**Beef Cow Nutrition and Feeding**

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**Cattle are Ruminants**

The digestive system of cattle includes a large fluid filled rumen containing a large population of microbes with the ability to break down fibrous components of roughages and initiate feed digestion. As feed passes from rumen to smaller stomach structures, water is absorbed and the animals own digestive enzymes further break down feed for nutrient absorption.

**Required Nutrients**

As calories define the energy in food we eat, and what is used or required for activity and growth; in cow rations energy is often expressed as TDN (Total Digestible Nutrients) or Mcals. This may be expressed on a percentage basis of feed or in pounds per day. Cattle obtain energy from digestible fiber, starch and to a lesser extent sugars and fats.

Protein is also required both for the rumen microbial population and the animal. Supplying the need for rumen nitrogen is met by feed sources which are easily degraded in the rumen. Microbial activity is further associated with greater fiber breakdown and roughage intake. The animals need for protein for growth, lactation and reproduction is met by a combination of microbial protein and protein which bypasses rumen breakdown and is digested and absorbed further in the GIT (gastrointestinal tract).

In addition to energy and protein a variety of minerals and vitamins are required for physiological functions and in the diet. Calcium and phosphorus are needed in the greatest quantities with varying concentrations amongst commonly fed feeds. While other minerals as copper, zinc, selenium are needed in much smaller quantities, they are often deficient on feed produced in soils in the region and provided in supplements.

Most vitamins are often provided in high quality, fresh green forages, but are also supplemented to insure against deficiency with mature, weathered forages, grains and grain by products.

**Factors Affecting Nutrient Requirements**

Many things impact the nutritional needs of the cows of which level and state of production is probably the most dramatic. Nutrient needs are greatest shortly after calving in early lactation and returning to estrus for rebreeding. Conversely nutritional needs are lowest following weaning while cows are dry and in mid-gestation. It is an opportunity to utilize lower value cost feed alternatives and/or too cheaply put weight on and recondition cattle.

Young developing cows as two and three year olds require higher quality feeds to meet their added requirement for growth. Cows selected and capable of high milk production will have increased nutrient needs for both maintenance and milk production.

While larger cows do not need feeds higher in quality or nutrients expressed as a percentage, they will have greater intakes and a need for additional quantities of protein and TDN.

In the north, cold stress also impacts energy needs. Cold stimulates intake and if given the opportunity a cow can eat more to meet added need to about -10° F. Extremes beyond this due to wind chill or ambient temperatures require feeding higher energy feed rather than increasing feed provided. The impact of cold can increase cow energy needs is less for cows in good flesh and body condition.

**Assessing Nutritional Status**

There are several approaches and tools to help determine if the beef cow’s nutritional requirements and needs are being met. These including: testing feeds for nutritional content, visually evaluating cow appearance, assaying blood and tissue for nutrient status, formulating and evaluating rations which compare feed provided to cow requirements adjusted to production and environmental factors.

**Body Condition Score**

A standardized scoring system has been developed to rate a cow’s visual appearance from 1 to 9 based on body fat and fleshiness. Higher scores equate to higher condition and weight cows, reflecting current and past nutrition has supported weight gain and body maintenance. Low scores equate to thin cows which have likely utilized body energy reserves to meet requirements, and have likely been losing or have lost weight.

Cow weight and condition will fluctuate through the year associated with feeding level, pasture condition, and nutrient demands. Cow condition should be monitored as cows are observed. Cows noted to be losing weight or thin (BCS of 4 or less) in the fall need to start receiving supplemental feed and/or have calves weaned. Thin cows should be reconditioned prior to brutal cold winter and for optimum calf health and rebreeding to calve in smooth moderate flesh generally or BCS of 5 of for cows and 6 for heifers.

