Health and Management Techniques

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A healthy, disease-free herd is a goal for all beef producers. A herd health program will be most successful when it is customized to meet the herd's needs. Local veterinarians are knowledgeable about diseases in the area and should be able to make cost-effective recommendations. Plan a program that prevents diseases and disorders; do not depend on a veterinarian just to treat problems.

Requirements for a successful herd health program include:

- Adequate handling facilities
- Good nutrition, especially with trace mineral supplementation
- A working relationship between producer and veterinarian (valid veterinary-client-patient relationship)
- A willingness to follow a program once it is established
- A management level that reduces stress in cattle

Several management techniques including identifying, implanting, vaccinating, castrating, and dehorning, should be done in as timely and humanely a manner as possible. Having a controlled breeding season simplifies timing of vaccines. As discussed in Chapter 4, adequate handling facilities are necessary to properly restrain the animals for vaccination and treatment. Work carefully when processing cattle. If trying to set a record for speed, cattle may be unduly stressed or injured. Cattle can be worked rapidly enough when they are handled skillfully and gently and when the handling facility is constructed so that cattle flow through it easily. Remember that animal health products, such as vaccines and implants, must be administered properly to be effective. Therefore, emphasize proper technique rather than speed. Vaccines do not work in animals that are chronically diseased, in poor nutritional status, stressed, ill, or heavily parasitized.

Pre-calving Check

Spring calving cows, particularly heifers, in poor body condition are at risk for calving problems. The result may be lighter, weaker calves at birth, which can lead to a higher death loss, and more susceptibility to diseases such as scours. Pregnant animals in poor condition before calving provide inferior colostrum and have lower milk production. This can lead to lighter weaning weights or fewer pounds of calf to sell. Females in less than desirable body condition at calving are slower to return to estrus. Therefore, body condition at calving affects the current calf crop (milk production) and next year's calving date (due to a later rebreeding date).

Spring calving herds will also require a high magnesium supplement to prevent grass tetany or "hypomagnesemia" (see "Forage-related Disorders" later in this chapter for specific information on magnesium requirements).

Environment has an impact on calf survival. Calves born into a filthy environment (muddy lot) have the energy drained from them quickly if cold and wet and bacteria can easily invade the navel. A calf has little stored energy reserves and needs this energy to stand and nurse shortly after birth. A clean, dry pasture for calving is ideal if there is shelter and a catch pen so the cow can be restrained if calving assistance is required. Research has shown that when cattle are fed in the early evening (5 p.m.to 6 p.m.) during the last few weeks of pregnancy, more cows will calve during daylight hours, making calving problems easier to identify.

Calving Difficulty

Observe heifers and cows for signs of calving difficulty. Allow a reasonable amount of time for a cow to deliver on her own, approximately two hours from appearance of the water bag to delivery of the calf. Intervention is necessary if either the water bag or feet have been visible for more than one hour with little or no progress or if actively straining for more than 30 minutes without making visible movement of the calf. Heifers should be allowed no more than one hour to deliver the calf once the water bag is visible before intervening. Calving difficulty often occurs in mature cows when calves present backwards (dewclaws are pointed up), breech (tail first and no legs), or malpositioned legs or head. If the heifer/cow is not making progress, she should be quietly moved to a facility to adequately restrain her for examination. Clean the area around the vulva with soap and water. Use plastic obstetrical sleeves; bare hands and arms are not recommended in case potentially contagious organisms are present. Plenty of lubrication should be used to protect the vaginal area. A calf can generally be delivered with firm, steady traction if the head and both forelimbs are in the birth canal. If the calf is too large, the head and legs will not be able to enter the birth canal and a Caesarean section must be considered. Prolonged efforts with no progress can lead to a dead calf and cow. If you cannot correct a problem after 30 minutes of trying, you should call for veterinary assistance to assess the situation. Bear in mind that cows assisted early (within 90 minutes) have a 16% higher pregnancy rate at pregnancy check but every hour a cow spends stuck in Stage 2 labor delays rebreeding by four days.

During gestation, the placenta of the cow effectively separates the blood of the fetus from that of the dam and prevents any transfer of protective immunity while in the uterus. Therefore, the calf is born completely dependent on the absorption of maternal antibodies from colostrum after birth. Colostrum is the milk produced from the mammary gland in the first 24 hours after birth. A calf's gastrointestinal tract is designed to temporarily allow the absorption of antibodies (immunoglobulins) from the small intestine, called "passive transfer." Passive transfer only occurs during the first 24 hours after birth; it is most efficient in the first four hours of life and declines rapidly after 12 hours of age. At 24 hours, the gut is completely closed and there is no further immunoglobulin absorption. These absorbed antibodies must be consumed in order to protect the calf from disease-causing organisms

until its own immune system becomes functional. Early suckling of good quality colostrum is essential for survival.

The inability of the calf to get adequate colostrum after birth can lead to "failure of passive transfer" (FPT). If the calf is weak at birth, especially if it has a swollen head, or was manually delivered from a heifer, an oral calf feeder can be used to provide the necessary colostrum to the calf. The oral calf feeder (esophageal feeder) should be used on a calf positioned with the head bent down at a slight angle (nose below the ears), the ball should be lubricated (vegetable oil), and you should see or feel the ball on the left side of the neck when properly positioned (Complete instructions may be found in the section on calf scours). Colostrum from your farm is the best one to use because it has antibodies against the diseases found on the farm however good powdered colostrum replacement products are commercially available.

A mature cow has more concentrated antibodies (immunoglobulins) in colostrum than a heifer; the concentration of immunoglobulins is highest immediately after calving and decreases over time. Colostrum can be frozen and kept until the next calving period but no longer than one year. Be careful to freeze it in small amounts and not in one large gallon jug. Frozen colostrum must be slowly thawed out in a warm water bath and not placed in the microwave to thaw. Be cautious about using another farm's colostrum, especially from a dairy, because of the risk of acquiring Johne's disease and bovine leukosis virus.

Numerous colostrum replacements are available on the market. The use of a colostrum replacement product offers a convenient method to improve passive immunity by mixing a powdered commercial product containing bovine IgG with water and feeding the calf. A colostrum replacer contains a minimum of 100g of IgG per dose, protein, minerals, vitamins, and energy and is designed to be fed when no maternal colostrum is available. This should not be confused with a colostrum supplement product that is designed to be fed *in addition to* and after natural colostrum. Colostrum supplements are significantly less expensive than replacement products because they contain less than 50 mg IgG per dose and have no added nutritional value.

Annual Cow Evaluation

A cow should be evaluated every year to determine if she can continue in the herd. Seven quality checks are designed to determine her potential for reproductive success and detect any physical conditions that might cause future problems. Pregnancy check is an ideal time to evaluate these seven areas.

1. **Pregnancy.** If not pregnant, cull at appropriate time to reduce feed costs.
2. **Disposition.** Flighty cows that are difficult to move into working pens and chutes often produce calves with the same traits. Culling troublesome cows will select for good disposition in the herd.
3. **Eyes.** Check for "cancer eye."
4. **Feet and legs.** Check for lameness or poor conformation.
5. **Udder.** Check for dry or light quarters, poor conformation and large, pendulous teats that make nursing difficult.
6. **Body condition score (BCS):** This should be between 5 and 6 in an adult cow.
7. **Mouth:** Check if older cow or low BCS for teeth problem; "smooth-mouthed" or "broken-mouthed" will require feed supplementation to maintain body weight.

Deciding Who to Cull

Every year, the cow-calf producer needs to critically evaluate each animal in the herd and decide if she is paying her upkeep. Open cows (those that are not pregnant) at the end of breeding season obviously are the top of the cull list. With variable costs running $400-$500 per year per head, breeding stock depreciation running another $100-$150 per year, and an additional $100-$300 in fixed costs (2017 estimates), keeping open cows is a financial black hole. Beyond pregnancy status, what other variables are important to evaluate? Structural soundness, body condition score, age, performance, and disposition are vital components in developing a culling order. This culling order is exceptionally important during times of drought or a year with marginal hay production because deeper culling may be required to manage through a difficult season. To begin, it is best to think about those cattle in the herd with the least chance of being productive in the long term or farthest away from being productive. Equally important are factors such as disposition and phenotype that affect the marketability of offspring. The following is a list of factors to consider when deciding who to cull this year.

Example of a Culling Order
- Disposition
- Pregnancy status
- Structurally unsound/chronic condition
- Age
- Poor performance
- Phenotype
- Bred cows over 9 years of age
- Replacement heifers
- Bred cows 3-9 years of age

Disposition. A cow's attitude is an important consideration in any cattle operation. Bad behavior has both a genetic component and is also learned by calves at an early age. Mean cattle are dangerous to people, damage facilities, tear up fences and make gathering and working cattle a nightmare. Remember a good cow can be protective without being dangerous and destructive.

Pregnancy Status. A cow should produce a calf at least once a year and the sale of that calf needs to pay her way. Diagnosing a cow as "open" (not pregnant) is as simple as a veterinarian palpating for pregnancy at least 40 days after breeding or removing the bull. A simple, inexpensive blood test can also be used 28 days post-breeding to determine pregnancy status. If many cows are found open at pregnancy check, work with a veterinarian to determine if reproductive disease, poor nutrition, bull infertility or inability was the cause. Remember that cows that calve late in the season have less opportunity to breed back in a controlled (for example, 90 day) breeding season. Summer heat and fescue toxicosis can be important contributors to low conception rates.

