Animal Health

Anti-Quality Factors in Rangeland and Pastureland Forages

Illinois

General Information

We, as producers and technical specialists, try to focus on providing information to the livestock clients on how to improve the quantity and quality of the forages, produced and consumed, for the livestock to improve performance and gains. First we should look at the definitions of both Quality and Anti-Quality Factors.

Forage and Nutrition

"Forage quality can be defined as the degree to which forage meets the nutritional requirements of a specific kind and class of animal. An 'anti-quality component' would, therefore, be any factor that diminishes the degree to which forage meets the nutritional requirements of a specific kind and class of animal." [1]

This is further complicated by the animal types and the various growth and production stages of the animals at different periods of time in their life cycle. The anti-quality components can vary in both kind and class in the plants. The two types are phytochemicals in plant tissues or structural inhibitors in leaf and stem arrangements. These can result in mineral deficiencies, toxicities, or mineral deficiencies. Chemical inhibitors can result from plant metabolism or from microbes living in the plants. Other anti-quality factors in forages can be related to the presence of insects and diseases. Any anti-quality factor can reduce dry matter intake, limit dry mater digestibility or cause nutritional imbalances. These same factors may also be toxins that shut down vital systems in animals, resulting in abnormal reproduction, disturbed endocrine or neurological function, causing genetic aberrations, or suppressing immune function leading to increased death and diseases.

"The study of these anti-quality factors is both complex and compelling because of the many and unrelated causes and yet potential for many interactions and subtle interrelationships." [1]

Economics

If we look at the economic impacts from anti-quality factors, these can have the potential to be very expensive to a livestock operation. "Tall fescue toxicity has been estimated to cost the beef industry over $600 million annually. Reproductive and death losses of livestock to poisonous plants have been estimated at $340 million in the 17 western states alone." [1] Other imbalances in forages can occur such as magnesium deficiency, reported to inflict a loss ranging from 1-3% for beef cows annually. This could be equivalent to $150 million in the U.S. if only 1% of the 42.6 million cows and heifers that calved by January 1, 1999, weighing 1100 lb. per cow, and were valued at $0.35 per lb. The fescue toxicosis can have a long lasting and measurable effect on the animals throughout the stress of cross country transportation and throughout a 150 day feeding period. It can also effect livestock production by lowering the immunity of an animal and cause higher medication costs.

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Economics (continued)

Poisonous plants can occur in any rangeland and pastureland area. These can be one of the most important economic impediments to profitable livestock production. "Based on an estimated 1% death loss in cattle, a 3.5% death loss in sheep, and a 1% decrease on calf and lamb crops due to poisonous plants, the economic impact with in the 17 western states had been estimated at $340 million annually." [1] This is only a few of the areas the anti-quality factors can have an impact. Low forage quality that can reduce gain performance is another large contributing factor in the economic picture of an operation. Thus, if we all look at the importance in forage testing for feed values and mineral content, we may improve our operation's bottom line. Also, the species identification within our grazing areas can save us several dollars by utilizing the forage at the proper time and eradicating potential hazardous plants. Some of these poisonous plants tend to grow in shaded areas; thus restricting livestock use in shaded areas may be an easy control mechanism to avoid animal access.

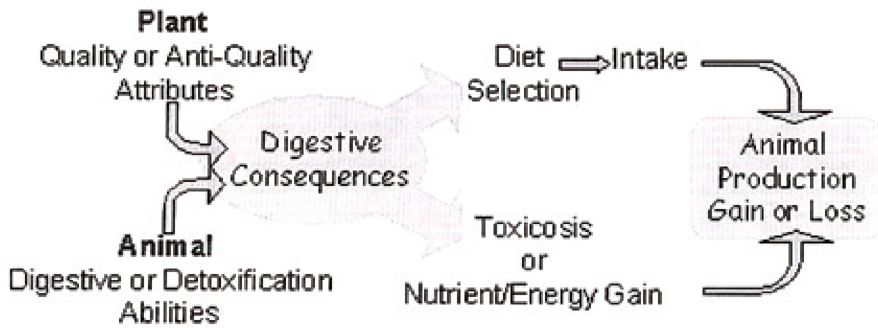

Fig. 1. Digestive consequences are at the center of how animals respond to anti-quality factors in forages. The actual digestive feedback animals receive is determined by plant forage quality and animal digestive and detoxification abilities. The consequences of consumption, in turn, affect diet selection and intake and the nutrients and energy available for animal growth and maintenance.

References

[1] Quotes are taken from Station Bulletin 73 July 2001 prepared by USDA/NRCS Grazing Lands Technology Institute, Idaho Forest, Wildlife and Range Experiment Station Moscow, Idaho and University of Idaho.

Figure 1 from Station Bulletin 73, July 2001, prepared by USDA/NRCS Grazing Lands Technology Institute, Idaho Forest, Wildlife and Range Experiment Station, Moscow, Idaho and University of Idaho.

Prepared by

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December 2006

Animal Health

Control of Parasites in Grazing Beef Cattle

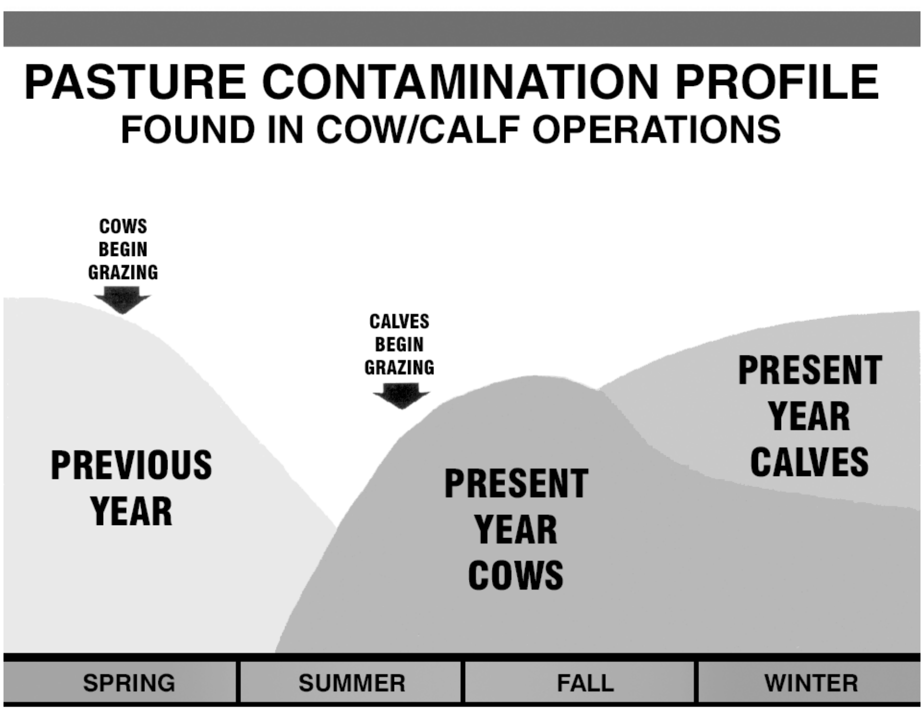
Illinois

By: G. L. Meerdink, D.V.M. Extension Veterinarian, University of Illinois College of Veterinary Medicine

Unless in total confinement, cattle will be exposed to parasites that result in production loss and, perhaps, health problems. Control of internal parasites can be accomplished by administration of any of several oral, injectable or pour-on products available on the market. Too often the decision to deworm cattle is based on their appearance. By the time the effects of parasitism are visible, major economic loss and health compromises have occurred. The issue is when and how often to deworm cattle relative to the herd exposure and re-infection. Optimum parasite control for grazing cattle relies on strategic deworming in order to decrease re-infection. **We must "treat" the pasture as well as the animal.**

- Worm larvae survive winter and are infectious until late spring
- Warm, wet weather increases worm larvae viability
- Worm larvae populations from pastures in spring can be excessive and cause disease in cattle
- Ingested larvae mature to adult worms, produce eggs which pass out with the feces and further contaminate the pasture
  - *Ostertagia* sp., specifically, has the ability to encyst in the wall of the abomasum to later flood the intestinal tract with a high larvae population
- Pasture reinfection from infected cows readily provides larvae for calves (which are less resistant to worm deleterious effects) as well as cows

Figure 1. Over-wintered parasitic larvae provide re-infection for cows put on spring pastures who perpetuate the pasture parasite contamination and provide exposure to new calves.**



Goal is to maintain "parasite safe" pastures
- Kill adult worms before grazing
- Kill immature worms before egg shedding
- Time treatments to seasonal grazing pattern

Deworm cattle at the end of the grazing season to prevent carry-over of worms (worming after the first frost with some products will also kill external parasites)

Deworm cattle a few weeks after putting on pasture to kill newly acquired worms before they mature and begin laying eggs to reduce pasture recontamination
- A dewormer which can kill immature worms will be necessary to use at this time (one that kills only adults will not be effective)

Young animals are more susceptible to worm infections and should be treated three to four weeks after turnout followed by several repeat treatments three to four weeks apart
- (longer than four weeks can allow for sufficient maturation of the parasite to allow shedding of eggs)

Pasture contamination is related to grazing pressure
- Dragging pastures to break up and dry fecal pats reduces larvae numbers
- Intensive grazing practices intensifies the need for parasite control strategy

Contact your veterinarian
- Optimum product type for specific control period
- Strategies for dewormer administrations to coincide with other cattle handling requirements (e.g., vaccination, pregnancy examination, etc.)