Moderate condition scoring cows (BCS 5) will be smooth in appearance and full in the quarter with only the last rib or two visible. As cows deposit fat and move to higher condition scores (BCS 6-7) they will become flat over the top line, have some fullness to the brisket, and patchiness over the pin bones. Conversely thin cows (BCS 3-4) will be sharp over the spine, with rib and hip bone structure easily visible. Very thin cows will also have lost muscling and become very flat or sunken in the rear quarter.

Generally, about 80 to 100 pounds of body weight is needed to move a cow up one numerical body score. Furthermore, under cold conditions, higher fleshed cows have reduced maintenance needs. Extension, breed association, and feed dealers have developed publications or computer apps defining BCS.

**Feed Testing and Ration Formulation**

Feeds and particularly forages vary considerably in their nutrient levels and feed value. Obtaining representative samples of feeds and submitting for laboratory analysis will provide an estimate of feed value and an indication if the feed will meet animal needs, or must be supplemented with higher quality feeds. Accurate dry hay samples are best obtained by coring bales. Silage samples can be grabbed at various locations across the bunker face when opened for feeding.

Cow nutrient requirements for energy, protein, and minerals can be compared against levels in feeds or combinations of feeds. Computer spreadsheets and programs are available to make these calculations and adjust for various effects of weather, for cow size and type, and stage and level of production. Producers can balance rations themselves or use services to formulate and evaluate rations available from consulting nutritionists, feed companies, and the extension services. Testing feed and evaluating rations allows for more precision feeding to meet needs and minimizing feeding costs and expenses.

**Consequences of Poor Nutrition**

Many variables influence the nutrient needs of cows, and there is a biological priority to how available nutrients are used.  Nutrients are first used for animal maintenance and survival.  Secondly nutrients will be used for growth in young animals, and once these needs are met nutrients will support milk production in lactating animals, and finally for reproduction.  The effect of not meeting nutritional needs will have an impact on animal health and production, particularly by underfeeding, but over feeding has consequences to productivity and cost as well.

**Fertility-Breeding**

Body condition and fat reserves majorly effect reproduction including: the onset of puberty in heifers, cow’s postpartum anestrus period, conception rates, and embryonic/fetal survival.  Cows calving in thin condition as a result of inadequate gestational nutrition are characterized by extended anestrus after calving and poor conception and pregnancy rates during a breeding season to maintain a yearly calving interval.   The reproductive performance of cows thin at calving can be improved with pre breeding flushing; however, fertility rates will likely never match cows who calved in moderate condition, maintained weight in early lactation, and were on an increasing plane of nutrition during breeding.  Additionally, cows or heifers bred under good nutritional conditions but post breeding get subjected to markedly poorer nutrition have poorer embryonic survival and resulting lower first cycle and overall pregnancy rates.

**Calf Survival and Weight**

Additional consequences of underfeeding cows both pre and post calving are seen in calving difficulty, calf vigor, calf survival, and calf growth and weaning weights.  While cows underfed during gestation often have slightly smaller calves at birth, calving difficulty often increases associated with weaker labor.  Additionally, these lighter calves may lack vigor at birth, fat reserves for cold tolerance, and receive less and poorer quality colostrum therefore lacking immunity and being more vulnerable to scours and respiratory complications contributing to greater calf losses.  Sometimes a specific deficiency such as lacking vitamins or minerals can also impact calf vigor with less relationship to cow condition.  Cows not receiving adequate energy and protein will have reduced milk production directly reducing early calf growth and development and subsequent market weights.  Cows fed to excessive body condition are also likely to have increased calving problems associated with internal fat deposits and restrictions to the birth canal and larger calves.  Fat deposited in the udder also reduces future milk production.

**Fetal Programing**

Current research is providing some interesting insight into how nutritional stress under fetal development during gestation can alter future animal outcome and potential.  If the developing fetus does not receive optimal nutrients through placenta blood flow at critical stages of development carcass traits relating to muscle fiber size and fat cell numbers can impact carcass weight, yield, and marbling.  Fetal nutrition has also been demonstrated to have an impact of subsequent fertility and feed efficiency of heifers depending on the gestational nutrition/supplementation of their dams. This work further reinforces the need to provide cows adequate feed to meet their defined nutritional needs and avoid consequences from nutritional stress/deficiency.