Structural soundness/chronic conditions. Bad hooves or claws, lameness due to hip/knee injury, eye problems, and poor udder conformation are all examples of structural problems that adversely affect performance (Figure 7-1). Good feet and legs are essential for weight maintenance, breeding, calving, self-defense, and raising a calf. The udder should be firmly attached

with a level floor and high enough that newborn calves can easily find and latch onto teats. Cows with blind or light quarters, funnel or balloon shaped teats, or any history of mastitis are strong candidates for culling.

Cows with chronic conditions that will not improve such as progressive weight loss, early cases of cancer eye, repeated episodes of vaginal prolapse during pregnancy, and extreme sensitivity to the effects of fescue toxicosis should be removed from the herd as soon as the calf is weaned. Cows with confirmed disease conditions such as Johne's disease, bovine lymphoma, or advanced cancer eye should not be returned to a commercial market as breeding stock. The most common reasons for carcass condemnation at slaughter include emaciation, lymphoma, peritonitis, cancer eye, blood poisoning, bruising, and other cancers.

Age. Cows are considered most productive between 4-9 years of age. Look at the teeth to assess the age but evaluate them in light of diet-cows that eat gritty or sandy feeds and forages have increased tooth wear beyond their years (see "Estimating Age of Cattle by Their Teeth" later in this section). Cows with badly worn or missing teeth will have a hard time maintaining body condition. Older cattle die of natural causes, too.

Poor Performance. Record keeping is an invaluable tool for evaluating performance. Readable visual tags on both the cow and calf allow matching of calf sale weights to the dams and identification of cows that did not produce a calf. Inferior genetics and poor milk production produce lightweight calves that do no grow well. An overweight cow or large framed cow with a small calf that doesn't grow and gain weight usually means the cow is not producing much milk. Sick baby calves may be an indication of poor quality colostrum and poor mothering ability.

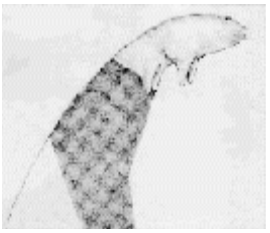
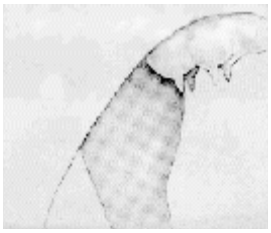
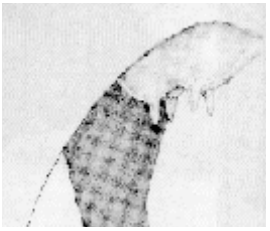
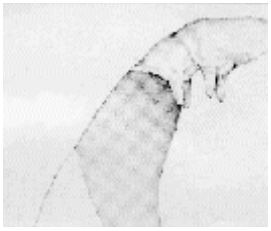
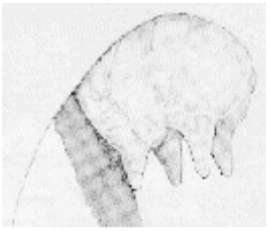
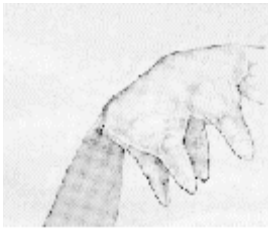
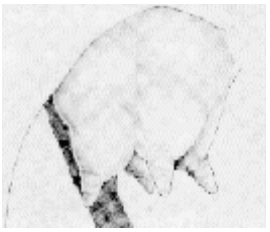
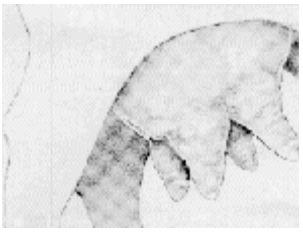
Phenotype. These are cows that do not "fit" the herd because of external features such as unusual breed, size, muscling and color. These challenges may be overcome to some degree by choice of sire to balance out the unwanted traits. Remember that buyers of commercial calves look for uniformity in color, weight, and frame in a set of calves.

The last ones to go. Hopefully culling will never have to go this deep in the herd. Bred cows over 9 years old, replacement heifers (especially those that did not breed in the first 30 days), and bred cows 3-9 years old should be the last sold. Thin cows that conceive late in the breeding season should go first.

Since 20% of gross receipts in a typical cow-calf operation come from the sale of cull animals, pay attention to price seasonality and body condition score before sending these animals to market. Prices are highest in spring and lowest in late fall/early winter when spring born calves are weaned and culls sent to market. Adding weight and body condition to culls is an opportunity to increase profitability but can be expensive. Work with a nutritionist to come up with realistic cost projections before feeding cull cattle for a long period of time.

When it comes to making decisions on who to cull, remember to consider functionality in the environment. Is she an "easy keeper?" Does she keep flesh and condition and raise a good calf, even when feed and forage is limited? On the opposite side, does she give too much milk or is her frame size so large that you can't keep weight on her, even when pasture is plentiful? Is her pelvis so small and

Figure 7-1. Udder scoring system for beef cattle.

Score	Description	
	Udder Suspension	**Teat Size**
9	Very tight	Very small
		
7	Tight	Small
		
5	Intermediate	Intermediate
		
3	Pendulous	Large
		
1	Very pendulous	Very large, misshapen
		

American Hereford Association; BIF Guidelines, 2020

Cull Cow Language

- Breakers (75-80% lean): Highest conditioned cull cows (BCS ≥ 7), excellent dressing percentages
- Boners or "boning utility" (80-85% lean): Moderately conditioned (BCS 5-7), well-nourished commercial beef cows (usually highest price cull)
- Leans (85-90%): Lower BCS (1-4), lower dressing percentages, susceptible to bruising during transport and expect more trim loss. Moving cows from lean to boner status can usually be done efficiently

tight that calving is a problem and will be a problem in her offspring? Functionality leads to longevity and improved efficiency. By retaining more young cows in the herd, you can decrease the number of replacement heifers needed and cull cows that are only marginally profitable. Young cows also increase in value as they mature because the body weight of the cow and her calf's weaning weight will continue to increase from 2-5 years of age. Longevity may also be improved through crossbreeding because hybrid vigor adds essentially 1.3 years of productivity or one more calf per cow.

In summary, a herd of easy-keeping, efficient cows is possible through rigorous culling and careful selection of replacements. Matching genetics to management and environment results in maximum efficiency, longevity, and, ultimately, maximum enjoyment of cattle production.

Table 7-1. Sample cattle working schedule.

Time	Calves	Cows/Bull
Birth	• Identify • Record birth date, dam • Castrate (delay 12-24 hours for bonding with dam)	
Prebreeding	• Vaccinate 7-way clostridial (Blackleg) • Pinkeye vaccine in the spring • Castrate/dehorn if needed • Implant male feeder calves if castrated	• Vaccinate IBR/PI-3/BVD/BRSV, Lepto-5, Vibrio, Pinkeye • Deworm • Sort into breeding groups • Bull breeding soundness exam
Midsummer[1]	• Deworm[2] • Reimplant steers according to label directions	• Deworm[2] • Remove bull from spring breeding herd
Preweaning	• Vaccinate: IBR/PI-3/BVD/BRSV • Booster 7-way clostridial vaccine	• Pregnancy examination • Evaluate cows for problems
Weaning (after stress is over)	• Booster IBR/PI-3/BVD/BRSV • Treat for internal and external parasites	• Sell open and cull cows • Treat for lice and grubs in late fall
Before calving		• Vaccinate against scours

[1] Avoid working cattle during periods of extreme heat; early morning is best.
[2] Use a dewormer that is effective against inhibited Ostertagia larvae.

Vaccinations

Your veterinarian can provide valuable advice to develop a vaccination program to prevent contagious diseases for your particular herd. The time of year you calve and when you prefer to work them will influence the program for your herd. Table 7-1 is an example of a Cattle Working Schedule, in which cattle are gathered five times a year.

Vaccination is a tool that is used alongside other management tools such as forage management, proper nutrition, maintaining a clean environment, biosecurity, and stress management. Vaccination programs are designed to protect the herd against disease caused by infectious organisms, such as viruses or bacteria. Vaccines contain either killed or modified live organisms that do not cause disease. These vaccine organisms stimulate the animal's immune system to "remember" how to mount a response if it is later infected with that organism. A vaccine cannot prevent infection but will allow the animal to recognize and respond more quickly to infection, lessening the severity of disease.

Most vaccines contain either modified-live or killed organisms or a combination of the two. Modified-live vaccines (MLV), both for viruses and bacteria, replicate (multiply) in the animal after injection. The organisms have been modified so that they do not cause the disease but stimulate the immune system similar to a natural infection. In general, MLV stimulate a longer-lasting immunity than killed vaccines. However, MLV may cause abortion if given improperly to pregnant cattle. Most modified-live vaccines must be reconstituted by adding sterile water (diluent) to a dehydrated "cake" in a separate sterile vial. Once mixed, the vaccine organisms are fragile and survive for only 45 minutes if in direct sunlight and/or heat. Use a cooler to protect vaccines from extremes of cold or heat and from sunlight. In a cooler, MLV organisms can survive approximately one to two hours.

Killed vaccines contain organisms or subunits of organisms that do not replicate (reproduce) in the animal after injection. Killed vaccines contain an adjuvant (added substance) that stimulates the immune system to respond to the vaccine challenge. Table 7-2 lists the advantages and disadvantages of killed and modified-live vaccines.

Table 7-2. Modified-live versus killed vaccines.