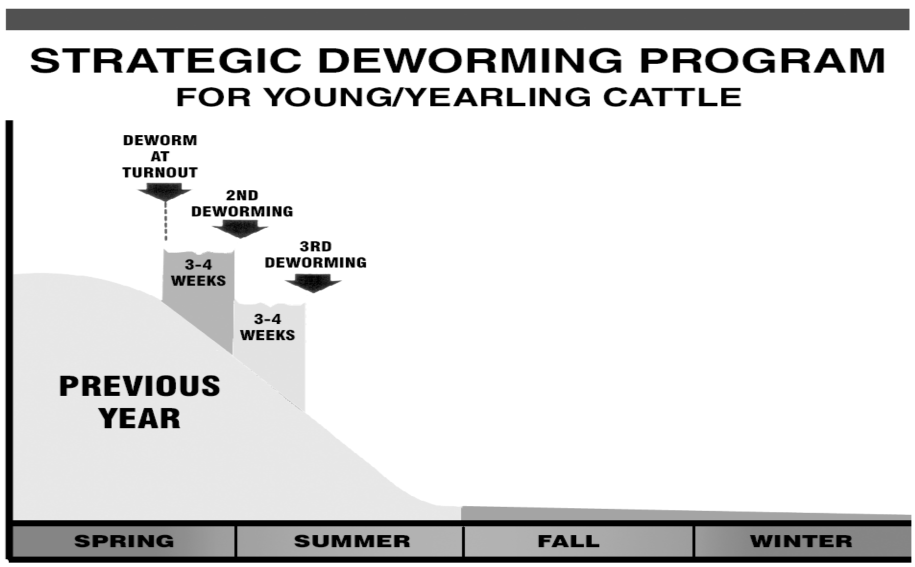


Figure 2. Deworm cattle before turning out to pasture and following treatments to avoid recontamination of pasture**

**Bliss DH: The Cattle Producer's handbook for Strategic Parasite Control. Hoechst Roussel Vet, 1997

Additional Fact Sheets:
-*Control of* ***Equine*** *Parasites* -R.D. Scoggins, DVM, University of Illinois
-*Control of Internal Parasites in* ***Sheep*** – R.D. Scoggins, DVM, University of Illinois
-*Control of Parasites in* ***Dairy Cattle*** – Dick Wallace, DVM, MS, University of Illinois

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Project funding provided by: North Central Region Sustainable Agriculture Research and Education Program

Project coordinated by: Dean Oswald, Animal Systems Educator, Macomb Extension Center, 480 Deer Road, Macomb, IL, 61455.

November 2000

Animal Health

Bloat and Pasture

G. L. Meerdink, DVM -Veterinary Diagnostic Lab & Extension University of Illinois

Illinois

Bloat or ruminal tympany is the abnormal extension of the rumen and reticulum caused by excessive retention of the gases of fermentation. Rumen gasses separate from the rumen contents and the gas pocket is eliminated by eructation (belching). Normally, eructation can remove much larger quantities of gas than produced at the maximum rates of fermentation. Therefore, bloat does not occur because of excessive gas production but rather from insufficient elimination.

Causes of bloat include:

- Nerve receptors surrounding the entrance into the rumen from the esophagus, the "cardia region," detect the presence of gas and allow gas release–eructation. If fluid or foam (as in frothy bloat) contacts the cardia region, it remains firmly closed. Thus, rumen gas accumulates.
- Frothy bloat is usually related to highly digestible plants, especially legumes. Soluble leaf proteins and plant particles readily produce a stable foam-like material that obstructs the cardia and restricts eructation. Reducing foam and freeing the gas for release is difficult.
- Ruminal contractions are essential for eructation. Therefore, any injury to the nerves of the rumen or other disruptions of rumen activity can result in bloat.
- Cattle that are down for an extended time can bloat because the cardia is covered with fluid that prevents eructation. Eructation occurs when the animal stands or roles up on the sternum after the fluid moves away from the cardia.
- Feedlot cattle on high concentrate diets might have some bloat problems related in part to reduced rumen motility. Also, some bacteria (that can proliferate in high concentrate rumen environments) are thought to produce a slime, resulting in a stable foam which impairs eructation like a frothy bloat.

Observations:

- Bloat incidence decreases when legumes begin to flower (probably due to reduced digestibility).
- Bloat is reduced when grazing is continuous and not interrupted.
- The bloat potential for legumes is not necessarily lost after a killing frost. Pasture bloat is more likely during the spring and other times when plants are young, succulent and have higher digestibility.
- It is safer to move cattle to a new pasture in the afternoon (after the dew has dried) with a rumen fill from the former forage.
- Forage maturity is a major plant factor affecting the incidence of pasture bloat. Grazing very succulent pasture, such as immature legumes in the pre-bloom stage, is the single biggest risk of bloat in cattle.
- Bloat onset may be observed within an hour after introduction to new pasture. However, cattle more commonly bloat on the second or third day (or longer) following introduction.
- Although acute death in the feedlots is unusual, mild bloat can affect performance.
- Generally, feedlot bloat is delayed which corresponds with the development of a suitable rumen environment for gas entrapment.

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Treatment:

- Removal of free gas can be done with passage of a stomach tube use of a trocar or large gauge needle inserted directly into the rumen high on the left side at the point of maximum distension. (Rumen penetration through the skin is usually avoided because of the chance of infection and peritonitis.)
- Frothy bloat is a challenge because the stomach tube, or trocar, are quickly plugged by the foamy material. (If time is of the essence, an emergency rumenotomy (surgical opening of the rumen) may be necessary to save the animal's life.)
- Anti-foaming agents such as non-toxic oils, detergents or surfactants can be used to decrease the surface tension and break down the foam to larger gas bubbles that can be removed with stomach tube or eructated. Polaxalene® is faster and more effective than oils and is recommended for treatment. (This may be of little value for feedlot or grain bloat.)
- Saliva is important in the prevention/reduction of bloat. Tying a stick in the mouth like a horse's bit has been used to promote saliva production. The alkalinity of saliva may assist in denaturation of the stable foam. Careful drenching with about 100 to 150 grams of baking soda (sodium bicarbonate) in water might accomplish the same end.
- Mildly bloated feedlot cattle ("swellers" or "tight") might respond to walking, which can shake the foam down and coalesce the foam into a large bubble that can be expelled.
- In any event, the treatment approach will depend on the degree of animal distress. This condition can kill quickly.

Prevention:

- Pasture bloat is unpredictable and difficult to prevent. A host of strategies have been tried to prevent the problem. The objective is to decrease the rate of rumen fermentation (which contributes to foam that prevents eructation). No one strategy works consistently, but a few ideas include:

    - Don't turn hungry cows into lush alfalfa. Fill them with dry hay before turning them out.
    - Restrict grazing time or pull cows from pasture when the first cow stops eating.
    - Do whatever is necessary to make the change to new forage as gradual as possible.
    - Turn cattle out after dew is gone; wait until afternoon when forage is dry.
    - Don't remove cows at the first sign of bloat. They'll adapt if left on the pasture.
    - Bloat often occurs with warm humid weather following a rain. The fast-growing tips of legume plants contain agents that promote the production of froth.

- Seed pastures with grass-legume mixtures. (Because of selective grazing, this surely does not guarantee prevention.)
- Oils and fats and bloat preventative agents such as Polaxalene® (i.e. Bloat-Guard™) certainly help in prevention. The challenge is getting enough into the animals at the time needed. (Individual dosing with liquids or capsules or flank application prior to turn-out has been successful.)
- Ionophores (e.g., Rumensin® and Bovatec ®) aid in the reduction of bloat.

Animal Health

Control of Parasites in Dairy Cattle

Illinois

By: Dick Wallace, DVM, MS Dairy Extension Veterinarian, University of Illinois Extension

- Consider the parasite life cycle(s) when designing a parasite control program.
- Evaluate the relative risk factors for the class(es) of animal(s) to be treated.
- Consider meat and milk withholding times before administration of the drug(s).

Birth – Weaning (2 months):
Housing types:
Hutches, individual pens
Group pens
Pasture - rarely
Parasites to control: Coccidiosis, Fleas
Control measures:
1) Sanitary surroundings and good hygiene, control barn cats
2) Medicated milk replacers

Trade name	Generic name	Label use	Dosage	Precautions
Corid	Amprolium	Treatment	10 mg/kg, feed or water, 5 days	Meat withdrawal 24 hours
Sulfas (various manufacturers)	Sulfaquinoxaline	Treatment	8-70 mg/kg, water, 7 days	Meat withdrawal 5 days
Bovatec	Lasalocid (Ionophore)	Preventative	100-360 mg/ head/day	No meat withdrawal
Corid	Amprolium	Preventative	5 mg/kg, feed or water, 21 days	Meat withdrawal 24 hours
Deccox	Dequinate	Preventative	0.5 mg/kg, feed, at least 28 days	No meat withdrawal
Rumensin	Monensin (Ionophore)	Preventative (>400 lbs)	100-360 mg/head/day	No meat withdrawal

Control Program:
Maintain sanitary environment, reduce exposure to manure from other cows and calves.
Use a milk replacer medicated with a coccidiostat.
Add Corid to milk replacer (at preventative dose).
Continue with coccidiostat until first calving.

Parasite Control Program for Dairy Cattle
Weaning to First Calving (~24 months):
Housing types:
Group pens with dirt or concrete lot
Group lot with sparse pasture
Pasture

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Parasites to control: Coccidiosis, Nematodes, Cestodes, Ectoparasites
Control measures:
1) Manure and pasture management
2) Drugs

Trade name	Generic name	Label use	Dosage	Precautions
Ivomec	Ivermectin	Internal and external	200 mcg/kg, SQ or pour-on	Meat w/d 35 days Milk w/d 49 days
Cydectin, Eprinex	Moxidectin, eprinomectin	Internal and external	pour-on	No meat nor milk withdrawal
Rumatel	Morantel tartrate	Internal	0.44 g / 100 lbs, mixed in feed	Meat w/d 14 days No milk withdrawal
Panacur or Safe-Guard	Fenbendazole Paste - 10% Feed - 0.5%	Internal	5-10 mg/kg, orally, paste, liquid suspensionor feed pellet	Meat withdrawal: Paste = 8 days Feed = 13 days No milk withdrawal
Taktic	Amitraz	External	2 gal mixed spray/ adult animal	No meat or milk withdrawal
Expar	Permethrin	External	0.5 oz / 100 lbs	No meat or milk w/d, won't get grubs

Control Program:

Spring: Calves born in the fall - no exposure to pasture over-winter
Expar/Taktic for external parasites
Yearlings born the previous spring - any exposure to pasture
Bred heifers born the previous fall - any exposure to pasture
Ivomec/Cydectin/Eprinex or Panacur and Expar/Taktic
Heifers due to calve - any exposure to pasture
Cydectin/Eprinex or Panacur and Expar/Taktic