**Feedstuffs and Supplements**

The beef cow is very versatile and can be fed a variety of feeds.  Because of her ruminant digestive system, her primary and typically least cost feed is forage.  Forage however encompasses a variety of both grazed and harvested roughages of considerable variation in nutritive value. Baled hay including farmed annuals, tame grass and legume perennials, native prairie and lowlands, and crop residues predominant as winter feedstuffs.   The harvest of corn as silage is increasing as a versatile high yielding, high quality, feed that balances nutrition of low quality feeds while producing significant feed off limited acreage. When forage is very scarce or expensive, alternatively cows can be limited feed high grain diets, or substantial amounts of readily available grain or crop processing byproducts as screenings, middlings from wheat processing, distiller’s grains from corn ethanol production, beet pulp, or meals from oil seed crushing.  Additionally, commercially manufactured dry and liquid feed supplements are available to balance diets and complement a variety of home raised feeds.

**Roughages**

Nutritive value and quality of roughages is highly varied and influenced by a variety of factors including species, stage at harvest, weather damage, and harvest and storage loss.  Fiber levels are less and digestibility, crude protein, and TDN content greatest for early cut (pre seed production) hays; however, some yield is sacrificed at this time.  Generally, legumes as alfalfa, field pea, clovers, etc. will be high in both protein and calcium, whilst crop residues as straw or stover are very low in most all nutrients but can serve as portion of the ration in combination with higher quality feeds.  Depending on quality, hay alone can often be consumed in sufficient quantities to meet most all nutritional needs of wintering cows.  Forage quality is the primary factor effecting intake.  Low quality forages are less palatable and digest slowly slowing the rate of passage, and most likely won’t meet cow needs without supplementing with better feeds and providing rumen degraded protein to enhance digestibility and intake.

**Silages**

Silage is a wet and fermented feed that is highly palatable to cattle and high in quality particularly energy or TDN.  While corn silage is often considered a forage, it is in fact more a blend of grain and forage. Optimum fermentation occurs when whole plant moisture is 60-65% moisture and the starch milk line has progressed to three fourths of the way down the kernel.  This results in a good pack to eliminate oxygen and readily available carbohydrates for fermentation.  Corn silage is useful as an energy source to utilize low quality feeds as crop residues, for conditioning thin cows, or meeting lactation needs of highly productive heavy milking cows.  At times and some locations wet beet pulp is available that can be used similarly to silage.

**Grain and Grain By-Products**

At times, grain including barley, corn, wheat, or screenings, is a cheaper and more readily available source of nutrients than forage. Grain is also a much more concentrated feed with high levels of TDN per lb. making it useful in supplementing some added energy to marginal or low quality forages.  Whole grains however are predominantly starch which can have some negative effects on forage digestion.  This antagonism can be managed by limiting grain levels to less than .35% of body weight and daily feeding at same time.  Feeding high levels of grain with low quality forage will further reduce the digestibility of the roughage, however it may still be economically advantageous to feed relatively high levels of grain, while maintaining adequate roughage for rumen health (about 10lbs/hd/da). In general byproducts of grain processing are better cow feeds as most of the starch has been removed leaving very digestible fiber, some fat, and concentrating protein and phosphorous levels. Oil seed meals and distiller grains are very high in protein and an excellent supplement when additional protein is needed, Distillers grains or wheat middlings are also very good sources of energy which can substitute for forage or provide supplemental energy.

**Commercial Supplements**

Home raised and commodity feeds are most economical and provide the bulk of what cows are fed. However, to balance the feeds being fed to meet cow specific nutrient requirements manufactured feed supplements may be necessary and used.  In some areas cow cake or pellets are used to supplement energy, protein, vitamins, and minerals.  More likely however is to utilize commercial block, tub, liquid, or granulated supplements to furnish vitamins and minerals fortification and deliver additives as Bio-Mos, prebiotics, iononphores, etc. and only very limited amounts of protein and energy.