	Advantages	Disadvantages
Modified-live vaccine	• Single dose can provide protection • Less expensive per dose • More rapid immune response • More natural and complete immune response • Longer-lasting protection	• May cause abortion in pregnant animals • Need to be reconstituted before use • Inactivated by heat and sunlight • Partial bottles cannot be stored • Must be used within 1-2 hours after mixing
Killed (inactivated) vaccine	• Can safely be given to any animal at any stage of pregnancy • Stable in handling and storage	• Increased adverse reactions • More expensive • Needs 2 doses initially to be protective • Shorter protection time

Vaccines are available for many disease conditions. However, many diseases do not routinely threaten most beef herds, and some vaccines are not sufficiently effective to justify their use. Therefore, only the most significant vaccines are included in a routine vaccination schedule. In the young animal being vaccinated for the first time, a second or "booster" vaccination is often required a few weeks after the first vaccination to properly prime the immune system. This is exceptionally important if using killed vaccine. Label directions must be followed to obtain the desired immune response.

Vaccinations for the Cow-Calf Operation

One of the most common questions in cow/calf production is what vaccines are necessary on an annual basis in Kentucky to keep the herd healthy. The guidelines set forth here are designed to help answer that question but the details of what products to use and when to administer them are best decided by the producer and veterinarian. Technology is constantly changing and updating science to make today's vaccines safer and more effective than any time in the history of cattle production. However, the sheer number and types of vaccines and dewormers available today can make the correct selection of products challenging. Every farm has different disease risks and challenges regarding labor and facilities needed to work the cattle. A veterinarian is equipped with the knowledge and skills to determine what will work best in each unique situation.

Cows and Bulls 4-6 Weeks Prior to Breeding

- Viral respiratory vaccine (IBR, BVD, PI_3, BRSV) with *Campylobacter fetus* (vibriosis) and 5-way leptospirosis (HB optional) Fetal Protection (FP) product preferred. If the cow is pregnant at the time of vaccination, use a killed vaccine product to reduce the risk of accidental abortion. Certain modified live vaccines can be used in pregnant animals, but only if used strictly according to label directions.
- Seven-way clostridial vaccine (Blackleg), necessary if under 2 years of age; optional (highly recommended) as the cow ages depending on the exposure risk of the herd
- Deworm—perform at least twice per year (spring and fall). If only once is possible, deworm in late spring. Deworming in the fall is a good practice to reduce the number of worms that overwinter in the cow but is not as important as the spring and early summer when larvae are active in rapidly growing pasture. Do not deworm adult cattle if less than 2 weeks prior to breeding season as it may interfere with hormone production.
- Tag cattle for identification and/or retag those that have lost tags.
- Breeding Soundness Exams are highly recommended for herd bulls and should be conducted 60-75 days prior to turnout (see Chapter 5, "Managing Reproduction"). Bulls need the same vaccinations and deworming as the cow herd.

Heifers 6 Weeks Prior to Breeding

- Viral respiratory vaccine (IBR, BVD, PI_3, BRSV) with *Campylobacter fetus* (vibriosis) and 5-way leptospirosis—modified live strongly recommended; fetal protection (FP) product is preferred; follow label directions; booster at minimum 30 days prior to breeding
- Seven-way clostridial vaccine (Blackleg)
- Deworm with a branded (not generic) product; heifer is under increased nutritional demand because she is still growing herself and trying to reproduce; young animals do not have the immunity to parasites that adult cattle possess, therefore it is important to use effective dewormers

Calves 1-3 Months of Age

- Identify with tag
- Vaccinate with 7-way clostridial (Blackleg) vaccine—although the calves are too young to mount a good immune response, this dose of vaccine will initiate ("jump start") the immune process; do not give Blackleg vaccine at birth.
- Dehorn, castrate—the earlier these practices are completed, the better
- Optional Practices:
  - » Implant steers at the time of castration (unless you plan to sell calves in an organic or natural market)
  - » Viral respiratory vaccine-killed, MLV (see "Additional Considerations," page 99), or intranasal (intranasal preferred for young animals<4 months old)
  - » Pinkeye vaccine (administer in late spring/summer prior to fly season)
  - » Deworm; begin deworming calves at 4-8 weeks old depending on time of year and expected level of pasture contamination with parasite larvae
  - » Test for BVD-PI (ear notch); consult a veterinarian if this is something to consider; if BVD has been diagnosed in the herd or there is a history of unexplained abortions, stillbirths, weak calves or birth defects in the herd, testing all calves is the proven first step to find persistently infected (PI) animals

Calves 2-3 Weeks Pre-weaning

- Viral respiratory vaccine (IBR, BVD, PI_3, BRSV)-killed or MLV (see "Additional Considerations," page 99), but follow label directions regarding MLV usage in nursing calves
- Deworm with an endectocide (examples: Ivomec®, Dectomax®, Eprinex®, Cydectin®, LongRange®) for internal and external parasites; use a branded product—not a generic; drench anthelmintic (white liquid dewormer given by mouth) such as Safeguard®, Synanthic®, or Valbazen® may be used but a second product will be required for external parasite (flies, lice) control
- 7-way clostridial vaccine (Blackleg); follow label directions regarding the need for a booster
- **Optional:** Vaccinate with *Mannheimia haemolytica* toxoid—this vaccine, commonly known as a "Pasteurella shot" or "Pneumonia shot" is given pre-weaning in anticipation of the stress associated with weaning; in a low-risk situation in which the calves are weaned on the farm and no new additions are added to the group, this vaccine may be delayed until after weaning; consult your veterinarian and check your marketing plan since many programs (for example: CPH45) specify what vaccines must be administered and when in order to participate.

Calves at Weaning

Delay working calves until the stress of weaning is over. It is best to wait until the calves are eating, drinking, and most (if not all) have stopped walking and bawling.

- Booster+ viral respiratory vaccine-MLV strongly recommended and often required by special sales.
  - » For replacement heifers and bulls: Viral respiratory with *Campylobacter fetus* (vibriosis) and 5-way leptospirosis vaccine included. Booster according to label directions; MLV is strongly recommended for recently weaned calves to be kept in the herd.
  - » For steers: Viral respiratory **without** *Campylobacter fetus* (vibriosis) and 5-way Leptospirosis vaccine.

- Booster 7-way clostridial *if required* by label direction
- Optional practices:
  - » Implant: Follow label directions, especially when re-implanting. Do not implant females to be used for breeding purposes. Do not implant if planning to sell on the natural or organic markets.
  - » *Pasteurella multocida* and/or *Histophilus somni* (formerly known as *Haemophilus somnus*) vaccines—consult with a veterinarian for current recommendations.

Cows after Calves are Weaned

- Check cows for pregnancy by palpation, ultrasound, or blood test. If open, strongly consider culling her.
- Check for other problems: Eyes, mouth, udder, feet and legs, body condition, disposition.
- Scours vaccine—administer prior to calving. Products vary on when to administer them during late gestation so follow label directions carefully.
- If leptospirosis is a persistent problem, cows may need a booster of 5-way leptospirosis vaccine.

Additional Considerations:

- If calves cannot be processed preweaning, then do the steps for "Calves at Weaning" then booster the viral respiratory vaccine (and the 7-way clostridial if required on label) in 2-3 weeks. If castrations and dehorning were not done earlier while the calf was on the cow, these practices need to be completed as soon as possible. Tetanus vaccination is strongly recommended when performing late castration; especially if banding. Consult your veterinarian regarding whether to use a tetanus toxoid or antitoxin.
- Modified live vaccines (MLV) provide fast, broad immunity and are excellent stimulators of cell-mediated immunity. They are generally preferred in recently weaned calves and usually required by most preconditioned sales. However, **only use modified live vaccines in pregnant cows and in nursing calves if the cows were vaccinated with MLV in the last 12 months** (check label for specific requirements). If this requirement is not met, a killed vaccine must be used until the cow is open and the calf is weaned.
- Killed vaccines provide safe, protective immunity but must be given twice (usually 2-3 weeks apart) if it is the first time a viral respiratory vaccine is administered. Annual boosters are required after the initial two-shot sequence; twice a year is recommended when using killed products.
- If heifers have been allowed to stay with the herd bull until weaning, most likely some are pregnant. A prostaglandin injection (for example: Lutalyse®) can be given to the heifers once they have been away from the bull a minimum of 10 days. These injections work best in early pregnancy so do not delay administration if needed.
- Try to minimize the number of injections given at one time as much as possible. Multiple vaccinations cause neck soreness. Multiple Gram negative vaccines may cause cattle to spike a fever and go off feed for a short period of time.
- Keep good vaccination records. Record date, vaccine name, serial numbers and expiration dates at a minimum.
- Utilize fly control and pinkeye vaccine beginning in late spring.
- Letters in a vaccine name mean:
  - » IBR, BVD, BRSV, and PI_3 are diseases included in a viral respiratory vaccine.
  - » An "FP" in the vaccine name stands for "fetal protection" and means protection against fetal infection and abortion due to the BVD virus.
  - » An "HB" in the vaccine name stands for the strain of *Leptospira* known as "Hardjo bovis" that is a common cause of reproductive failure in cattle.
  - » "HS" stands for "*Histophilus somni*" (formerly known as *Hemophilus somnus*).
  - » "L_5" stands for the five strains of leptospirosis.
  - » "V" stands for "vibriosis."

In summary, vaccination programs must be designed around the specific needs of the cattle. Numerous vaccines are available for other diseases (for example: brucellosis, anaplasmosis, trichomoniasis, *Clostridium perfringens* Type A, foot rot, papilloma or wart virus) but they may or may not be useful in all situations. Always discuss concerns with a veterinarian to develop the plan that will work the best.

Diseases

Several diseases can be a problem in Kentucky beef herds. By understanding the causes of these diseases, producers can be better equipped to prevent them.