Fall: Calves born in the spring - any exposure to pasture
Yearlings born the previous fall - any exposure to pasture
Bred heifers born the previous spring - any exposure to pasture
Ivomec/Cydectin/Eprinex or Panacur and Expar/Taktic
Heifers due to calve - any exposure to pasture
Cydectin/Eprinex or Panacur and Expar/Taktic

Adult lactating cows:
Housing type:
Complete confinement - Expar/Taktic spring and fall as needed.
Any pasture exposure - Spring and Fall
Ivomec/Cydectin/Eprinex or Safe-Guard/Rumatel and Expar/Taktic

Additional Fact Sheets:
-*Control of **Equine** Parasites* – R.D. Scoggins, DVM, University of Illinois
-*Control of Internal Parasites in **Sheep*** – R.D. Scoggins, DVM, University of Illinois
-*Control of Parasites in **Grazing Beef Cattle*** - G. L. Meerdink, DVM, University of Illinois

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Animal Health

Control of Equine Parasites

Illinois

By: R. D. Scoggins, D.V.M., Extension Veterinarian, University of Illinois College of Veterinary Medicine

Administration:

How an anthelmintic is administered has little bearing on its effectiveness. IN GENERAL, as long as the following criteria are met, regardless of the route of administration (stomach tube, intra-oral, or mixed with feed), effective deworming should occur:

1. The correct amount of dewormer must be administered based on an accurate estimation of the horse's weight.
2. Dose consumption and/or retention must be complete.
3. The anthelmintic selected must be highly effective against the parasites infecting the horse.
4. The anthelmintic must be approved for use via the route of administration selected.

Adults:

In most cases, six dewormings yearly aimed at strongyle control are the framework for a complete interval deworming program (table 1).

Bot infestation: Boticides should be administered at least two times per year. Once about one month after the first bot egg is noticed on the hair coat of horses, and once after the end of the botfly season.

Foals:

Interval deworming programs for foals should include six dewormings at 2 month intervals beginning at 8 weeks of age. Routine anthelmintic therapy is begun at 8 weeks of age, because that is when immature and mature adult stages of P. equorum are commonly first present in the small intestine (table 2).

Tapeworm Control:

Some beneficial control of tapeworms can be achieved with the manufacturer's recommended dosages of pyrantel pamoate (6.6 mg/kg). Better control can be achieved with double the label dosage of pyrantel pamoate (13.2 mg/kg). Benefit from treatment can be optimized by treating 2 weeks prior to and at the conclusion of the grazing season.

Environmental Control:

Additional parasite control beyond that achieved by routine administration of anthelmintics may be obtained by implementing management practices that further decrease the number of infective stages of parasites in the environment. Management practices that enhance parasite control include the following:

1. Routine removal of feces from stalls, pastures, and paddocks.
2. Proper disposal of manure. Manure SHOULD NOT be spread on pastures unless it has been composted for over one year.
3. Regular rotation of pastures and avoidance of overstocking.
4. Quarantine all new additions. Have fecal examinations conducted and use appropriate treatment with non-benzimidazole anthelmintics before intermingling with other horses.
5. Prevention of fecal contamination of feed and water.
6. Harrowing pastures during the driest and hottest season of the year.
7. Deworm all horses housed together at the same time.
8. Have fecal examinations performed regularly to evaluate parasite control (10-14 days following treatment).

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Table 1: Example of an interval deworming program for adult horses in the North Central United States.

Month	Anthelmintic	Efficacy
February	Pyrantel pamoate	Nematodes
April	Oxibendazole	Nematodes
May	Fenbendazole & Piperazine	Nematodes
July	Ivermectin	Nematodes and Bots
September	Pyrantel pamoate	Nematodes
November	Ivermectin	Nematodes and Bots

Table2: Example of an interval deworming program for foals with an average birth date in February in the North Central United States.

Age (Months)	Anthelmintic	Efficacy
2	Ivermectin	Nematodes
4	Oxibendazole	Nematodes
6	Pyrantel pamoate	Nematodes
8	Ivermectin	Nematodes & Bots
10	Pyrantel pamoate	Nematodes
12	Ivermectin	Nematodes & Bots

Table 3: Example of a seasonal deworming program for adult horses in the North Central United States.

Month	Anthelmintic	Efficacy
May	Ivermectin	Nematodes
July	Ivermectin	Nematodes & Bots
December	Ivermectin	Nemoatodes & Bots

Additional Fact Sheets:

-*Control of Parasites in **Grazing Beef Cattle*** - G. L. Meerdink, DVM, University of Illinois
-*Control of Internal Parasites in **Sheep***– R.D. Scoggins, DVM, University of Illinois
-*Control of Parasites in **Dairy Cattle*** – Dick Wallace, DVM, MS, University of Illinois

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November 2000

Animal Health

Ergot and Cattle Health

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Illinois

Ergot is associated with the fungus, Claviceps sp., which infects a variety of grasses, notably the cereal grains. Ergot bodies are the black-purple bodies (similar in appearance to rat droppings) that form in place of a seed in grass heads. See Figure 1. (Grasses take up the mold spores from the soil and are transported to the seed heads. Ergot bodies develop and drop to the ground for the next generation.) These bodies contain a number of alkaloids, referred to as ergot alkaloids, that affect blood vessels, the nervous system, and other organ systems.

Ergot alkaloids are the same toxic agents found in endophyte-infected fescue.

What does this do to cattle?

- Some of these alkaloids are capable of constricting blood vessels. The result is dry gangrene of the extremities: feet, tail, and ear edges.
- Lameness is generally the first sign, along with swelling around the fetlock area. Back legs are usually first affected. Swelling and pain becomes severe followed by sloughing of skin and eventually the foot is sloughed above the hooves. This disease has been called "fescue foot." (Figure 2.)
- Fescue foot is more common during winter, most likely because low temperatures contribute to decreased blood circulation.
- Decreased milk production (due to inhibition of prolactin) is common. This can occur with no evidence of foot involvement.
- Reproduction (particularly conception) is impaired; with severe involvement, calving can be impaired.
- With milder cases, the loss of switch hair from the tail and, perhaps, the edges of ears can occur.
- Though more associated with fescue, these alkaloids disturb the animal's heat regulation that is associated with the "summer slump" syndrome.

Prevention:

- Clip pastures to restrict grazing of grass heads.
- Clipping fescue pastures is especially important since the endophyte-infected grass also contains some of the same alkaloids.
- Ergot bodies and toxins survive baling and ensiling. If baled with grass heads, collect chaff by shaking hay into a plastic bag and look for the ergot bodies. If present, feed sparingly (if at all). Avoid feeding contaminated hay during the winter.
- Providing shade during summer and supplementing some grain, especially during breeding, seems to reduce effects somewhat.
- Ammoniation of contaminated hay has been found to reduce toxic effects; as yet, the degree of success with this on ergot-contaminated forages has not been determined.

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NRCS Natural Resources Conservation Service
UNIVERSITY OF ILLINOIS EXTENSION College of Agriculture, Consumer and Environmental Sciences
University of Illinois College of Veterinary Medicine
Illinois Department of Agriculture
ILGLCI Illinois Grassland Conservation Initiative

Figure 1. Several different grass varieties infected with black ergot bodies.

Figure 2. This calf was one of several with sloughed hooves.
The were fed large round bales of brome grass infected with ergot.

Animal Health

NEOSPOROSIS - Abortion in Cattle

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Illinois

General Information

Neospora caninum is a very common protozoal organism and a common cause of abortion in cattle. Minor reductions in milk yield in dairy cows or reduced growth in feedlot steers has also been attributed to this organism, but these effects, if true, are small. A reasonable goal of herd management is to reduce the risk of transmission of Neospora. Total elimination is unrealistic. A depiction of the neosporosis life cycle follows.

Observations

- Dogs, and other canines, e.g., coyotes, become infected by eating tissues of infected animals. Infected dogs shed oocysts in their feces for about 1 week.
- Oocysts can survive in the environment for a long time.
- Once a cow is infected, she probably remains infected for life.
- Many, probably most, infected cows never abort and can be excellent producers.
- Neospora is transmitted to cattle in different ways:
  - A chronically infected cow can transmit the organism during pregnancy to her fetus. (vertical transmission)
  - Cattle can become infected by ingesting Neospora oocysts that have contaminated pastures or feedstuffs from the feces of infected dogs, or other canines. (horizontal transmission)
- Heifers born with Neospora infections (congenital, from dam during gestation) are more likely to have an abortion during the first pregnancy than are heifers that were born uninfected (and that remain uninfected).
  - This method of disease transmission is believed to be associated with the larger herd outbreaks of abortion.
- 40-50% of Illinois white-tailed deer have a positive blood test. Though dogs and other canines can become infected by eating the infected tissues, deer cannot directly transmit Neospora to cattle.

Prevention Control

- Prevent dogs (coyotes, etc.) from defecating in stored feeds intended for breeding cattle.
  - Some examples include: use containment facilities (silos, bins, etc.); close feed storage doors; cover bunker silos; dog and coyote-proof fence feed storage areas.
  - Cattle are more likely to consume dog feces if feed is mixed (i.e., TMR).
- Restrict canine access to dead stock (including placentas).
- Limit the number of dogs. (The prevalence of infected cattle is statistically associated with both the presence and number of dogs.)

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Prevention Control *(continued)*

♦Generally, culling cows based on serologic (blood) testing for Neospora antibody titers is not recommended.