**Feed Processing and Delivery**

When cows are unable to meet their nutritional needs through grazing, either some supplemental or all of their nutritional needs must be met through the delivery of harvested roughages, commodities, or other feedstuffs.  The challenge is to meet this need efficiently, both managing cost, investment and losses.  Feeding infrastructure and equipment utilized can vary greatly depending on types of feedstuffs utilized and the scale of an operation.  At the least, a single feed as baled hay may be periodically fed on the ground with simply a loader or pickup; versus, blending multiple feed ingredients into a mixed ration and delivered in a feed box into bunks on a daily basis.

**Grinding and processing**

Corn silage and grain byproducts as wheat midds or distillers grains, have been chopped and ground at time of harvest or processing.  They can easily be incorporated into mixed rations and efficiently utilized without any further processing.  There are however possibilities and situations to consider chopping long hay or rolling/cracking grain as it is fed.  Chopping or grinding hay is required to include in many feed wagons and mixers and, may reduce processing and mixing time of vertical style mixers capable of blending long hay.  Shredding or grinding hay will not improve digestibility to any significant degree but often can increase intake and reduce feeding waste.  Whole grains have improved rumen digestibility if cracked or rolled to break the seed coat and increase surface area.  Improvement with corn and oats is considerably less than for barley and wheat and often not processed.

**Delivering Feed**

Baled hay is often fed by loader tractors and bale carriers as long hay.  Rolling out bales provides greater access and opportunity to all animals and can reduce waste from trampling and bedding if not being fed in feeders and on dry or frozen ground.  A very popular method is to utilize a bale shredder/processor to carry hay to cows and shred long hay with fails into a windrow on the ground.  Advantages of processing bales includes improving palatability and consumption of coarser lower quality roughages while minimizing waste and refusal and providing equal feeding opportunity to cows regardless of pecking order.  Other reasons for use include limiting waste and debris on feeding fields to be subsequently farmed, and eliminating a chore of hand removing twine and net from bales (needs to be routinely removed from processor drum to minimize contamination in processed feed).  Losses from fines and dust can actually be a disadvantage to processing high quality alfalfa hay. Grain/cube hoppers, tanks, and buckets are used to feed supplemental grain or concentrates and can be included on bale processors, utvs, pickups, or tractors when a feed wagon/truck is not used.  When substantial amounts of wet feeds as silage, beet pulp, or wet distillers grain is being fed, a feed mixer as a tractor towed or truck mount is utilized.  A variety of companies and styles are available including auger, reel, or vertical screw mixers in capacities ranging from couple ton to twenty.  Delivering feed with a mixer box not only allows for great versatility of feeds that can be used, a method to deliver feed to large numbers quickly, but also the means to be more precise in meeting nutritional needs.  The equipment cost and the added operational cost of both loader and delivery units dictates economics of scale to be feasible.

**Bunks and Bale Feeders**

When cows are out wintered in protected fields and pastures, feed is often fed on the dry sod or frozen snow covered ground.  However, for cattle yarded in corrals or being fed under wet/muddy conditions, feed is typically placed in bunks and racks to minimize waste and loss.   Depending on facilities and rations, this may include feeding mixed rations into fence line bunks, turned tires, and high capacity or bottomless moveable bunks.  Under these situations, baled hay should be fed in rings, racks, or wagons to restrict access and reduce feeding waste.  Large differences in bale feeders exist in cost, durability, and effectiveness in reducing waste. Cradle, cone, and hay saver designs restrict the cow’s ability to easily pull hay out to where they stand and reduce feeding losses.