Anaplasmosis

Anaplasmosis is caused by a microscopic parasite that destroys red blood cells. Horseflies, mosquitoes, and ticks are the principal blood-sucking insects that spread anaplasmosis. Since the infection is easily transmitted by the transfer of infected blood, outbreaks can occur after working cattle without proper disinfection during procedures such as dehorning, castrating, ear tagging, and vaccination without changing the needle. Disinfect equipment and change needles between animals to minimize spread of the disease.

Initial signs of anaplasmosis include fever, weakness, icterus (jaundice), anemia, pale mucous membranes, dehydration, and constipation. Often no signs are observed and the animal is simply found dead. Most cases occur in late September, October, and early November in adult cattle (usually three years old and up).

Oxytetracycline is the drug of choice for treating anaplasmosis. In an outbreak situation, mass medication of cattle with a single injection of long acting oxytetracycline will likely arrest any clinical or late prepatent infections. Oral consumption of chlortetracycline for at least 60 *continuous days* at the higher level of the approved range 0.5-2 mg per pound of body weight during the insect vector season (May-November) has been demonstrated to control active infection. Currently, no commercial vaccines are available against anaplasmosis although Kentucky is approved by the USDA for sales of the experimental anaplasmosis vaccine marketed by University Products LLC of Baton Rouge, La. The vaccine has provided good protection against anaplasmosis throughout the United States, including Puerto Rico. The vaccine recommendations include a two-dose regimen given four weeks apart with annual revaccination required.

Blackleg

"Blackleg" and "malignant edema" are diseases caused by clostridial organisms that live in the ground in a protected spore form and enter calves through ingestion, inhalation or wounds. The bacteria are not spread directly from animal to animal but come from the soil. These organisms produce toxins (poisons) in the animal's body that are rapidly fatal. Blackleg usually occurs in cattle six months to two years of age; malignant edema can occur at an older age.

The "7-way" or "8-way" clostridial vaccine is effective, inexpensive, and economical. All calves should be vaccinated beginning at two to four months of age, depending on the product. Follow label directions carefully regarding what age to administer the primary and booster doses of the vaccine.

Bovine Leukosis Virus

Bovine leukosis virus (BLV) is a very common occurrence in beef cattle herds. The virus is usually transmitted through contact with blood from an infected animal. BLV can spread through such procedures as injections with dirty needles, surgical castration and/or dehorning, tattooing, rectal palpation as well as through biting insect vectors such as horseflies. Calves may also be exposed while nursing an infected dam. BLV is the cause of the cancerous blood disease "enzootic bovine leukemia" (bovine lymphosarcoma or malignant lymphoma). However, only approximately 2% of BLV-infected animals will go on to develop these cancers affecting lymph nodes and white blood cells. Tumors may occur in the spinal canal, uterus, heart, abomasum, kidney and/or lymph nodes. The most common clinical signs of cancer in cattle include anorexia, weight loss and fever or sudden death.

Blood testing is the first step to identify BLV-positive (infected) animals. Testing should be done in animals over six months of age and not around the time of calving in cows. Measures to control BLV include using single-use needles, cleaning and disinfecting equipment between animals with a disinfectant such as chlorhexidine, and implementing an integrated pest management program. Economic losses stem from the inability to sell cattle for export or as bull studs, condemnation of carcass at slaughter if tumors are present, and clinical disease/death loss.

Bovine Spongiform Encephalopathy

Bovine spongiform encephalopathy (BSE) is a chronic degenerative disease of cattle that affects the central nervous system. It was first diagnosed in the United Kingdom in 1987 and is considered rare in North America. BSE is also referred to as "mad cow disease."

This disease is not contagious and is believed to be caused by a prion. The only known method that cattle can contract BSE is through the consumption of animal by-products with infective material such as brain, spinal cord, retina, and distal small intestine. There is neither a treatment nor vaccine to prevent the disease. The incubation period (time from infection to symptoms) is two to eight years. Once clinical signs are seen, death usually occurs in two weeks to six months. Most cases have occurred in cattle between three and six years of age, usually dairy cattle.

As of 1997, Federal Drug Administration (FDA) prohibited the feeding of most mammalian protein to cattle. Several diseases in Kentucky are more common to cause central nervous system (brain) signs than BSE. These include listeriosis (circling disease), rabies, polioencephalomalacia (thiamine deficiency or high sulfur diet), grass tetany, milk fever, and ketosis. You should consult with your veterinarian for an accurate diagnosis if cattle are showing abnormal brain signs, such as staggering, excessive bellowing, or down (non-ambulatory).

Bovine Respiratory Disease

See "Pneumonia/shipping fever."

Bovine Respiratory Syncytial Virus

Bovine respiratory syncytial virus (BRSV) is a prevalent virus that can cause respiratory disease in cattle of all ages but primarily affects calves in outbreaks. BRSV is also considered a disease that predisposes animals to secondary bacterial infections. Vaccination can reduce severity and protect calves and cattle from disease. BRSV vaccines usually are in combination with other respiratory viral vaccines (IBR, PI_3, and BVD) and are available in modified-live or killed forms. Intranasal BRSV vaccines are often used in young calves as these vaccines stimulate immunity in the nose rather than relying on the immature immune system. BRSV can spread quickly in naïve cattle (3-10 days) and is found in the nasal and tracheal mucosa in infected calves, replicating and causing inflammation in these tissues. Clinical signs of BRSV can take two to four days to develop. BRSV infection is associated with high morbidity (60% to 80%), and fatality rates may be as high as 20%. BRSV can cause clinical disease in older heifers and adult cows, but generally older individuals will have less severe or subclinical BRSV infection.

Bovine Viral Diarrhea Virus

Bovine viral diarrhea virus (BVD) can cause a variety of clinical conditions, including abortions, birth defects, weak calves at birth, pneumonia, death, and persistent infections. The BVD virus is frequently diagnosed in Kentucky due to its immunosuppressive effect that increases susceptibility to respiratory disease, especially in recently weaned stocker calves. There are two forms of infection; a transient infection (TI) is an infection of short duration (usually 10 days to two weeks) during which time the calf is very susceptible to contract additional diseases because the virus stops the immune system from functioning. A persistent infection (PI), on the other hand, is a life-long infection a calf is born with but does not generally cause problems for the infected animal.

Persistently infected (PI) calves occur when a pregnant dam with inadequate protection (poorly vaccinated) is infected with BVD sometime during 40 to 125 days in gestation. The calf contracts the virus *in utero* and is born "persistently" or forever infected. A PI calf may be born undersized and have slower growth rates, or it may appear normal. The most efficient transmission source for the BVD virus is contact with PI cattle. A PI calf continuously sheds the virus from all secretions during its life. PI bulls can introduce BVD into a herd of cattle through the semen or direct contact. There is no treatment to remove the virus for cattle with persistent BVD infection.

Biosecurity plans should include isolation of newly acquired animals for at least two weeks and testing for the virus, either by an ear notch (skin) sample or a

serum sample. Limit movement of cattle on and off the farm, especially pregnant animals, to reduce the chance of exposure. Vaccination programs routinely are used to limit disease from BVD infection, especially prebreeding vaccines to promote fetal protection and prevent PI calves.

The commercial viral vaccines available are killed/inactivated or modified-live virus products. In general, modified-live vaccines should not be used in pregnant animals unless administered strictly according to the label directions. The killed BVD vaccines are safe for use in pregnant cows. When using a killed virus vaccine for the first time, a booster is required in two to four weeks after the first vaccination. Replacement heifers should be vaccinated at five to six months of age and booster this in two to four weeks according to label directions. Modified live vaccines are strongly recommended for replacement heifers.

Annual revaccination of the breeding herd is recommended prebreeding to get maximum fetal protection. All new additions should be screened for PI cattle with an inexpensive blood test or ear notch skin sample since PI animals serve as a continuous source of infection. A purchased pregnant cow or heifer may test negative herself but be carrying a PI calf so it is vitally important to test her calf at birth for persistent infection. Consult a veterinarian about the appropriate use of vaccines in your herd as well as testing procedures to identify and remove PI cattle. **Remember, PIs are considered defective and there is a legal, moral, and ethical obligation to dispose of these animals without sending/returning them to commerce.**

Brucellosis

Brucellosis (Bang's disease) causes abortion in cattle. More importantly, brucellosis can cause a disease in humans called "undulant fever." Cows with brucellosis shed large numbers of infectious organisms at calving. Calves receiving milk from infected cows shed live organisms in the feces. Kentucky is certified brucellosis free along with most of the United States except for a few Western states. Test and slaughter of infected animals is required by law. Prevention may include calfhood vaccination of heifer calves with RB51 strain vaccine between four to 10 months of age. Heifer calves must be vaccinated by an accredited veterinarian. Upon vaccinating a calf, the veterinarian will place an official tattoo and tag in the right ear and record the vaccination with the state veterinarian. Work with your veterinarian to determine if vaccination is necessary. Herds can be certified brucellosis-free with annual blood testing.

Coccidia

Coccidia are intracellular protozoan parasites that can cause serious economic losses due to weight loss, reduced performance and possibly death. The coccidian life cycle is complex. The single-cell oocysts are passed in the feces of infected cattle and "sporulate" to form the infective stage. The sporulated oocysts are consumed by a susceptible animal and attack the lining of the intestine. This development cycle in the intestinal tract destroys intestinal cells. The amount of damage done is directly related to the number of oocysts ingested. Outbreaks of bloody diarrhea are associated with the stresses of weaning, shipping, overcrowding and dietary changes.

