0	0	0
1000	61.4	90.4	97	99.8	0	0	0
1200	76.7	92.5	97.7	0	0	0	0
1500	82	94.6	-1.2	0	0	0	0
2000	87.2	96.7	99.8	0	0	0	0
2500	90.4	98	0	0	0	0	0
3000	92.5	98.8	0	0	0	0	0
3500	94	99.4	0	0	0	0	0

Concentrate and Roughages-Dealing with Complexity. There are many situations

where multiple concentrates and roughages are fed while animals graze on rangelands. It is important to know that NUTBAL will feed the concentrates first in order presented in the fields and then the roughages followed by the rangeland. If dry matter allocated exceeds dry matter intake potential of the animal, NUTBAL will feed only up to the fill potential and issue a warning on the report as to how much you exceeded intake. When estimating how much is fed, you must not include waste in the consumption value. It is common for clients to estimate consumption by dividing the estimated weight of hay allocated by the number of animals and number of days it took to consume the hay. A wastage value needs to discount this disappearance value. Typical values for hay are 15-25% while concentrates are approximate 3-5%. The CP and TDN values printed at the end of the report provide you an estimate of diet quality considering all the concentrates, roughages and rangeland consumed.

The Response Adjustment Field. This section should only be used when you have a good knowledge of moderating effects on the various nutritional components such as the effects of grain, protein supplements or stress.

When Do I Use the Rumen Degradable Protein >75%? Forages that are of C₃ origin can present nutrient conditions with excess non-protein nitrogen (cell contents) that exceeds the available carbohydrates for microbial populations to utilize. This creates a high ammonia environment in the rumen by the microbes and ultimately is absorbed into the blood stream and eventually urinated in the form of urea. This costs the animal energy to rid itself of the ammonia and suppresses appetite drive. Therefore, NUTBAL PRO uses the level of rumen degradable CP of 75% to alter the fecal output of the grazing animal. Fecal output is substantially reduced in growing animals and matures as DOM/CP ratio declines below a value of 4. If you are grazing green, actively growing cool season pasture and the DOM/CP ratio is less than 4 you are most likely in conditions with >75% rumen degradable CP. Intake is reduced because the amount of quality amino acids are not reaching the lower gut and negatively impacting ability to meet demands for protein. Primarily the liver and soft tissue of the gut need this protein for muscle growth.

Two solutions exist but cannot be solved with NUTBAL. One is to supply a readily available source of rapidly fermentable structural carbohydrates (eg. Beet pulp, wheat middlings) which provides a positive carbon source for the excess nitrogen being created. The other technique is to not alleviate the excess nitrogen issue and feed protected proteins (by-pass protein) that allow amino acids to escape into the lower gut after hydrolysis in the true stomach (eg. Fish meal, blood meal, feather meal, cottonseed meal, corn gluten).

What do I do About Metabolic Modifiers? When you select an implant or metabolic modifier you are attempting to improve efficiency of conversion of feed/forage to liveweight gain in growing animals. Allocation of these physiological modifiers, can affect the dry matter intake of forage, net energy for maintenance value of the forage ingested, digestibility of forage crude protein, and possibly the net basal metabolism of the animal at the tissue level. NUTBAL PRO allows characterization of any metabolic modifier if the known effects are publicly available. Beware that many products are compared to a true control, eg. nothing used. But we know little about interactions that might counter advertised effects, % times a % times a %

impact.

Implants which stimulate growth of the animal increase IDM fecal output about 8% as a percent of body weight. A new family of growth hormones and antibiotics are being approved for use in cattle and will impact this adjustment factor. Greater turnover and escape of ingested forage can also lead to higher propionate levels and more efficient yield of microbial protein synthesis that escapes rumen degradation thereby increasing crude protein digestibility. These effects must be carefully studied before putting them into NUTBAL PRO.

Writing an Advisory

The product of your efforts is the advisory report you send to your client. How you communicate needed actions will determine your success with the NIRS/NUTBAL nutritional management system. If you have sent in a fecal sample that properly represents the herd's plane of nutrition, and represented the animals and their environment properly in NUTBAL, the final step is running the report and writing a recommendation for your client.