**Self-fed**

Most feeding systems deliver feed to the herd daily as a means reduce losses and manage nutrition. Some alternatives are available to reduce feeding costs through limited equipment operation and providing feed for multiple days at a time.  For small groups of cattle even a single hay bale may feed the group for days.  With the use of bale feeders to control waste, bales could be provided to cover several days feed needs and only replenished when consumed.  For larger herds, the practice of bale grazing in which cattle may get access to a supply of bales to meet there needs for several days to several weeks is an alternative.  Strategies to manage waste include bale placement (30ft apart), mix of forage quality (little waste of high quality expensive feed), limited allocation (40 lbs per cow for 4-5 day supply of bales), and feeding on sites where residual will improve soil fertility.  Although mineral supplementation can be daily allocated in delivered feed, many provide as free choice self-fed supplements some of which also included limited protein and energy.  Popular are salt limited granular mineral mixes and tubs which restrict intake by hardness and encourage use with molasses and palatable ingredients. Similar formulations are available as liquid feeds delivered through lick wheel tanks that limit intake or by the use of limiters that have a taste aversion.

**Nutritional Disorders and Disease**

A variety of afflictions and ailments of cattle have direct relation to what they eat and nutrition.  These include nutrient deficiencies and imbalances, a variety of toxicities, and other feed related problems.  The list of nutritional diseases includes grain overload, bloat, founder, acidosis, tetany (grass staggers), pulmonary emphysema (fog fever), nitrate poisoning, prussic acid poisoning, sweet clover poisoning, ketosis, hypocalcemia (milk fever), urinary calculi, white muscle disease, selenium toxicity (blind staggers), ergot toxicity, mycotoxins, polioencephalomacia (polio), and a multitude of lesser seen and known others. Several of the more prevalent conditions leading to cattle losses are summarized by the following.

**Acidosis**

Also sometimes referred to as grain overload is a condition in which rumen ph drops significantly often from a sudden switch in feeds from high roughage to high concentrates or a diet high in rapidly digested grains associated with a buildup of lactic acid.  In acute cases cattle become lethargic, weak, and die suddenly. Subacute acidosis is often recognized by cattle showing discomfort, having foamy grey diarrhea, a lack of appetite, and poor performance or weight gain. Episodes of acidosis often result in founder (lameness and distorted hoof growth), liver abscesses, bloat, and suppressed immunity.  It can best be prevented by feeding roughage based rations, gradually including grain through step up acclimation, being attentive to cattle intake patterns to avoid instances of over eating, and including buffers as sodium bicarbonate in rations.

**Bloat**

Simply bloat is a buildup of gas (a product of fermentation and digestion normally belched off) in the rumen and a common cause of cattle deaths.  It is often characterized as feedlot or pasture bloat with somewhat differing factors.  High grain highly digestible rations fed to cattle on feed can produce large amounts of gas and indigestion associated with acidosis can contribute to bloat.  Including an ionophore and avoiding finely processing grains is helpful and recommended.  More common is pasture or legume bloat which is common on immature alfalfa (pasture and hay) and, lush rapidly growing forages. The formation of a heavy frothy foam in the rumen from the digestion of these feeds, traps rumen gases and leads to bloat.  Bloat can be recognized as a bulging or distension of the left side which leads to respiratory distress and sudden death. If detected in time it can be treated by using a stomach tube or a trocar to release gas from the paunch.  Mild cases may also be treated by drenching with bloat reducing liquids to reduce surface tension in the rumen.  Several feed additives are available to similarly help prevent bloat. Pasture bloat can be minimized by including at least 50% grass in alfalfa plantings, never turn hungry animals into risk pastures, avoid grazing legumes before bloom, provide mineral supplementation, and avoid turning in under moist damp situations.