Coccidiosis is primarily a disease of confinement. Affected animals may be off feed and strain to defecate, resulting in fresh blood in the manure and, in severe cases, rectal prolapse. Management techniques recommended to reduce exposure to oocysts include decreased stocking rates, minimizing stress, and providing clean housing. Feed should be kept off the floor to prevent contamination and waterers should be cleaned regularly. Use of the ionophores monensin (Rumensin®) or lasalocid (Bovatec®) or use of decoquinate (Deccox®) will help prevent coccidiosis. Do not allow horses to consume Rumensin® or Bovatec®. Cattle showing clinical signs of coccidiosis must be treated with drugs such as amprolium (Corid®) or sustained-release sulfas to cure clinical animals. Consult a veterinarian for treatment and prevention advice.

Cryptosporidia

Cryptosporidia are tiny protozoan parasites that invade the intestinal cells of the small and large intestine. It is a major contributor to calf scours/diarrhea and often becomes deadly in combination with a virus or bacterial agent. The disease is common in one- to four-week-old calves housed indoors. Cross infection between animals and humans is possible, so washing hands is advisable after handling young scouring calves. There are no medications available in the United States considered effective against cryptosporidia. They can survive for long periods in the environment, especially inside barns, so effective cleaning is imperative to prevent disease.

Foot Rot

Foot rot is an infectious disease characterized by sudden lameness and inflammation of the tissues between the claws. It is caused by injury to the skin between the claws, allowing infection with the bacteria *Fusobacterium necrophorum* and *Bacteriodes melaninogenicus*. The affected tissue becomes swollen and painful, and only light weight is placed on the toe. A characteristic foul odor is easily detected but little pus is observed. Treatment usually consists of systemic (injectable) antibiotics or treatment of the interdigital area with copper sulfate either by wrapping the hoof or by footbath. Prevention includes good nutrition (especially adequate zinc in the mineral preparation) and measures to ensure good hoof health such as improving drainage to reduce mud and manure buildup.

Histophilus somni (formerly Haemophilus somnus)

Histophilus somni is a normal bacteria found in the upper respiratory and urogenital tract of cattle but is a source of problems if it reaches the lungs or bloodstream. *Histophilus* can cause respiratory (pneumonia), heart, and brain disorders in feeder calves, and reproductive disorders in adult cattle. Commercial vaccines are available but have very limited success in inducing protection against disease. Thrombotic meningoencephalitis (TME) is a rapidly fatal brain disease in cattle due to *H. somni*.

Infectious Bovine Rhinotracheitis

Infectious bovine rhinotracheitis (IBR or bovine herpes virus-1) is the cause of viral respiratory and reproductive diseases affecting cattle. IBR can cause respiratory infections, abortion in cows exposed during pregnancy, infertility, and eye inflammation (conjunctivitis).

All forms of IBR can be controlled by vaccination with products for intranasal administration or injectable. Modified-live virus vaccines, in combination with BVD, BRSV and PI_3 for injection, are most effective but can cause abortion in pregnant animals if label directions are not carefully followed. Calves should be vaccinated 30 days before weaning and receive a booster dose at weaning or vaccinated at weaning and boostered two to four weeks later. Replacement heifers should be vaccinated again at least 30 days before breeding. The breeding herd should receive an annual booster dose, preferably modified live prebreeding.

Johne's Disease

Johne's disease (pronounced *yo-knees*) is a contagious bacterial infection of the intestinal tract of ruminants caused by the bacterium *Mycobacterium avium* subsp. *paratuberculosis*, commonly referred to as "MAP". This is a slow, progressive disease that begins when *calves* (not adult cattle) are infected with the MAP bacteria, most often around the time of birth but infection can occur up to 6 months of age and very rarely after. Johne's infection is mainly caused by calves ingesting MAP-contaminated feces from nursing dirty teats. In beef cattle, this is possible in high traffic areas (around hay rings, feeding areas) when mud and manure are splashed on the udder, when calving cows in dirty sheds or barns, or when cattle are held in close confinement. MAP is also shed in colostrum and milk of infected cattle. Once MAP gains entry into a calf, the organism lives permanently within the cells of the small and large intestine where it multiplies and causes the intestinal lining to slowly thicken. With time, the thickened intestine loses the ability to absorb nutrients, resulting in watery diarrhea. There is no blood or mucus in the feces and no straining. The clinical signs of diarrhea and extreme weight loss in spite of having a good appetite, do not show up until 2-5 years of age or even older. There is no treatment available and the animal eventually dies due to starvation and dehydration. The MAP organism begins to be "shed" in the feces years before diarrhea starts and continues until the animal's death. Map bacteria are very hardy due to a protective cell wall that allows survival for long periods (potentially 1-5 years) in the environment.

In almost all cases, the MAP bacteria arrived on the farm when an infected animal was purchased and added to the herd. The bacteria can be hiding in replacement heifers, cows, breeding bulls, recipients used for embryo transfer, or even in an infected calf purchased to graft on a cow. It is easy to buy (and sell) infected, young breeding age animals with no obvious symptoms even though they are already incubating the disease. However, these infected animals will shed the MAP organism, in increasing numbers as the disease progresses, contaminating the farm environment and increasing the risk of infection spread within the herd. MAP-contaminated colostrum from other herds, especially from dairies, is another potential source.

No treatment exists for Johne's disease. Cattle become shedders of the bacteria before they show clinical signs of diarrhea and weight loss. Cattle can be tested by collecting feces and submitting for PCR analysis or a blood test can be performed. A negative result does not guarantee the animal is negative; some animals with infection are slow to produce antibodies or shed the organism and are consequently slow to test positive.

The key to preventing, controlling, and eliminating Johne's disease in a herd is implementation of appropriate biosecurity measures including buying only from reputable sources and testing all new additions in the herd. Consult a veterinarian to develop a specific plan tailored for the herd.

Leptospirosis

Leptospirosis (often referred to as "Lepto") is a bacterial disease that causes abortions, stillbirths, and birth of weak calves. *Leptospira hardjo* (*L. borgpetersenii serovar hardjo*) and *pomona* (*L. interrogans serovar pomona*) are the two strains of primary concern for Kentucky cattle. The infection localizes in the kidneys and is shed in the urine to infect other cattle or humans. Prevention of leptospirosis is a good reason to keep cattle out of stagnant ponds.

All breeding-age female cattle should be vaccinated against the five strains of leptospirosis. Annual revaccination is highly recommended, especially when cattle are allowed access to farm ponds. Older leptospirosis vaccines have a short duration of immunity and require revaccination every three to four months to maintain adequate herd immunity. Recently, new vaccines against *L. hardjo bovis* (vaccines with the initials "HB") have been shown to protect against that strain and provide longer duration of immunity (up to one year) than the traditional Lepto-5 vaccines. The new vaccine does not eliminate carrier animals; treatment with oxytetracycline is necessary to eliminate carriers of leptospirosis.

Listeriosis

Listeriosis (circling disease, silage disease) is caused by the bacterium *Listeria monocytogenes* that is most often associated with feeding moldy silage or baleage, especially during cool weather. Animals show neurologic disease and may display head pressing, drooped ear, and/or compulsive circling. The recovery rate is best if treatment is administered early in the course of the disease. Listeria may also cause abortion and eye lesions. Prevention includes discarding moldy feed, especially fermented feeds, and cleaning contaminated areas. Rule out other diseases that can cause similar signs, especially rabies.

Neosporosis

Neosporosis is caused by a protozoan parasite *Neospora caninum.* The protozoa may affect the developing fetus, but it does not cause clinical illness in the adult. Once infected, the cow is infected for life and there is no effective treatment. Depending on when exposure to *Neospora* occurs during gestation, infection may result in fetal death, abortion, stillbirth, or birth of weak calves. In future pregnancies, normal calves may be born already infected with the organism and can pass it on to their offspring. The disease is primarily a problem in dairy cattle but is increasingly found in beef cattle. Abortion epidemics may occur if feed is contaminated with the organism.

The dog and the coyote have been identified as the definitive hosts and is where the parasite produces the infective eggs (oocysts). Cattle are exposed to *Neospora caninum* with accidental ingestion of feed or water contaminated with dog or coyote feces containing the oocysts. Cows can be blood tested to determine if they have

been infected. Diagnosis of the infection in affected calves is based on heart and brain abnormalities in the calf or aborted fetus, abnormalities in the placenta and positive blood tests. A vaccine was available but has been withdrawn from the market.

Parainfluenza Type 3

Parainfluenza type 3 (PI-3) primarily causes mild respiratory problems in cattle. It is considered to be a secondary factor in shipping fever outbreaks. Effective vaccines are available, including intranasal vaccines or modified-live and/or killed vaccines for injection. PI-3 vaccines are usually given in combination with IBR, BVD, and BRSV.

Pinkeye

Pinkeye (infectious bovine keratoconjunctivitis) in cattle is characterized by inflammation and watering of the eye, painful sensitivity to light, and varying degrees of corneal damage. Research in Kentucky indicates a definite decrease in weaning weight of calves with pinkeye. This decreased performance, coupled with a decrease in selling price of affected calves, can mean significant losses for Kentucky beef producers.

Pinkeye is caused by the bacteria *Moraxella bovis*. These bacteria are covered with hair-like structures used to attach to the cornea or clear portion of the eye. Once attached, it releases a toxin that kills cells on the surface of the cornea. Early detection and prompt effective treatment are essential to reducing spread and limiting damage to eye. The earliest signs include a large amount of watery tears that often flow down the face, excessive blinking, squinting, and sensitivity to light. In 1 to 2 days, the cornea appears white and a small ulcer or "pit" develops towards the center of the eye. Some cases will resolve while others progress to deep ulceration and corneal rupture.