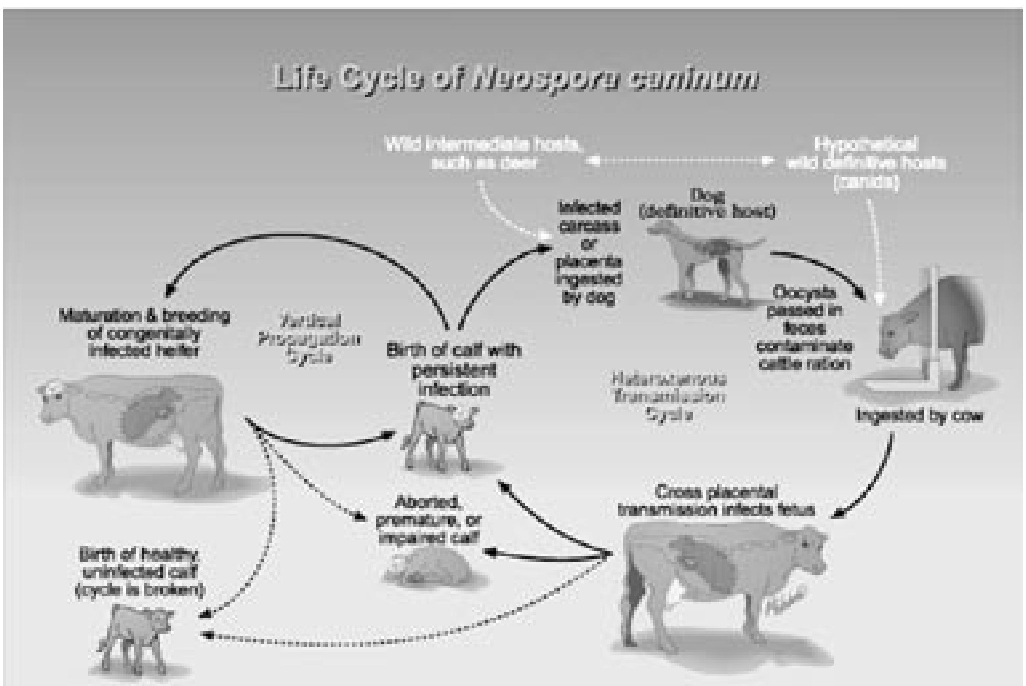
- ⬩Chronically infected cows have a measure of immunity. Previously infected cows have a decreased risk of abortion compared to acutely infected cattle during neosporosis abortion outbreaks.
- ⬩The titer cut-off between serum-negative and serum-positive cows is not perfect and the Neospora antibody titer in any particular cow can fluctuate above and below cut-off level.
- ⬩In herds with a chronic neosporosis abortion problem, selection of serum negative replacement heifers can speed the rate of reduction of Neospora-infected cattle.
- ⬩Blood-test replacement heifers anytime after six months of age and keep only negative animals, or, keep only heifers born to serum negative cows. (This strategy must be accompanied by practices to reduce the risk of transmission from dogs.

♦Vaccination

- ⬩To date, no independent reports of the product's efficacy have been found. Thus, a recommendation at this time is questionable.
- ⬩Two doses are required the first year it is used.
- ⬩Serum tests for the Neospora antibody do not distinguish the difference of vaccination from natural infection.

♦Pasture treatments will not affect the likelihood of exposure to the organism. This is an unlikely source of infection for large numbers of animals.

♦Testing the farm dog is of little value. Not all dogs will be serum positive after infection and the period of shedding of oocysts subsides within a few weeks.



Drawing by Kerry Helms

Acknowledgements

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December 2006

Animal Health

Pink Eye in Cattle

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Illinois

Pinkeye (or Infectious Bovine Keratoconjuctivitis) is caused primarily by Moraxella bovis along with a number of inciting factors. Because of the pain involved and potential for blindness, this is an economically important disease to prevent. Estimates indicate approximate weight losses of about 20 lbs. With the loss of one eye and at least 65 lbs. in calves over a 205 day period. Loss in milk production, labor, medication and loss in value are additional economic losses.

Observations

- Although M. bovis is considered the primary causative agent, a number of other infectious agents (e.g., IBR virus, Mycoplasma, Chlamydia, etc.) can affect severity and incidence in the herd. Young animals are more sensitive.
- Source of the organism is from carrier animals. The organism overwinters in the eye, nose, and vagina of some animals.
- Solar radiation, flies and dust, or anything else that causes eye irritation, play significant roles in the severity and incidence rate of the disease.
- Flies are significant transmitters of the organism. (Pinkeye incidence of 14% has been measured with 6-10 flies/head and 26% was related to 16-20 flies per head.
- Pinkeye in calves is enhanced by eye irritation from tall pasture grasses and seed heads.
- Though usually a warm, humid, summer problem, outbreaks do occur in winter and can be severe.
- Incidence and severity is probably less with increased pigmentation around the eye.
- Virulence (disease-evoking severity) is enhanced by solar radiation. Outbreaks seem to be associated with periods of maximum solar UV radiation.
- Nutritional deficiencies (vitamin A, iodine, etc.) influence incidence and severity.

Disease Signs

- Tearing and blinking are the first signs of pinkeye. Pain and sun sensitivity is significant.
- Conjunctiva (tissues around the eye) are red and a white spot can eventually be seen on the cornea (center of the eye).
- The white spot on the eye is an area of dying tissues that eventually results in rupture of the eye associated with loss of sight and a great deal of pain.

Treatment

- Treatment at the first signs is critical. In just a few days, irreversible blindness can occur.
- An eye patch or surgical eyelid closure to block sunlight aids recovery and reduces pain.
- Several antibiotics are usually effective and different methods of administration are possible. Contact your veterinarian for best selection and administration method.
- Resistant strains do occur. If there is a poor response to treatment, samples should be collected for culture identification and antibiotic sensitivity tests.
- If treatment response is not noticed in 24-48 hours, contact your veterinarian. Different strains or other immunological factors can alter therapeutic methods and vaccine response.

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Prevention

- Vaccines are generally beneficial, but responses are variable. Results are compromised if administered too late. Two doses (3 weeks apart) administered before fly season are needed. Consult with your veterinarian regarding the best choices for your region.
- Because of strain differences, an autogenous (vaccine made from the culture from your herd) might be necessary.
- Control flies. A host of control programs are available. Dragging pastures to disrupt manure pats retards fly reproduction and reduces populations somewhat.
- Maintain a strong herd immunity against IBR with routine vaccination.
- Optimize nutrition status, including minerals. Supplement vitamins A & E in animals accustomed to a poorer quality hay diet and during winter.
- Clip pastures to reduce eye irritation for young calves.
- Shade helps reduce the solar radiation that enhances development of the disease.
- Treat diseased eyes as quickly as possible to prevent permanent eye damage, weight loss, and reduce transmission of the causative agent to others.
- Separation of affected animals has been advocated. However, the benefits are questionable since infected flies travel appreciable distances.

December 2003

Animal Health

Control of Internal Parasites in Sheep

Illinois

By: R. D. Scoggins, D.V.M., Extension Veterinarian, University of Illinois College of Veterinary Medicine

Internal parasites of sheep are one of the most costly diseases that sheep producers have to contend with. Parasite damage may range from reduced productivity to death losses. Most internal parasites either suck blood or destroy tissue. The resultant damage may cause the animal to remain unthrifty for life.

Most midwestern universities involved with sheep have done extensive research in internal sheep parasites and their control.

Control is based on a combination of drug treatment and management to reduce reinfestation. Preventing animals from being reinfested can eliminate parasites over a period of time. This is not feasible under most production conditions except by using expanded metal flooring. Work at Dixon Springs Agricultural Research Center several years ago showed the value of expanded metal floors for controlling parasites and foot rot.

Sheep have a number of characteristics that make them more susceptible to parasites than other livestock.

1. Sheep parasites are mostly blood-suckers.
2. Sheep tend to be very close grazers therefore contacting large numbers of larvae.
3. Unlike other animals, sheep have little aversion to grazing amidst heavy fecal contamination.
4. Their strong flocking instinct encourages them to graze close together.
5. Sheep parasites are prolific egg producers.
6. Sheep develop very little immunity to protect them against parasites.

Parasites may produce obvious symptoms to almost no symptoms, depending on the severity or “parasite load.” Poor doing animals may exhibit diarrhea, weight loss, sudden paleness of mucous membranes, weakness and even death. Severe damage has usually occurred by the time symptoms appear.

A veterinarian should conduct a physical exam. A fecal egg count and even an autopsy may be needed to evaluate the problem. It is important to determine which parasites are present and at what level of infestation.

Pasture is the most risky management method for spreading parasites. Infective larvae develop on the grass stems protected by shade and moisture. Every mouthful of grass carries infective larvae into the sheep.

Heat and dryness are most effective in controlling parasite larvae. Midwest winters have relatively little effect against infective larvae.

Control programs using dewormers vary in how they are used. Some elect to deworm on a regular schedule, every 6-8 weeks. Others deworm strategically at specific times in the production cycle while others deworm based on increasing fecal egg counts. The most effective ones have a veterinarian involved who monitors the program and checks the results of treatment.

Fecal egg counts before treatment identify the kinds of parasites and the level of infection. Samples checked following treatment should be 7-10 days after treatment. Samples should be fresh and represent at least 20% of each group of sheep.

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Following treatment, sheep should be moved to clean pasture or a clean environment to reduce reinfestation.
Treatment is only one aspect of parasite control.
For treatment to be effective, the following considerations are important:

1. Use the correct medication.
2. Must be used at the correct dosage.
3. Appropriate timing/interval.
4. Fecal examination 7-10 days following treatment.

A number of medications are available for treating parasitized sheep. There are basically four families of dewormers.

1. Ivermectin
2. Pyrantel
3. Benzimidazoles
4. Levamisole

This does not include inophores or other medications for the treatment of coccidiosis.
Use of medication depends on:

1. Type of parasite being treated, i.e., ivermectin does not kill tapeworms or flukes.
2. Correct route of administration: all have an oral drench formulation that is effective.
3. Proper dosage based on weight so determine correct weight.
4. Be sure dose is swallowed. Many small producers use horse paste wormers that sheep frequently spit out.

It is important to work with a veterinarian to monitor the program to be sure it is effective.

Unnecessary treatments, use of an inappropriate drug or using the wrong dosage are all expensive and inappropriate.

Each program should be designed for the individual circumstances. Two neighbors may need to have quite different programs depending on their individual circumstances.

One possible scenario based on management would be:

1. Deworm ewes - 2 weeks before breeding as part of the flushing process.
2. Deworm ewes - 30 days prior to lambing.
3. Deworm ewes - at lambing time.
4. Deworm ewes - at weaning.