**Nitrates**

Plants with a buildup in nitrate levels can result in cattle consuming excessive amounts which can result in poisoning and death.  High levels of nitrate in the soil from heavy fertilization coupled with adverse environmental conditions which decrease plant growth (drought, frosts, herbicide damage, plant disease, unbalance fertility) can result in plant nitrate accumulation.  Many plants can accumulate nitrates but annual cereals as oats, corn, sorghum, sudangrass, and some weeds are most likely to be accumulators.  Generally, nitrate is highest in young plants and just before flowering and decreases as plants mature with accumulations greatest in the lower third of the plant stem or stalk.  Nitrates can also accumulate in water, particularly ponds and shallow wells with run off and leaching from high nitrate soils.  Excessive nitrates in feed and water results in high levels of nitrite as it is broken down in the rumen.  This is absorbed into the bloodstream and results in diminished ability of the blood to carry oxygen with toxicity dependent on how much and how fast nitrate is consumed.  Symptoms can appear suddenly and include difficult breathing, loss of coordination, abortion, and death.  Tests are available to measure nitrate levels in forage to determine animal safety. Generally, levels of over 4000ppm (.4%) are considered toxic and should not be fed.  Levels under 1000ppm are considered safe for all classes of cattle without restriction.  Intermediary levels need to be fed with limitations to dilute with non-nitrate feeds and if over 2000ppm not fed to pregnant animals.

**Tetany**

Grass staggers is the common name for a condition of hypomagnesaemia or tetany most often seen in the spring on young rapidly growing grasses in high milking cows.  It is a result of depletion of magnesium levels from inadequate intake for output.   Symptoms include restlessness, staggers, excitable, aggression, and convulsions.  Treatment can be made but must be prompt, and therefore it should be prevented by supplementation of minerals and salt including added magnesium oxide particularly at spring turnout.

**Mycotoxins**

Mold and fungi are prevalent in the environment, including on forages and grains for cattle feed which can reduce palatability and nutrient levels.  Additionally, they often produce mycotoxins which can have significant effects on livestock.  Healthy cattle appear to tolerate higher levels for longer periods of time than other species, but certain mycotoxins such as aflatoxin have been associated with liver damage, poor performance, and even death.  Feed with high mold and spore loads and/or the presence of mycotoxins has also been associated with abortions.  ND feeding trials have demonstrated the ability to use scab infected grain with high vomitoxin levels in cattle rations at appropriate levels without effecting performance or reproduction.

**Summary Guidelines**

It is the responsibility of producers with cattle operations to make sure their animal’s needs are provided. The primary need is that they have adequate feed and water. Providing feed becomes the major activity of northern plains ranchers considering the time to harvest and transport feed, maintain pastures fences, deliver winter feed, and cleanup feed waste and manure. They are challenged to do so in economical ways to remain profitable in a tight margin business where feed and pasture costs amount to about two thirds of total production expense.

**Feed Quantity and Cost**

On an as fed basis, beef cows will consume about 3% of their body weight daily as moderate to good quality hay which is likely to meet most nutritional requirements for gestation and maintenance. On very low quality roughage as crop residue, intake drops to 2% of body weight or less due to slow breakdown and passage, and may result in significant and rapid weight loss. In contrast, very high quality forage can be consumed at intakes over 3% (close to 4% under cold conditions) and provides enough energy for modest gains. Hay wintered cows will need approximately one large bale per month of feeding with some reserve provision for an early winter, bitter cold, or late spring turnout (typically 6-7 1200-1400lb bales/cow).

**Supplementing Protein**

Energy (TDN) is the nutrient needed by beef cows in the greatest quantity; however, protein intake is critically important for several reasons and at times supplemented. Having an adequate amount of rumen degraded protein enhances microbial activity in the rumen and the breakdown of fibrous feeds thus increasing their digestible energy content, rate of passage, and forage intake. Additionally, critical levels of protein are needed for immune function, growth (including fetal), and milk production (including colostrum). Legume hay, grain byproducts as distiller’s grains, oilseed meals, pea screening, and wheat midds are all good sources of protein and can be fed as limited quantity supplements where a base forage is abundant but below requirements for protein. Often .5 lb. of added protein per day is provided equating to 1 to 3 lbs. of supplement per day. Little difference in effectiveness is seen if high protein supplemental feed when delivered daily or every several days at X the amount. Non protein nitrogen as urea can used to meet a portion of this need for rumen microbes but should probably not exceed an equivalent of a third of supplemented protein.