Treatment with a long acting antibiotic along with topical fly repellant is the best course of action to reduce the spread of pinkeye in the herd. Active cases of pinkeye with excessive tearing attract flies that spread the bacteria quickly. Work with a veterinarian to determine the best antibiotic for the situation. Isolation of the affected animals will also help limit the spread. A patch can be used to protect an affected eye however it is difficult to see if the eye is improving or deteriorating when covered. If the case of pinkeye is very advanced, a veterinarian may suture the eyelids together or use a third eyelid flap to stabilize the cornea. Do not rely on sprays alone since they remain in the eye just a few minutes before tears wash them away. To be effective, sprays must be applied 3-4 times daily. Vaccination alone will not prevent disease but may allow faster response to treatment. An overall good level of nutrition, adequate vitamin and trace mineral intake, a comprehensive vaccination program, and parasite (fly) control are all exceptionally important in improving an animal's ability to fight off any disease process. To reduce as many of the pinkeye risk factors as possible, prevent corneal damage from sun by providing shade, control face flies, clip pastures to prevent mechanical injury from grass and plants, and provide an abundant clean water source in order to keep calves hydrated, allowing the eye to stay clean and moist. Recent eye cultures have indicated that *Moraxella bovoculi* also contributes to pinkeye, especially cases in the winter months. Some veterinarians have autogenous vaccines prepared from pinkeye cases cultured on the farm to stimulate immunity against both *M. bovis* and *bovoculi.*

For further information, see ID-135: *Infectious Bovine Keratoconjunctivitis ('Pinkeye') in Cattle* (http://www2.ca.uky.edu/agc/pubs/id/id135/id135.pdf).

Pneumonia/Shipping Fever/Bovine Respiratory Disease Complex

Pneumonia/shipping fever/bovine respiratory disease (BRD) is caused by a complex interaction of bacterial and viral organisms along with stress in an animal, leading to infection and inflammation of the lungs. Clinical signs include depression, fever, off-feed, an increase in the rate and depth of respiration, cough, nasal discharge, and open-mouth breathing. BRD is associated with the stress reaction to changes in diet, a new environment, weather, water, dehorning, castration, weaning, handling, confinement, hauling, and mixing with new groups of calves.

Several viruses are major contributors to BRD. They are highly contagious and include bovine respiratory syncytial virus (BRSV), bovine viral diarrhea virus (BVD), infectious bovine rhinotracheitis (IBR), and parainfluenza (PI3). Bacterial agents are ultimately responsible for the severe lung damage. Bacteria take advantage of stress and viral infection to overcome the immune defenses and cause pneumonia. *Mannheimia* (formerly Pasteurella) *haemolytica* is the bacterium that often causes "shipping fever pneumonia," especially in stocker and feedlot cattle. These bacteria can cause severe pneumonia and result in quick death if the animal is not treated with effective antibiotics early in the course of disease. *Pasteurella multocida, Histophilus somni,* and *Mycoplasma bovis* are other bacterial species that can contribute to pneumonia (Table 7-3).

Successful treatment of BRD involves early recognition of sick animals, appropriate treatment, follow-up, and prompt retreatment of relapses. Clinical signs include depression (Table 7-4), decreased appetite (Table 7-5), abnormal breathing (Table 7-6), and fever on examination (Table 7-7). Coughing is not always present early in pneumonia. It is important to watch cattle at feeding time. Sick calves may walk to the bunk but not eat.

Antibiotics and other therapeutic agents should be selected on the basis of symptoms shown and with a protocol developed with a veterinarian. Often bacterial organisms become resistant to an antibiotic that has worked well in the past and a new antibiotic must be selected. Mass treatment of all calves (metaphylaxis) should be considered if sickness is expected in a group of high-risk calves or if increasing rapidly. A hospital pen is an option so sick animals can be closely observed and easily treated but must be cleaned and sanitized regularly.

Prevention includes reducing stress and exposure while promoting resistance to infection. Preconditioning is one successful approach. This management and marketing program significantly reduces illness and death due to BRD. The Kentucky Certified Preconditioned for Health CPH-45 program ensures that the calves have been vaccinated, weaned a minimum of 45 days and have learned to eat from a feed bunk and drink water from a trough. The calves must be offered a free choice mineral with minimum specifics for copper, selenium, zinc, manganese, and salt content. The program includes required vaccinations (IBR, PI-3, BVD,

BRSV, and 7-way clostridial) and treatment for internal and external parasites. Some sales require specific vaccine and parasite products, so always check with the sale location for their requirements and timeline. There is a guarantee that the calves do not include bulls, stags or pregnant heifers. The producer certifies that the procedures are done according to required BQA standards.

Salmonellosis

Salmonellosis is a disease that causes diarrhea in calves and adults. It can lead to multiple deaths in a herd. "Salmonellae" is a collective term used for the many different serovars of *salmonella* bacteria that are known to infect cattle. Salmonellae are invasive bacteria that can penetrate intestinal, oral, ocular, or nasal mucous membranes. Cattle are primarily infected with salmonellae by three methods:

- **Transmission by wildlife.** Rodents and birds can bring in salmonellae from outside sources or act to maintain the infection by infecting cattle feed.
- **Being fed contaminated animal protein by-products.** The bacteria can rapidly multiply in high-moisture feeds after contamination by birds, rodents, or equipment.
- **Transmission by cattle and other livestock.** Asymptomatic and sick cattle can shed large numbers of the bacteria in the feces into the environment while appearing healthy.

A link between intensive management practices, such as crowded conditions and high-protein diets, and an increased incidence of salmonellosis has been suggested. Stress factors play an integral part in the disease. Stresses include transportation of animals, inadequate nutrition, bad weather, overcrowding, parturition, and concurrent disease. *Salmonella* may affect calves already infected with rotavirus, coronavirus, or cryptosporidia. If the challenge dose of salmonella bacteria is large enough, salmonellosis may occur as a primary disease in older healthy cattle. The risk of disease may be greatest when the infection occurs in a herd that is under environmental or nutritional stress and is close to calving. Newer vaccines have improved efficacy against salmonellosis.

Table 7-3. Common causes of pneumonia.

Viral agents	Bovine Respiratory Syncytial Virus	BRSV
	Bovine Viral Diarrhea Virus*	BVD
	Infectious Bovine Rhinotracheitis	IBR
	Parainfluenza Virus Type 3	PI-3
Bacterial agents	*Histophilus somni* (*Haemophilus somnus*)	
	Mannheimia (Pasteurella) haemolytica	
	Mycoplasma bovis	
	Pasteurella multocida	

* Important cause of secondary pneumonia due to immunosuppression.

Table 7-4. Depression (attitude).

	Abnormal		
Normal	*Mild*	*Moderate*	*Severe*
• Bright • Alert • Moves with other animals	• Head lowered • Ears drooped • Eyes dull • Easily stimulated to move • Stiff gait	• Listless • Stiff gait • Stiff upon rising • Hunched up • Does not respond but moves when urged	• Looks very sick • Does not get up

Table 7-5. Appetite.

Normal	**Abnormal**
• Approaches feed when placed in bunk or trough	• Appears gaunt (empty) in left flank • Not interested in drinking • Does not immediately walk toward the feed when fed

Table 7-6. Respiratory index.

Normal	**Abnormal**
• Breathes in and out easily • No exaggerated motion • Inspiration and expiration performed at a normal rate	• Flared nostrils at inspiration • Extended neck to open airway • Open-mouth breathing • Shallow breathing • Exaggerated deep breathing • Soft, persistent cough • Drooling

Table 7-7. Temperature.

Normal	**Abnormal**
• Body temperature is 102.5°F when checked in the early morning	• Body temperature is 104°F or higher*

* Elevated body temperature may also be caused by heat, high humidity levels, animal's exertion before entering handling facilities, dark hair color, and consumption of high-endophyte fescue in the summer.

Scours/Diarrhea

Scours (neonatal diarrhea) is the most common infectious problem of young beef and dairy calves. Scours/diarrhea is caused by a number of infectious organisms (Table 7-8). The three basic factors involved with development of scours are: (1) a contaminated environment where the animals are born and raised, (2) poor quality and/or quantity colostrum consumption, and (3) infectious agents (viral, bacterial, or protozoal). One or more of the infectious agents damage the calf's

Table 7-8. Common causes of calf scours.

Infectious Causes	**Age Affected**
E. coli	1-5 days
Clostridium perfringens	2-10 days
Salmonella	1-4 weeks
Rotavirus	1-4 weeks
Coronavirus	1-6 weeks
BVD	2-6 weeks
Cryptosporidia	1-6 weeks
Coccidia	> 3 weeks

intestine and cause scours. Events leading up to infection and disease are the result of interaction among all three factors.

Calf Scours Treatment

- Identify, record information, and if possible, isolate the calf with its dam from healthy herd.
- Use oral (esophageal) feeder if the calf is weak and will not suckle. Use electrolytes to rehydrate calf and to help reduce the depression. Commercial electrolyte solutions are best as they provide the optimal combination of ingredients to correct fluid deficits and provide energy.
- A nonsteroidal anti-inflammatory drug such as Banamine® is useful to decrease pain and fever but overuse can result in ulcers in the digestive tract. Intestinal protectants and motility modifiers such as Kaopectate® are not recommended.
- Consult with a veterinarian concerning the use of antibiotics and/or the need for IV fluid therapy. Calves with diarrhea have an increased number of coliform bacteria in the small intestine regardless of the original cause so calves generally recover faster with antibiotic therapy. IV fluid therapy is needed in cases with severe depression, inability to stand, a weak suckle reflex and a low rectal temperature.