If fecal egg counts warrant, deworm or check whenever animals appear not to be doing well.
This program would be for ewes lambing in confinement and lambs weaned before going to pasture.
Other management systems would require different parasite control strategies.

Additional Fact Sheets:
-*Control of **Equine** Parasites* – R.D. Scoggins, DVM, University of Illinois
-*Control of Parasites in **Dairy Cattle*** – Dick Wallace, DVM, MS, University of Illinois
-*Control of Parasites in **Grazing Beef Cattle*** - G. L. Meerdink, DVM, University of Illinois

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November 2000

Fertility

Pasture Fertilization

Illinois

Introduction

Pastures respond to a fertilization program like any other crop. However, in designing a pasture fertilization program, the producer must consider the productivity of the grazing animals, the plant species present, and the management level and goals for the pasture. Fertilizing pastures is different than fertilizing for hay. Research data and farmer experience has shown that pasture productivity can be increased two to three times with a well-planned and managed fertilization program.

Starting Point

A current and accurate soil test is the best guide in designing a pasture fertilization program. Collect one composite sample per 2 ½ acres in late summer or early fall. Ideally, each paddock should be sampled separately. Slope and aspect should be sampled separately. Avoid sampling where livestock tend to "camp" (near water and shade).

Soil samples should be analyzed for pH, available phosphorus (P_1), and potassium.

For existing pastures, sample to a 7-inch depth and collect a few samples (maybe 20% of total), in a separate container, to a 2-inch depth for pH only. Where lime is needed, adjust the rate to account for surface application (lime rate dependent upon the volume of soil neutralized). Some testing laboratories make lime recommendations based on sampling depth.

When planning to establish a new pasture in a prepared seedbed, plan ahead. Sample 6 months to a year before seeding, to a 7-inch depth and incorporate needed lime with tillage at least 6 months before seeding.

Species and pH

Pasture grasses can grow over a wider range of pH than legumes. As a general guide, soil pH for cool-season grass pastures should be 6.0 to 7.0 and 6.5 to 7.0 for legume pastures. A minimum pH of 6.5 is suggested for legume/cool-season grass mixtures.

Legumes "make" N

Legumes "fix" atmospheric nitrogen and make it available for plant growth. If legumes comprise 30 percent or more of the sward, do not apply nitrogen fertilizer since an adequate amount will be contributed through fixation. If the legume portion is less than 30 percent, grass will probably respond to nitrogen fertilizer.

Studies have indicated that a legume-cool season grass mixture produces more than a nitrogen-fertilized grass pasture.

Legumes should be properly inoculated when seeded to assure good nodulation.

Impact of P and K

Phosphorus (P) and potassium (K) are essential nutrients for plant production. Once the soil is corrected to optimal soil test levels (P_1 of 40 to 50 pounds per acre and K of 260 to 300 pounds per acre) for these nutrients, monitor their status by soil testing every 4 years. Optimal levels will vary by soil type, area of the state, and to a certain extent by the species grown. Once these optimal levels have been reached, additional P and K fertilizer is not considered economical nor does it provide for consistent yield responses.

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Grass Needs N

Nitrogen is essential for the formation of protein and thus stimulates production. Nitrogen fertilizer should be considered for a grass dominant pasture. Research indicates that the first 30 to 50 pounds per acre of nitrogen are used most efficiently and that split applications of this amount generally maximize yield.

Grass pastures will respond quickly to nitrogen-make sure you can utilize the forage produced.

The first application should be made in late summer to stimulate growth for fall production (for those utilizing deferred grazing or stockpiling, an early August application is suggested). The second application should be made in early June when the spring flush of grass growth is over. Since early season growth is generally excessive, an early spring application is not suggested unless the first harvest can be efficiently grazed or will be harvested as hay or silage. Nitrogen application early in the season can make the grazing management of the spring flush more difficult.

Source of nitrogen is important for summer application. Urea or UAN solutions are easily lost if a 0.5-inch rain does not occur shortly after application. Ammonium and nitrate forms of nitrogen are non-volatile and can be applied without significant loss.

Nutrient Cycling

Sixty to 80 percent of the P and K removed by grazing is returned or recycled on the pasture in the form of manure and urine. Grazing animals also recycle a significant amount of N from consumed pasture forage. Nitrogen in urine is quickly converted to available ammonium and nitrate. Nitrogen in dung is slowly released and utilized by surrounding grass.

Manure distribution is greatly affected by grazing management. Manure and urine distribution is more uniform on rotationally grazed pastures since animals spend less time in any one site and forages are grazed more evenly. A high stocking density and short grazing period will also improve the uniformity of manure distribution.

Manure as Fertilizer

In addition to the nutrients distributed during grazing, some producers spread manure on pastures. This is an acceptable practice but needs to be done with caution. Manure should be applied shortly after a grazing period. It should be applied first to grass pastures. Manure can make the forage less palatable. There will be volatilization loss of nitrogen from surface applied manure. One should monitor P and K soil test levels. To minimize P and K runoff, do not apply to sloping, frozen ground.

Plant Analysis

Tissue analysis can be used to diagnose forage production problems (especially status of micronutrients), to check the nutritional status of the forage, and to fine-tune fertility and grazing management. Tissue analysis should be used with, not instead of, soil test results.

For More Details

Additional information is found in the *Illinois Agronomy Handbook* available at Extension offices.

Summary

Fertilization, along with well-managed livestock and forage, is key to an efficient pasture program. Pasture fertilization management is a continuous process.

November 2000

Water Resources Development For Management Intensive Grazing of Beef Cattle

Illinois

Development of a good watering source for pasture operations can make or break the system. Several considerations for the producer are:

- Water quality and quantity
- Water Supply equipment
- Groundwater protection
- Human and animal safety

Water Quantity

Beef animals require about 9 gallons of water per 1000 lbs. of bodyweight per day in winter. They require up to about 30 gallons per 1000 lbs. of bodyweight per day in summer. For management intensive grazing applications, the total water supply must be adequate for the herd, but may have much more constant demand on the flow rate than in non-intensive grazing applications where the entire herd goes to water at once. If the water tank is placed within 500-800 feet of the paddock, cattle will visit the tank one at a time or a few at a time, placing less demand on the water source.

Supply Equipment

Tank Sizing: Many producers use water tanks that only hold 20-50 gallons. Ample valve sizing, along with the proper sized water pipe, keeps the water level in the tank higher as cattle are drinking, and reduces the risk of cattle tipping the tank over. Only in the case where a slow or intermittent pumping source is used, for example, a direct-connect solar pumping system, will a large tank be required that holds the water supply for a day or more.

Tank Valves: Select tank valves based on the maximum flow rate needed at the tank. Some inexpensive float valves can only supply 2-3 gallons per minute, which will often be insufficient for small tanks where two or more cattle are drinking simultaneously. Slightly more expensive, full–flow floats can deliver up to 20 gallons per minute with the proper pipe and system design. A bottom-inlet float device on the tank controls the water level and is generally out of reach of the cattle.

Wellhead Protection: Protect wells and groundwater from pollution by proper construction at the wellhead. Guidelines for wellhead construction and upgrades are set by the Illinois Department of Public Health. Remember to seal abandoned wells according to accepted practice standards.

There is a potential danger of groundwater contamination from livestock watering equipment. Any tank or waterer supplied by well water or a water district pipeline should be fitted with a vacuum-break or backflow prevention device to prevent tank water from entering the water supply in the event of a line pressure loss. Most top-mounted commercial float valves have an air gap or anti-siphoning valve, but plumbing codes and/or health department regulations may require specific backflow prevention equipment.

Energy-free or electrically-heated permanent waterers should be sized for one watering space (1 cup or 2 lineal feet of tank) per 25 head. Midwest Plan Service, MWPS-6, Beef Housing and

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NRCS Natural Resources Conservation Service
UNIVERSITY OF ILLINOIS EXTENSION College of Agriculture, Consumer and Environmental Sciences
Illinois Department of Agriculture
ILGLCI Illinois Grassland Conservation Initiative

Supply Equipment
(Continued)

Equipment Handbook, has details on pasture tanks and freeze-proof waterers.

Refer to Midwest Plan Service MWPS-14, Private Water Systems Handbook, for information on how to develop various types of springs for a water supply.

Ponds and streams can provide water for cattle in pasture systems, but it is desirable to fence cattle away from such surface water when possible, allowing only limited access to the water. A good alternative is to provide an appropriate pumping system to deliver the water from the pond or stream to a pasture tank.

Siphons: When a pond or other static water source is not too distant from the pasture being developed, it is sometimes preferable to keep the cattle away from the pond by routing pond water to a tank through a siphon. The siphon outlet must be lower than the level of the pond, and the line must be guaranteed to be leak-proof from the pond waterline up, to prevent losing the prime. Friction losses in the pipe must be taken into account in order to get adequate water delivery. A float valve on the tank is adequate for controlling the system. Use a floating inlet or gravel screen inlet in the pond, keeping in mind that any screen on the inlet will add to the total pressure drop and reduce flow.

Ram Pumps: In rare instances, there is a spring-fed stream with adequate flow and gravity head to install a ram pump that will water cattle uphill from the stream. No other power source is needed. Check with the manufacturers for specifications; remember the pumps will deliver only a fraction of the water that goes through the pump. One manufacturer's literature suggested a ram pump with 1-foot drop to 10-foot lift should deliver approximately 15 to 20 percent of the water that it uses.

Solar Powered Pumps: Some pasture operations have a water source available but no electric utility power nearby. In this case a solar-powered pumping station may be a sensible option to consider. Solar systems are usually set up with a large tank, with up to five day's supply of water, allowing cattle water during cloudy periods when solar pumping is reduced. Contact University of Illinois Extension for help on sizing these systems; the technology is well established and there are several sources of equipment. The economics of solar pumping is not appropriate for every situation. Solar power can be used for virtually any application; the deeper the well or greater the lift, and the more flow rate required, the more expensive the system.