**Feeding Cows Grain**

When forage is inadequate to meet energy objectives of maintaining weight or reconditioning thin cows, or is scarce and expensive as in times of drought; grain can be used to supplement or extend forage. Off grade and market discounted grain is often a very economical feed. Inclusion in bunk fed mixed rations is an excellent way to deliver grain, however; a variety of grain boxes and hoppers are available to deliver separately to hay fed cows. Grain should be fed daily in such a way all cows get their equal access (lots of bunk space). The antagonistic effect of starch on forage breakdown can be minimized by limiting gain to several lbs. per cow a day. However, under forage shortages, cows can be essentially slowly stepped up to predominately a grain ration which maintains enough forage for rumen function (1% body weight). Digestibility of grains is improved by processing to /rolling is available. crack into several pieces and should be considered when grain is costly and grinding.

**Mineral Strategies**

Forage analysis and animal biopsies document several required minerals (in addition to salt) and vitamins are lacking or marginally deficient most of the time in cow diets. Symptoms are usually subtle; however, some productive losses are likely occurring. Common situations include: low phosphorous in mature forage; low vitamin A levels in stored or non-green feeds; low magnesium in lush cool season grass; marginal levels of copper, zinc, and selenium in feeds produced on the regions soils or less available with sulfates in water; and low calcium on grain, byproduct, or silage base rations. Many good commercial products in a variety of delivery options are available to balance needs with differing feedstuffs. Mineral supplements are formulated with mineral sources of varying bioavailability and cost. Organic chelated forms are generally superior and have value for correcting major deficiencies and for critical times. Additionally, some products also include additional additives as microbial, prebiotics, and compounds which aid in health and digestion. With deficiencies greatest on mature and weathered feed, and needs greatest in late gestation and breeding; supplementation is critical during late season and residue grazing and for late gestation through breeding.

**Controlling Feeding Cost**

In addition to identifying the most economical feeds to produce or purchase in a local area and situation, it’s important to not waste or lose feed. It begins with good feed harvest and storage techniques to manage harvest and storage losses which can be high for hay and silage. Control hay waste by limit feeding, processing coarse feed, and using bunks. Reduce feed needs by grouping cattle and feeding for need. First and second calvers, and old and thin cows can be fed separate from mature cows needing less. Graze more and feed less by extending grazing season with stockpiled forage, crop aftermath, and cover crop grazing in late fall and early winter. Source cheaper alternative feeds when available as crop residues, damaged crops and byproducts. Consider scheduling the herd to calve latter reducing nutrients needs from harvested winter feed and/or moderate cow type to lower milking reduced mature weight animals requiring less feed input to maintain condition.

**Critical Management**

In reality a cow’s nutrient needs are never met precisely every day. It is typical for a cyclic weight gain and loss pattern, accumulating condition and fat reserves which are latter utilized. Late fall is a critical management period to recondition cows which have lost weight while lactating and producing a calf. Once dry and weaned, cows can very economically put weight back on prior to the onset and extreme cold of winter. Periods of brutal cold are also critical and best dealt with by having cows in good condition and then providing extra feed, and shelter from wind when temperatures and wind chill drop. For extended subzero periods not only will extra feed be needed, but probably some supplemental grain or higher quality forage, if weight is to be maintained. Young thin cows are of special concern, as if not brought back to condition prior to calving will likely not rebreed timely. As gestating cows enter the final months of pregnancy, feeding should change and reflect higher needs for protein, energy, and minerals. For herds calving well in advance of spring grazing, lactation rations need to contain high quality feeds to meet this increased nutrient need and prevent considerable weight loss prior to turnout and breeding.