How to Use an Esophageal Feeder

- Prior to tubing the calf, examine the feeder to make sure it is clean and undamaged.
- The length of the tube and the size of the calf will dictate how far the tube should be inserted. Compare the tube length to the distance between the mouth of the calf and the point of the shoulder. This is the approximate distance the tube should be inserted.
- The calf should be standing if possible. Place its rear end into a corner and hold its head between your knees. If the calf won't stand, at least sit it up on its sternum (breastbone) and hold the head between your legs.
- To insure that no fluid runs into the mouth of the calf that could be inhaled in the lungs, either kink the plastic tubing or clamp it off during passage.
- Moisten the end of the feeder (the ball) with milk or vegetable oil to make it more slippery.

Table 7-9. Producer's worksheet: Herd assessment for calf scours.

Areas of Assessment	Yes	No	Points for Your Farm
1. Herd performance analyzed	0	5	
2. Forages tested	0	5	
3. More than 2% abortions (2 cows per 100 calves)	5	0	
4. Calve before March 10	5	0	
5. More than 20% first-calf heifers	20	0	
6. History of significant calf diarrhea	15	0	
7. Average Body Condition Score (BCS) less than 4	5	0	
8. Winter weight loss	15	0	
9. Premature calves (more than 30 days premature)	10	0	
10. Poor drainage in calving area	10	0	
11. Sick cows/calves remain in calving area	15	0	
12. Heifers calved separately from cows	0	10	
13. New additions (cows, calves, bulls) especially from sales barn	15	0	
14. Foster calves from outside sources	20	0	
Total score*			

* Total score of 55-70 indicates higher risk for calf diarrhea.

- Stimulate the calf to open its mouth by putting pressure on the gums or pressing on the roof of the mouth with your fingers. Do not hold the nose straight up; position the nose below the ears to reduce the risk of trauma to the back of the throat.
- Gently insert the tube into the mouth over the top of the calf's tongue. When the rounded end hits the back of the tongue where there is a ridge, the calf should swallow. Wait patiently until the calf swallows then slide the tube gently down the esophagus.
- Prior to administering the fluid, check that you feel the tube in the esophagus on the left side of the calf's neck. You should feel two tube-like structures in the neck: 1) the trachea (or windpipe) is firm and has ridges of cartilage all along its length, and 2)the esophageal feeder tube in the throat is firm but smooth.
- Administer the fluid by raising the bag above the calf and allowing the fluid to flow by gravity. Never squeeze the bag to hurry the process. The calf will begin to move (and vocalize) when it feels pressure as the rumen fills. Do not remove the tube until the fluid has had time to empty into the rumen.
- Again, kink the plastic tube or use a clamp before pulling the tube out in one swift motion.
- Immediately wash the tube and feeder in hot, soapy water. Follow with a chlorine and hot water rinse in order to remove the film of fat and protein that adheres to the inside of the feeder. If not properly cleaned and disinfected, there is a risk of inoculating bacteria directly into the intestinal tract when a calf is most vulnerable to infections.
- Keep the feeder in good repair-change them when it begins to show any signs of wear. Use a different esophageal feeder to deliver colostrum to newborn calves than the one used to treat scouring calves.

Calf Scours Prevention

- Decrease numbers of organisms in the environment with pasture management. Reduce stress: avoid crowding, provide adequate shelter, and keep cow teats out of the mud. Do not calve out cows in the same area used for confined winter feeding. It is best to separate heifers from the older cows before calving and return together after breeding (Table 7-9).

- Ensure that an adequate amount of good quality colostrum is consumed at birth.
- Provide the recommended nutrition (both protein and energy) and proper amounts of trace minerals, especially copper and selenium, to the cow during her pregnancy.
- Vaccinate the dam at the end of pregnancy to protect the calf through colostrum for *E. coli*, rotavirus, and coronavirus, and *Clostridium perfringens Type C* or administer vaccine to the calf by mouth at birth *before* the ingestion of colostrum.

Vibriosis

Vibriosis is a sexually transmitted disease caused by *Campylobacter fetus* sp. *veneralis* that causes early abortions and temporary infertility in the cow. The disease is spread through venereal transmission from an infected bull to females. Cows with previous exposure to infected bulls develop immunity and may be less likely to experience infertility than heifers. Infected heifers usually return to estrus in 6 weeks after the infection is cleared.

Treatment is difficult. Prevention is accomplished by vaccinating cattle before the start of breeding season. Bulls should also be vaccinated. Take precautions when adding breeding stock to the herd ("borrowing bulls") to prevent introducing the disease.

Forage-Related Disorders

Bloat

Ruminal tympany, or bloat, occurs due to a buildup of fermentation gases in the rumen. These gases are normally eructated or "belched" out of the animal. When this gas is prevented from escaping the rumen, it builds up, and stretches the rumen. As the pressure in the rumen increases, breathing becomes difficult because the diaphragm cannot expand so the lungs cannot inflate. In severe cases, death occurs from suffocation. Bloat potential is greatest during rapid growth periods in spring and declines during summer; generally mid-March through May in Kentucky.

Cause

Legumes and succulent cereal grain forages such as rye and wheat are considered high risk for promoting frothy bloat. Pasture bloat is usually associated with cattle grazing white (ladino) clover or alfalfa, and occasionally red clover. When these forages are at a vegetative stage, they are high in soluble protein, low in lignin, and have a highly digestible cell wall which can cause the formation of a slime that traps the fermentation gases and rumen contents, resulting in a foam (similar to the foamy head of a beer) that prevents the gas from being expelled. This type of bloat is termed "frothy" bloat because it is due to a foam rather than free gas. Other legumes, including lespedeza, crown vetch, and birdsfoot trefoil, rarely cause frothy bloat, in part due to a tannin content that lowers the digestion rate and yield of the soluble protein fraction.

Clinical Signs

Frothy bloat may occur on the first day of turnout but is more commonly seen on the second or third day. The main clinical sign is a swelling of the left region of the abdomen. Other possible signs include repetitive standing up and lying down, kicking at the belly, frequent defecation and urination, grunting, and extension of the neck and head. The animal will develop difficulty breathing when there is extreme pressure exerted on the diaphragm by the gas-filled rumen. Without treatment, the animal will collapse and die, generally three to four hours after clinical signs begin.

Treatment

To properly treat animals, the severity of the condition has to be accurately assessed. If the animal's life is not in immediate danger, passing a stomach tube and administering an antifoaming agent is recommended. Antifoaming agents include vegetable oils (peanut, corn, soybean), mineral oil, and "non- ionic surfactants" that will break up the stable foam and allow the gas to escape. Vegetable and mineral oils work equally well in the rumen. The most common non-ionic surfactant treatment is the poloxalene drench concentrate (Therabloat®). The recommended dosage for oils is between 80 and 250 ml/head and of Therabloat® is 1 to 2 fluid ounces, depending on the animal's weight.

The animal must be observed carefully for at least an hour after treatment to determine if the treatment was successful or if an additional therapy is needed. If the bloat does not resolve with treatment, the rumen can be punctured with a trocar and a cannula placed in the rumen. This procedure should be performed after acquiring proper training from a qualified individual, such as a veterinarian. If the bloat is severe when the animal is found, pressure inside the rumen must be alleviated immediately. In life-threatening cases, an emergency rumenotomy can be performed, in which a large hole is cut through the skin into the rumen, resulting in a sudden release of the rumen contents to the outside, relieving the pressure. Cattle typically recover with proper care of the incision and antibiotics.

Prevention

- Grow grass-legume mixtures instead of pure legumes. As the proportion of legumes exceeds 50% of the stand, the risk of bloat greatly increases.
- Avoid grazing very immature white clover or alfalfa. Research shows alfalfa grazed less than 10 inches tall had two times more bloat than when it is grazed at 19 inches.
- Moisture plays a role in a forage's bloat potential. Hungry cattle graze more aggressively when moved to a pasture, so they should not be moved to a new pasture with high legume content until midday—after the dew has dried and after they have grazed in the morning.
- Provide a full feeding of hay before turning animals into lush legume stands for the first time. High-quality grass hays that are palatable should be provided to encourage hay intake. Continue to offer access to this high quality grass hay for several days after turning into lush legume pastures.
- Although bloat is associated with certain plants, some animals have a genetic predisposition to bloat and these should be culled.
- The use of ionophores, a class of feed additives that inhibit growth of certain microbial species in the rumen, has proven effective in reducing the potential for legume bloat. Monensin is more effective than lasalocid and is the recommended ionophore for bloat control.
- Feed bloat-reducing compounds. The most common antifoaming surfactant and the only one currently approved for use in the United States

is poloxalene, which is frequently incorporated into a small block form. Most blocks are labeled to be fed at a rate of one block to every five head of grazing cattle. Poloxalene also comes in a loose granular form that can be mixed in with salt, mineral supplement, or some other feedstuff. When bloat risk is high, the recommended intake level is 2 grams per 100 pounds of body weight. When the risk is low, the feeding rate can be lowered to 1 gram per 100 pounds of body weight, but remember that animals need to consume the recommended dose for effective bloat prevention.

For further information, see Extension Fact Sheet ID-186: *Managing Legume-Induced Bloat in Cattle*.

Fescue Toxicosis

Fescue toxicosis and summer slump are terms widely used to denote poor performance of animals grazing tall fescue during the summer. This poor performance is due to the presence of high levels of a fungus in the fescue—the endophyte *Neotyphodium coenophialum,* that produces ergot alkaloids, especially ergovaline. Tall-fescue pastures containing ergot alkaloids are responsible for the toxic effects observed in livestock, including hyperthermia (elevated body temperature), gangrene of the extremities, decreased weight gain, and poor reproductive performance. The alkaloids cause vasoconstriction or narrowing of the arteries which leads to poor blood supply to many body systems. Hot, humid weather increases the negative effects.