When you run a report, you can view the report on the screen, print it out or save it to many file formats and write on the report in a word processor. The client is presented with some pre-formatted analyses which needs to be explained to them with recommended action at the bottom of the report (see report below). The detail provided depends on the complexity of the situation and degree of the problem presented from the analyses. In many cases, you are analyzing a situation where a feedstuff is specified and amount fed is provided. If the analysis indicates that the current situation is alleviating the problem and they are meeting the desired performance goals, then a simple statement indicating that current conditions and feeding regime are meeting stated goals will suffice. You might want to check on availability and pricing of more appropriate or cost effective feeds if the client is will to pursue this option. If you are working as an intermediary between the client and feed rep, involve the feed rep as much as possible in the analysis to allow them to learn from the process and represent their product in a proper manner. They may have alternative feeds to solve the solution or can provide feedback to the company on needed formulation changes.

Point out the most limiting nutrient at the beginning of the analysis. If you have had to modify input that is different from that provided on the form, explain what you did and why, ie. you used a lower weight or different body condition score or you choose a different temperature value.

Explain what a weight gain means to their eye of the cattle. For instance, a one unit change in body condition score may by 90 lbs. If the rate of loss is 0.5 lb/d this means that over the next 30 days they loose 15 lbs or about 0.15 units of a condition score (barely visible to the human eye).

There are cases where a problem exists but the client does not have any feed in mind. You can chose a variety of common feeds and do an analysis that shows their relative merit. You can also indicate that they need x.x lbs of protein or TDN per day to meet their need and

then let them go shopping for a feed that gives the lowest cost per lb of limiting nutrient. The best solution is to call this client and explore options with them and then conduct the analysis for a suite of feeds that were identified in the discussion. It is good to establish cash limits, feeding constraints, and degree of availability of the feed in question. Also, make sure you have the necessary nutrient information about the feed before you begin your analysis.

The actual recommended amount may have to be adjusted given the sampling interval of the individual. For instance, if a person is sampling every 30 days and there is a problem in terms of protein requiring feeding of 1.5 lb/d of cottonseed meal for the current situation, you need to anticipate how the animal's requirements will change during the sampling interval and how conditions in terms of forage quality and environment will alter the recommendation. If the animal is on an increasing requirement plane and forage quality is declining, you might want to recommend a level of feeding for a specified number of days followed by a change in level over another period of days. Warnings about unusual conditions and operational adjustments in feeding levels and kind of feed are good for those regions with unexpected severe weather events (snow storms, ice storms, heavy extended rains in cold weather, early frost). In some cases, it is advisable to run a series of cases with the anticipated conditions to see if your recommendations should be altered.

There are cases where requirements are declining and forage quality is increasing to the next sampling point. Again, recommended actions and adjustment during the sampling interval are warranted.

It is a wise practice to recommend when and under what conditions the client should collect the next sample. The interval depends heavily on the client's interest in the monitoring and the level of expected interaction between you and your client. If you are in a seasonal transition period, it is good to reduce the sampling interval and specify the conditions that warrant sampling again. For instance, fall to winter transition periods are uncertain as to when first frost occurs. You could recommend that a sample be taken in 21 days or 10 days after a killing frost and if it rains occur after the killing frost take the sample in 5-7 days. It is good to set up a baseline value every time conditions change substantially and then wait 14-21 days and take another sample to set a trend line.

Establishing a Sampling Interval. You should refer to the document on setting up sampling interval for further guidance. However, when to sample and how frequently is dependent on the financial status of the client and the degree of interest they have in the monitoring program. You should urge the client to at least do a sample once a month during the traditionally low quality periods. However, it is wise to do a 30-d profile for the entire year when first working with the client to identify opportunities to strategically apply nutrients through out the year. Also, identify unusual conditions that occur throughout the year and sample after about 5-7 days from the event's start with a 14-day interval to gain a better understanding of what it is doing to the livestock in question. Make sure that your advisories show value to the individual. Value can be reflected in feed costs, weaning weights, calf crop percentages, improved pasture management and last but not least managerial ease of mind. It is good practice to capture these values for showing how your service could impact future clients.