Wind Powered Pumps: During the May-September grazing period, wind energy in Illinois is much less reliable than solar energy. Economic and operational studies show that solar is a better buy than wind for pasture pumping. However, a hybrid wind/solar system may be economical in some situations and may work well with an extended grazing season. Contact the University of Illinois Agricultural Engineering Department for more information on wind energy.

Nose Pumps (cattle-operated): For lifting water up to about 20 feet and for fairly short distances, the nose pump will work well. The animals pump water a stroke at a time via a piston/valve arrangement by pushing the plunger back during drinking. Only one animal can access it at a time, so it is not practical for larger herds. Each nose pump will serve about 25 head.

Shallow-well Pumps: The simplest type of pump for use on a well is a shallow-well suction pump. A restriction on such a pump is the allowable maximum suction lift (depth to water plus friction head in the suction line. A good foot valve is necessary, to avoid loss of prime when the pump shuts off. Many shallow well pumps are not self-priming. Theoretically, atmospheric pressure will let a pump lift water nearly 30 feet from the water surface; practically speaking, the limit is more like 15 or 20 feet. To determine whether a shallow-well or a deep-well pump is needed where water is within a few feet of the surface, the well draw-down under actual cattle-watering conditions must be known.

Electric Power Supply: Getting electric power to a pump requires adequately-sized wiring to keep the supply voltage sufficiently high. Low voltage at the pump motor, caused by poor wiring or under-sized, can cause the motor to overheat and fail prematurely. Wire sizes for pumps

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Supply Equipment
(Continued)

depend on two factors: full-load motor amps (FLA) and length of wire run. Tables for figuring wiring sizes can be found in Midwest Plan Service MWPS-28, Farm Buildings Wiring Handbook. Also consult the Handbook for advice on grounding pumps and electrically-heated waterers.

Setting up the System

If you can gravity flow the water, linear low-density polyethylene (LLDPE) pipe is sufficient. For pressurized systems, use a rolled high-density polyethylene (HDPE) with a minimum of 150 PSI rated pressure. Use a pressure-flow chart to select the minimum size needed.

The ideal system provides water to every paddock. Sometimes it is necessary to use a lane to get cattle to water, using the same water tank for several paddocks. Economic analyses of grazing systems indicate that the money spent to provide water to several locations or to each paddock pays back rapidly.

Ideally, distance to water should be no more than about 800 feet.

Keep water systems portable and flexible at first. It is probably best to lay the pipe on top of the ground when beginning a management intensive grazing system. This allows the chance to make changes to paddock layout or the water system. Bury pipe when you are certain the system is configured the way you want it. Install a main trunk line underground and risers with quick-disconnects for the tank or tanks.

Other Considerations

Black pipe on top of the ground will heat water somewhat. Usually, heated water is not a problem in summer, because cattle can best use water at near rumen temperature. Solar heating will be minimize pipe that is shaded by vegetation. Keep the pipe under the fence to allow the taller forage to provide shade.

Temporary or mobile tanks can be placed under an electric fence to keep cattle pressure off the equipment and reduce tank upsets. Locating the tanks in different spots each time the paddock is used can help reduce forage kill and mud problems around the tank. The area around all permanent tanks should be graveled or otherwise treated to provide all-weather access. Consider using a combination of geotextile material covered with gravel to form a stable base around permanent water tanks. See Midwest Plan Service AED-45, Using All-Weather Geotextile Lanes and Pads, for more information.

For more information about water systems, contact your UI Extension office or the local NRCS office. MWPS handbooks can be purchased from UI Department of Agricultural Engineering or at www.mwpshq.org.

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Design Resource Tables

Table 1. Friction loss in feet/100 feet of plastic pipe

Gallons/ Minutes	Nominal Size				
	3/4	1	1 1/4	1 1/2	2
2	1.0	0.3			
4	3.7	1.2	0.3	0.1	
6	7.9	2.4	0.6	0.3	
8		4.1	1.1	0.5	
10		6.3	1.6	0.8	0.2
12			2.3	1.1	0.3
14			3.1	1.5	0.4
16			3.9	1.9	0.5
18			4.9	2.3	0.7
20				2.8	0.8
30					1.8
35					2.3
40					3.0

Table 2. Feet - PSI Relationships for Water

Pressure in Feet (of head)	Equals PSI
1	0.43
2	0.87
5	2.17
10	4.33
15	6.5
20	8.66
25	10.83
30	12.99
35	15.16
40	17.32
50	21.66

Pressure in PSI	Equals Feet (of head)
1	2.31
2	4.62
5	11.55
10	23.10
15	34.65
20	46.20
25	57.75
30	69.30
35	80.85
40	92.40
50	115.5
60	138.6

Acknowledgments

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Livestock Nutrition

Feeding Cows

Illinois

General Information

Of the factors that influence the growth and reproductive performance of beef cows, proper nutrition is probably the most critical. Because feed costs represent over half the total cost in a cow-calf production system, it is very important to keep feed costs low while meeting your animals' nutritional needs. Vital nutrients in beef cattle diets include water, energy, protein, calcium, phosphorus, potassium, sodium, trace minerals, and vitamins.

Types of Diets

Depending on your circumstances, you may choose from a number of feeding approaches for your herd. The traditional approach is to allow the cattle unlimited access to pasture or hay. But if the forage is not sufficiently high in protein and other nutrients, the cows may be malnourished even though they have all they can eat. Poor quality forage and crop residues have a high proportion of fiber to protein which takes longer for cows to digest. Consequently, cows can eat only about one and a half times their body weight per day of low-quality forage. If the forage is of high quality, however, cows can consume about three percent of their body weight daily. Unlimited access to feed is sometimes referred to as ad lib, short for the Latin ad libitim.

It may be necessary to supplement a low- to medium-quality forage diet with high-quality hay, or with soybean meal, grain, or co-products like distillers dried grains or corn gluten feed. With supplementation, cows can actually digest more low-quality forage—up to two percent of their body weight. Grain supplementation should be no more than 0.5 percent of the cow's body weight **(BW)**. If the forage is of such poor quality that more supplementation is required, you should consider using byproducts.

The most economical way to feed beef cows is to graze the cows. Brassicas and small grains with cornstalks can be used to provide fall and winter grazing very economically. If the cattle need to be fed due to snow cover or other factors related to your farm, you should develop a low cost method of feeding the cows. Following is a brief discussion of the factors influencing nutrition and some example diets. If your cows are thin or heavy milking, you will need higher energy diets than the examples provided. If your cows are larger than those described in the example, they will need proportionally more feed.

Water

Water is often the forgotten nutrient. **It is important to have an adequate supply of fresh, clean water available for cattle.** To be sure your water is not contaminated with chemical run-off or biological organisms, you should have it tested by one of the commercial services that are widely available.

Energy and Protein

The primary nutrients of concern for beef cattle are **energy** (referred to as "total digestible nutrition," or **TDN**) and **protein** (also called "crude protein," or **CP**). The example diets would need to be modified to account for these factors.

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Table 1 presents the composition of common feeds, including their dry matter (DM) factor, energy and protein provided, and the presence (+, ++) or absence (-) of the macro minerals calcium, phosphorus, and potassium. Actual values vary widely—it is advisable to pay for a nutrient analysis of your forage. If you buy commercial feed mixes, you can use the content analysis provided by the manufacturer. All values are expressed on a dry-matter basis to permit comparison of feeds that vary in moisture content.

TABLE 1. Composition of common feedstuffs

				Nutrients		
Feed	**DM**	**TDN**	**CP**	**Ca**	**P**	**K**
Alfalfa (early bloom)	88	53.0	18.6	++	+	++
Afalfa (late bloom)	88	50.0	12.9	++	-	++
Brome (**vegetative**)	**88**	**56.0**	**14.6**	**++**	**+**	**++**
Brome (late bloom)	88	53.0	6.0	++	-	++
Corn (cracked)	87	91.0	8.6	-	+	
Corn Silage	35	69.0	8.0	-	-	+
Clover (red; fresh)	25	64.0	15.6	++	+	++
Clover (red-hay)	88	55.0	15.5	++	+	++
Fescue (vegetative)	88	61.0	12.4	++	+	++
Fescue (late bloom)	88	46.0	7.4	++	-	++
Oats (rolled)	88	77.0	13.3	-	+	
Oat hay (early bloom)	88	64.3	9.2	++	+	++
Orchardgrass (vegetative)	88	72.0	18.4	++	+	++
Orchardgrass (late bloom)	88	54.0	8.4	++	-	++
Sorghum silage	**35**	**58.0**	**7.5**	**+**	**-**	**++**
Soybean meal	**90**	**90.0**	**44.0**	**+**	**+**	**++**
Sudex silage	**35**	**55.0**	**10.8**	**+**	**-**	**++**
Wheat (**cracked**)	**90**	**92.0**	**13.5**	**-**	**+**	
Wheat silage	**35**	**61.9**	**11.9**	**++**	**+**	**++**

Table 2 shows the typical composition of some common feeds and their prices. Using the values from this table and from Tables 1 and 3, diets were calculated for a 1,200-pound dry cow (last third of gestation) and for a 1,200-pound lactating cow in average condition with average milk production. Tables 4 and 5 show the calculated amounts and costs of various diets for these scenarios.

TABLE 2. Typical feedstuff values

	TDM. %	**CP, %**	**DM, %**	**Cost, $**
Corn	91	8.3	88	2.10/bu
Corn gluten feed	87	20.0	40	42/ton
Corn Silage	72	8.0	35	20/ton
DDGS (dry)	88	28.0	90	85/ton
Alfalfa hay	60	19.5	85	85/ton
Grass hay	54	12	85	85/ton
Mixed hay	54	12	85	60/ton
Poor hay (mature fescue)	46	7	85	30/ton
DDGS (wet)	88	28.0	45	28/ton
Soybean meal	90	44	90	162/ton

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TABLE 3. Hay waste

Feeding method	% wasted
Limit fed with corn—small bales or ground hay	0
Limit fed—bunk, small bales or ground hay	10
Ad libitum (“unlimited”)—bunk, small bales or ground hay	10
Ad libitum—big bales	30
Ad libitum—big bales (outside)	40

Note: Table 4 shows there is a large variation in cost per day for the diets—they range from 59 cents to $2.14 per day. If the cows were fed for 120 days, the high-cost diet for the dry cow would be $186 more (per cow) than the low-cost diet. That difference could certainly “make or break” your profit situation!

TABLE 4. Calculated diets for a dry cow (1,200 lbs.)

	Lbs. (as fed)	Cost/d, $
Limit corn—hay	8.2-7	.62
Limit DDGS (wet)—hay	15.6-7	.53
Limit DDGS (dry)—hay	7.8-7	.58
Limit gluten—corn	6.6-6.6	.50
Limit gluten	29	.59
Alfalfa* (ad lib, big bale)	50.4	2.14
Alfalfa (limit, bunk)	22	.94
Mixed hay*, (limit, bunk)	24.4	.73
Mixed hay*ad lib, big bale)	47.4	1.42
Poor hay-DDGS (dry)	29.4-7.4	.75
Poor hay, mixed hay	29.4-10.1	.74
Poor hay, alfalfa hay	29.4-6.9	.73
Corn silage—DDGS (dry)	37.1-1.0	.41
Corn silage—SBM	37.1-0.8	.43

TABLE 5. Calculated diets for a lactating cow (1,200 lbs.)

	Lbs. (as fed)	Cost/d, $
Limit corn, hay, SBM	13, 7, 1.4	.90
Limit gluten	39.4	.90
Alfalfa (limit, bunk)	33.1	1.40
Alfalfa* (ad lib, big bale)	50.4	2.14
Mixed hay (ad lib, big bale)	47.4	1.42
Corn silage, SBM	59.2, 2.8	.96

Acknowledgments

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Livestock Nutrition

Pasture-Based Feeding Programs for Dairy Cattle

Illinois

General Information

A successful feeding system (pasture-based system, traditional component feeding system, and Total Mixed Ration or TMR) should meet the nutrient requirements of the cow, use economical feed sources available in the area, and optimize profitability and income over feed costs. When considering a management intensive grazing (MIG) system, dairy managers must consider and manage the following factors;

1. Optimize rumen fermentation
2. Manage dry matter intake
3. Feed sorting and selection
4. Effective use of fiber
5. Economics and positioning other feeds

Optimizing Rumen Fermentation

The challenge with a pasture-based feeding program is to maintain rumen pH values from 5.8 to 6.2 that will support optimal digestibility, nitrogen flow, and desirable components. If pasture quality is less than 35% neutral detergent fiber (NDF) and over 80 percent digestibility, rumen pH can drop below 5.8. If additional fermentable carbohydrates are added such as, molasses or barley, pH levels could drop below the optimal level. However, some starch and by-product grains can stimulate microbial growth and provide needed energy.

- Maintaining rumen pH from 5.8 to 6.2 will be challenge with high quality legume grass forages. Lush pasture will be low in effective fiber due to low level of NDF (neutral detergent fiber) and rapid rate of passage. New Zealand workers reported that cows consuming only clover and grass pasture (no concentrate) experienced rumen pH under 5.5 with no supplemental grain. Adding 2 to 5 pounds of long forage particles (over one inch in length) can form and maintain a rumen or hay raft in the rumen.

- Limit the amount of a concentrate mixture to 5 to 6 pounds per meal to avoid "slug feeding" of starch leading to lower rumen pH and lactic acid formation. Providing 2 to 5 pounds of long forage prior to the grain and pasture consumption can increase rumen pH.

- Balance the rate of available nitrogen (protein) and carbohydrate degradation in the rumen by feeding grain and/or corn silage before lush pasture is consumed. The challenge is pasture that is low in rumen fermentable carbohydrate while containing excessive degradable and total protein. Feeding starch or digestible NDF (by-product feed such as corn gluten feed or soy hulls) before milking allows cows to return directly to the pasture after milking.

- Provide adequate effective fiber by maintaining a minimum of 5 pounds of forage particles that are over one inch or longer in length. Feeding 1 to 2 pounds of straw (one pound of straw functions similarly to 2 to 3 pounds of long hay), 5 pounds of baled hay, or 10 pounds of silage dry matter containing 40 to 60 percent on the top two boxes of the Penn State Particle Separator unit. These adjustments should adjust fiber levels.

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- Manage rumen turnover by slowing down rapidly fermentable pasture fiber by adding some long forage to the diet. Processing grains can change the rate and site of starch fermentation while by-product feeds (such as wheat midds, soy hulls, or corn gluten feed) can dilute starch levels in grain mixtures.

Managing Dry Matter Intake

Optimizing dry matter intake is another key factor in successful pasture-based feeding systems and programs. Energy is the first limit nutrient for milk yield, milk components, and reproduction in high producing cows. Dry matter intake (energy) can be limiting to 50 pounds of 4% fat corrected milk. New Zealand researchers report cows can consume about four pounds of pasture dry matter per hour of aggressive or active grazing. Six to eight hours are the normal daily grazing times. If higher levels of milk production are desired, additional dry matter will be needed. Dairy managers have three choices: additional forage (such as corn silage), more grain, and/or a partial TMR. To enhance pasture dry matter intake, pasture can be cut and allowed to partially wilt, allowing for great dry matter consumption. Grazing activity (distance walked and slope) will require more energy (can represent 4 to 5 pounds of milk energy used for walking).

Methods to achieve higher dry matter intake (if this is economical and is your goal) will require supplemental feeds that complement pasture nutrients and do not substitute for low-priced pasture nutrient sources.

- Cows under 50 pounds of 4% fat corrected milk may support this milk yield with high quality pasture only.

- Cows producing over 50 pounds of 4% fat corrected milk will require more energy, usually gained from concentrate and silage sources (energy is limiting).

- Cows producing over 70 pounds of 4% fat corrected milk will need more energy, added rumen undegraded protein (such as heat treated soy meal), and supplemental fat (energy and amino acids are limiting at this level of production).

Adding a buffer (such as sodium bicarbonate) can increase dry matter intake by stabilizing rumen pH (adding 0.3 to 0.5 pounds per cow per day to the grain mixture or partial TMR). Buffers can reduce concentrate intake at higher levels. To improve pasture intake, offering cows a fresh allocation (new paddock or moving an electric wire) every 12 to 24 hours is a recommended procedure.

One approach to estimate pasture intake is to calculate the amount of pasture dry matter based on NDF intake. Wisconsin workers report dairy cows will consume 1.2 percent of the cow's body weight as total NDF. Using this guideline with high quality pasture (40% NDF), a 1000 pound Jersey cow could eat 12 pounds of total NDF or 30 pounds of pasture dry matter (12 pounds divided by 0.40 which is 40% NDF in pasture expressed as a decimal). As forage NDF increases (pasture quality drops), pasture dry matter also declines reduces energy intake.

Feed Sorting and Selection

Pasture provides another challenge as cows can selectively graze legumes and/or grasses available and different plant parts (leaves or stems) leading to undesirable rumen pH and fermentation characteristics. If supplemental feeds are offered, control intake to maintain uniform consumption with adequate bunk space for feed access or along a hot wire in the pasture. One example would be to offer supplemental feed (corn silage, urea, minerals, molasses, and ear corn) prior to milking with adequate bunks which allows all cows to eat similar amounts of this partial TMR (PMR) before they milk.

For dairy cows, pastures should be clipped after each rotation to control weeds and unpalatable pasture (stems and plants going to seed). Some dairy managers will follow the lactating cows with dry cows or heifers to consume the lower quality pasture dry matter.

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Feed Sorting and Selection
(Continued)

Fiber can be measured or defined two ways in a dairy cow ration. Chemical fiber would include the percent Acid Detergent Fiber (ADF) or Neutral Detergent Fiber (NDF) or cell wall in forages based on lab analysis. Chemical fiber is inversely related to Non Fiber Carbohydrate (NFC) including starch, pectin, and sugar content. Effective NDF contributes to rumination and maintains rumen function.

Effective Fiber

Based on New Zealand and Ireland data, the effective pasture NDF ranges from 35 to 40 percent. Chemical NDF pasture levels can be low at 35% NDF (U.S. forages range from 40 to 55%). New Zealand worker recommend a minimum of 15 to 17% effective NDF based on pasture (38% grass NDF times 40% effective NDF). If lush pasture contains lower NDF values (new pasture, clovers, or selective grazing), rumen pH and feed digestibility can be less than optimal. If fermentable carbohydrates are fed with these pasture qualities (such as corn or barley grain), effective NDF levels need to be raised to 18 to 20% from hay, by-product feeds, and/or straw. Estimating effective NDF is difficult and labs do not routinely offer tests. The Penn State Forage Separator Box is used to estimate effective particle length for silages and Total Mixed Rations (TMR) (percent of feed particles in the top two boxes). If effective NDF is marginal, dairy managers may observe the following characteristics.

- Low milk components, especially milk fat (drop of 0.3 to 0.5 percentage points)
- Loose manure or low fecal scores (less than 3 on a 1 to 5 range)
- Lameness and abnormal hoof growth patterns
- Free choice consumption of sodium bicarbonate
- Licking or eating of dirt
- Lack of cud chewing

Economics of Pasture-Based Feeding Systems

The profitability of pasture-based intensive pasture based systems is one factor that appeals to dairy managers. Table 1 lists university field studies comparing grazing and non-grazing farms.

Table 1. Profitability of grazing expressed as dollars of net farm income ($NFI) per cow and comparative dollar advantage of the grazing herds.

State (year)	Non-grazing	Grazing	Difference
	———	$NFI/cow	———
New York (2000)	294	310	+ 16
Great Lakes (2000)	223	395	+ 172
Maryland (1996-2000)	367	660	+ 293
Wisconsin (1999)	290	331	+ 41
New York (2001)	496	555	+ 59

New York workers monitored 58 grazing herds (85 cows per herd) and 105 non-grazing herds (83 cows per herds) from 1996 to 2001. The following differences were reported:

- 1,008 pounds less milk per cow for the grazing herds
- Net farm income per cow was $71 higher for the grazing herds
- Veterinary and medicine costs were $13 less per cow for the grazing herds
- Machinery costs were $62 per cow lower for the grazing herds
- Investment per cow was $937 less per cow for the grazing herd.

These studies indicate that pasture-based systems can be economically competitive, but milk production declines must be minimized, milk cow nutrient needs must be met, and managers must avoid large investments in facilities and equipment. Dairy managers also report less hoof and leg problems, lower culling rates, and extra replacement heifers that can be sold. Dairy managers have three nutrient approaches with a pasture-based systems.

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Economics of Pasture-Based Feeding Systems
(Continued)

- Approach 1. Supplement 2 to 4 pounds of grain (New Zealand system) or 10 percent of the total ration dry matter. Potential milk yield could be 30 to 50 pounds of milk per cow per day or 12,000 to 15,000 pounds of milk per cow annually.

- Approach 2. Supplement 2 to 5 pounds of forage dry matter (corn silage or hay) and feed one pound of grain for each 5 pounds or 30 percent of ration dry matter. Potential milk yield could be 40 to 60 pounds of milk per cow per day or 15,000 to 17,000 pounds of milk per cow annually.

- Approach 3. Supplement 50 percent of the dry matter from PMR and 50 percent of the dry matter from pasture. Potential milk yield could be 60 to 80 pounds of milk per cow per day or 17,000 to 20,000 pound of milk per cow annually.

Acknowledgments

- Mike Hutjens, Extension Dairy Specialist, Urbana, IL
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Relative Forage Quality (RFQ)

Illinois

General Information

Relative Forage Quality (RFQ) is a new index to rank the quality of forages. Such an index is helpful in ranking forages for sale or inventorying forages to animal groups to meet certain quality needs in the ration.

This fact sheet is a follow-up to an earlier one (November 2000) titled Forage Quality.

Relative Feed Value (RFV) has been of great value for years as a quality index for ranking cool-season grasses and legumes based on combining digestibility and intake potential. These values have been calculated from acid detergent fiber (ADF) and neutral detergent fiber (NDF).

With introduction in 2001 of new approaches to determine animal requirements in the National Research Council Nutrient Requirements for Dairy Cattle, there was an opportunity to improve RFV through use of newer analyses and equations.

Thus the concept of Relative Forage Quality (RFQ) was introduced as a method to better predict animal performance from the analysis of forages.

Differences Between RFV and RFQ

RFV is based on the concept of digestible dry matter intake relative to a standard forage according to the following formula:

RFV = (DMI, as % of BW) x (DDM, as % of DM) ÷ 1.29

Where: DMI = Dry matter intake
DDM = Digestible dry matter
BW = Body weight
DM = Dry matter

Dry matter intake was estimated from neutral detergent fiber and digestible dry matter estimated from acid detergent fiber. The constant, 1.29, was chosen so that RFV = 100 for full bloom alfalfa hay. The constant was the expected DDM intake, as % of BW, for full-bloom alfalfa based on animal data.

RFQ uses the same concept and format except that TDN (total digestible nutrients) is used rather than DDM. In other words, RFQ has a digestible fiber component and is calculated as follows:

RFQ = (DMI, as % of BW) x (TDN, as % of DM) ÷ 1.23

RFQ adjusts intake for digestible fiber. Research has shown that intake is affected by digestibility of the fiber.

RFQ appears to give a much better quality estimate for grasses and legume-grass mixtures.

RFQ can be used for all forages, including warm-season grasses and brassicas (turnips, kale,

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rape, etc.). However, RFQ should not be used for corn silage because so much of the energy differences in corn silage relate to starch availability, which is not considered in RFQ.

Analysis from numerous forage samples shows a strong correlation between RFV and RFQ.

Relationship Between RFV and RFQ

The intent with RFQ was to have the same mean and range in forage analysis as RFV. Therefore, RFQ could be substituted for RFV without making economic and other management changes. It appears that RFQ can be substituted for RFV and they will be similar in about 60% of the samples.

In some individual forage samples, RFV and RFQ varied by over 20 points. When differences like these do occur, it is believed that RFQ will be a better estimate of animal performance than RFV. Also, RFQ more accurately discounts heat damaged hay or haylage.

In instances where RFQ was higher than RFV, the hay seller could have received more money for the hay (or the buyer could have simply received a good deal) and where RFQ was lower than RFV, dairy cows would not have milked as expected.

Summary

Due to the digestible fiber component, RFQ seems to predict animal performance better than RFV. It appears that RFQ and RFV average about the same, so RFQ can be substituted for RFV in pricing, contracts, and other uses.

Where to Get Help

For more information about Relative Forage Quality, contact the local office of the Natural Resources Conservation Service or University of Illinois Extension.

Information in this fact sheet was adapted from material and work by Dr. Dan Undersander, agronomist, University of Wisconsin-Madison.

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Miscellaneous

MINERALS

Illinois

General Information

Minerals are needed by cattle for maintenance and growth due to their involvement, including various enzyme systems and chemical reactions that occur in body tissues. They are also needed for bone and teeth formation. The amounts of minerals needed depend on the stage of growth and reproduction of the animal. The only minerals in addition to salt that are needed for beef cows in Illinois are calcium, phosphorus, and deficient trace minerals. Selenium and iodine are often deficient in Illinois' soil and may need to be supplemented. A general guide in determining the need for supplemental calcium (Ca), phosphorus (P) or potassium (K) is given in the following table.

TABLE 1. MACRO MINERAL LEVELS
IN GRAINS AND FORAGES

	Ca	P	K
Grains	-	+	-
Poor Forages	++	-	++
Good Forages	++	+	++

Ca and P generally adequate in high quality forages. Samples from well-managed pastures, small grains, or brassicas in Illinois document that there is no need for supplemental P or Ca. Some producers feed these minerals for "Insurance" to be sure there are no problems. Low quality pastures and crop residues need to be supplemented with Ca and P.

Other minerals, needed in much smaller amounts, are called "trace" minerals. The trace minerals selenium and iodine are deficient in many Midwestern soils and may need to be added to the diet. Selenium deficiency can lead to lowered fertility, white muscle disease, retained placenta, stillbirths, and weak calves that are susceptible to diarrhea and pneumonia. Generally, trace mineral supplementation is cheap and good insurance for preventing problems. Supplementing the cattle diet with a mineral mix that includes all the trace minerals is probably best. Recent research suggests that copper sulfate is more usable than copper oxide, so look for supplements with the sulfate form of copper. Also, magnesium oxide is recommended in spring mineral mixtures to prevent grass tetany.

Vitamin E interacts with selenium in the deficiencies mentioned so it is advisable to have at least 400 IU/lb. of vitamin E in a mineral mix. Vitamin A may be deficient in some feeds. It is advisable that it also be supplemented with at least 80,000 IU/lb. in a mineral mix. These mixtures should not be stored for extended periods because the vitamins can be broken down when mixed with minerals.

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Minimum Levels of Mineral

Minimum levels of important minerals in a salt mineral mix for high quality forage diets (assuming 4 oz/day consumption).

0-6% Phosphorus
10% Calcium
.003% Selenium
.01% Iodine
400 IU/lb Vit E
80,000 IU/lb Vit A

Minimum mineral levels in salt mineral mix for weathered hay, crop residues or poor pastures.

10% Phosphorus
12% Calcium
.003% Selenium
.01% Iodine
400 IU/lb Vit E
80,000 IU/lb Vit A

Minimum mineral levels in salt mineral mix for corn silage diets.

6% Phosphorus
20% Calcium
.003% Selenium
.01% Iodine
400 IU/lb Vit E
80,000 IU/lb Vit A

Minimum mineral levels in salt mineral mix for high grain diets.

0% Phosphorus
25% Calcium
.003% Selenium
.01% Iodine
400 IU/lb Vit E
80,000 IU/lb Vit A

We would also recommend including magnesium oxide to prevent grass tetany (spring and fall) and antibiotics to prevent anaplasmosis and pink eye (summer). There are many excellent commercial mineral mixes available both in a salt mix and alone. Either is acceptable but be sure that salt is available to supply the animal with sodium. The mineral mixture should be matched to the type of cattle and type of diet you are feeding. Also, be sure that the animals are consuming the recommended amount of the mixture to avoid deficiencies.

Prepared by

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Reference Materials / NRCS Contacts

Grazing Web sites

Great Lakes Grazing Network
http://www.glgn.org/

University of Illinois Ag and Natural Resources
http://web.extension.uiuc.edu/state/index.html

University of Illinois TRAILL
http://www.livestocktraill.uiuc.edu/

University of Illinois Sheepnet
http://www.livestocktraill.uiuc.edu/sheepnet/

University of Illinois Dairynet
http://www.livestocktraill.uiuc.edu/dairynet/

University of Illinois Beefnet
http://www.livestocktraill.uiuc.edu/beefnet/

Penn State Forage Page
http://www.cas.psu.edu/docs/casdept/agronomy/forage/forages.html

Penn State
http://pubs.cas.psu.edu/

University of Missouri
http://aes.missouri.edu/fsrc

University of Wisconsin
http://uwex.edu/ces/forage

Cornell
http://www.css.cornell.edu/forage/forage.html

South Dakota University
http://www3.sdstate.edu/

Purdue University
http://www.agry.purdue.edu/ext/forages/rotational/index.html

Oklahoma State
http://pods.dasnr.okstate.edu/docushare/dsweb/Homepage/

North Carolina niversity
http://www.ncsu.edu/forage

West Virginia
http://www.caF.wvu.edu/~forage/product.htm

Ohio State
http://ohioline.ag.ohio-state.edu/lines/acrop.html

Alabama
http://www.aces.edu/pubs/docs/indexes/

American Forage and Grassland Council
http://www.afgc.org

Greenmount College-N. Ireland
http://www.greenmount.ac.uk/

Grazing Lands Conservation Initiative
http://www.glci.org

NRCS Grazing Lands Technology Institute
http://www.glti.nrcs.usda.gov/

Iowa State Extension Publications
http://www.extension.iastate.edu/Pages/pubs/

University of Wisconsin
http://www.uwrf.edu/grazing/

West Virginia Extension
http://www.caf.wvu.edu/~forage/

Mississippi State University
http://www2.msstate.edu/~dlang/foragesms.html

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