Cattle consuming fescue infected with high levels of the fescue endophyte show some or all of the following symptoms:

- Lower feed intake
- Lower weight gains
- Lower milk production
- Decreased pregnancy rates
- Long, rough hair coat
- More time spent in the shade or mud due to higher body temperature

At least three areas should be considered to avoid or minimize the effect of the endophyte in animal production:

- **Manage to minimize the effect.** Clipping seed heads or chemically suppressing seed head development eliminates the most concentrated source of the endophyte and helps keep the plants vegetative. Hay harvested at the proper stage of maturity also gives better animal performance than late-cut hay.
- **Dilute out the endophyte.** The most practical way is to add legumes, such as clovers, to the fescue pasture. Even small amounts of legumes can increase animal gains.
- **Replace infected stands with low-endophyte varieties.** Several low-endophyte or endophyte-free varieties are now available. When choosing new varieties, pay attention to adaptability, forage production, animal performance, persistence, and pest resistance. These new varieties require good grazing management to persist in a stand.

For more information, see Chapter 2, "Forages for Beef Cattle," or see ID-221: *Fescue Toxicosis* at http://www2.ca.uky.edu/agc/pubs/ID/ID221/ID221.pdf.

Grass Tetany

Hypomagnesemic tetany or "grass tetany" is a disorder caused by an abnormally low blood concentration of the essential mineral magnesium (Mg). Synonyms for this disorder include spring tetany, grass staggers, wheat pasture poisoning, or lactation tetany. Grass tetany is considered a true veterinary emergency requiring prompt treatment with magnesium to prevent death.

Cause

Hypomagnesemia occurs most often in beef and dairy cows in early lactation because of the large demand for magnesium during lactation and the cow's limited ability to mobilize magnesium reserves within her body. Affected cattle are often found to have concurrent low blood calcium. Typically, this disease occurs when grazing annual ryegrass, small grains (such as wheat or rye) and cool season perennial grasses (tall fescue, orchardgrass and Kentucky bluegrass) in late winter and early spring (Feb-April). Fast-growing spring grass is often high in potassium (K^+) and nitrogen (N^+) and low in magnesium (Mg^{++}) and sodium (Na^+); each of these factors contributes to decreased absorption of magnesium through the rumen wall. "Winter tetany" in beef cattle is another form of hypomagnesemia caused by consuming low energy forages with low concentrations of magnesium over a long period of time, usually throughout winter. Clinical signs of grass tetany are then triggered by a stressor such as a cold weather snap.

Clinical Signs

Grass tetany or hypomagnesemia often causes sudden death in older lactating beef cows weeks or even months after calving without appropriate supplementary mineral feeding. The hypomagnesemic cow is most often found dead with disturbed soil around its hooves indicating paddling/seizure activity before death. If seen in the acute stage, grass tetany is characterized by hyperexcitability (nervousness), tetany (constant contraction of muscles resulting in muscle stiffness and rigidity), convulsions and then death. The earliest signs of twitching of the facial muscles, shoulder, and flank are due to the uncontrolled activation of peripheral nerves. Affected cows become separated from the group and have a startled expression, show an exaggerated blink reflex, frequent grinding of the teeth, and may show aggression. As the fall in blood magnesium progresses, sustained muscle spasms become more common, eventually causing the cow to stagger and fall. Convulsions and seizures quickly follow, with chomping of the jaws and frothy salivation. Affected animals lie with the head arched back and the legs paddling. The heart rate may reach 150 beats per minute (approximately twice the normal rate) and can often be heard without the use of a stethoscope. Respiratory rates of 60 breaths per minute (normal is 10-30 breaths per minute) and a rectal temperature as high as 105°F may result from the excessive muscle activity. Animals may get up and repeat these convulsive episodes several times before they finally die. The diagnosis is made based on history, clinical signs, and low magnesium concentration in the blood, spinal fluid, or eye fluid.

Treatment

Animals exhibiting grass tetany are in need of immediate veterinary treatment; preferably 1.5-2.25 grams of magnesium intravenously for an adult cow. Tranquilization by the veterinarian may be needed to reduce the risk of injury during treatment. Response to therapy is not always good and depends largely on the length of time between onset of symptoms and

treatment. Cattle that do recover take at least an hour which is the time it takes for spinal fluid magnesium levels to return to normal. Many of these cows will relapse and require more treatment within 12 hours. Administering oral magnesium gel once the animal has regained good swallowing reflexes or drenching with magnesium oxide or magnesium sulfate will reduce the rate of relapse.

Prevention

- Provide a high magnesium mineral supplement at least 30 days prior to calving. Cows require approximately 17-20 grams of magnesium daily or 4 ounces per day of a 15% magnesium mineral mix during the late winter and early spring. UK Beef IRM mineral recommendations for free choice supplements for grazing beef cattle include 14% magnesium in the trace mineral mix and all from magnesium oxide (no dolomitic limestone or magnesium mica). These complete mineral mixtures also supply additional sodium in the form of salt to aid in combatting high potassium intakes. Consumption should be monitored because magnesium is not palatable and mineral intake is generally inadequate if using poor quality mineral products. High magnesium mineral may be discontinued in late spring once the grass is more mature, the water content of the forage is decreased, and daily temperatures reach at or above 60°F.
- Feeding ionophores (monensin, lasalocid) has been shown to improve magnesium absorption efficiency.
- Soil test and apply fertilizer based on soil test results and use no more potassium than recommended since grasses are often luxury consumers of potassium.
- Legumes are high in magnesium and will help offset the problem although their growth is limited in late winter.
- Limit grazing to 2-3 hours per day with free-choice access to high quality hay for early lactation cattle on lush pasture during susceptible periods or graze the less susceptible animals (heifers, dry cows, stocker cattle) on the higher risk pastures since the threat of disease is very low in non-lactating cattle.

For further information, see ID-226: *Hypomagnesmic Tetany or Grass Tetany*, http://www2.ca.uky.edu/agc/pubs/ID/ID226/ID226.pdf.

Nitrate Toxicity

Nitrates are present in all plants, but normally their concentrations are not excessive. Under normal growing conditions, nitrate from the soil is absorbed by the roots of forage plants, and is supplied to the leafy upper portions of the plant where it is converted into plant protein. However, adverse environmental conditions such as drought, sudden weather changes (cool, cloudy weather), leaf damage (due to hail, frost, or herbicides), or heavy fertilization with nitrogen, can cause plants to develop and retain potentially dangerous levels of nitrate. The lower stalks and stems at the base of the plant are the site of highest accumulation. Nitrate levels will remain high until there is new leaf growth. Hay will remain a hazard because toxicity is unchanged by drying, but the nitrate concentrations in ensiled forage crops may be reduced by up to 60% with proper fermentation and microbial degradation.

Cause

Drought-stressed sorghum, sorghum-sudangrass or corn are the source of most of the forage-related cases of nitrate poisoning in Kentucky, but wheat, sudangrass, rye, pearl millet, soybeans, beets, Brassica spp. (rape, kale, turnips, swedes) and oats can also accumulate nitrates. Common weeds that are nitrate accumulators include ragweed, pigweed, thistle, bindweed, dock, jimsonweed, and Johnsongrass. Although these are not complete lists, these weeds and forages are the most problematic. Surface water or water from shallow wells may contain nitrates, especially if there is run-off from fertilized land contaminating the water. Both water and forage should be analyzed to ensure that total nitrate does not exceed toxic levels.

Nitrate poisoning in ruminants may also result from consumption of nitrate fertilizer. Cattle that gain access to stored nitrate fertilizers, especially when deprived of salt, may consume toxic quantities very quickly. The highest number of nitrate toxicity cases brought to the UK Veterinary Diagnostic Lab result from the consumption of fertilizer.

Nitrates enter the bloodstream as nitrite, which combines with hemoglobin in red blood cells to produce methemoglobin, a form incapable of transporting oxygen. Death occurs as a result of asphyxiation as methemoglobin levels approach 80%. Nitrate and nitrite poisoning can occur in all animals but cattle are considered most susceptible because of the rapid conversion of nitrate to the more toxic nitrite form by rumen microorganisms.

Clinical Signs

The first indication of nitrate toxicity may be the discovery of one or more dead animals while others may be exhibiting clinical signs. Signs of nitrate poisoning in an animal include weakness; rapid, labored breathing; rapid, weak heart beat; staggering; muscle tremors; and recumbency (inability to stand). Affected animals typically show signs of poisoning within a few hours after consumption of a toxic dose of nitrates. Examination of the mucous membranes, especially the vaginal mucous membranes, may reveal a brownish color. Chocolate-colored blood and a brownish cast to all tissues are hallmark signs of nitrate poisoning. Most deaths occur within the first 6-8 hours after onset of clinical signs and largely depend on the quantity and rate of absorption of nitrite and the amount of stress or exercise the animal is forced to do. After death, nitrate concentration can be accurately measured in the eye fluid. Pregnant cows that survive toxicity will likely abort 3-7 days following recovery from nitrate poisoning.

Treatment

Animals showing signs of nitrate poisoning should be quietly removed from the source of toxicity and a veterinarian should be contacted immediately. Administration of a 2% solution of methylene blue intravenously by the veterinarian will aid in converting methemoglobin back to hemoglobin.

Prevention

- Nitrate fertilizer should be stored where cattle do not have access to it and accidental spills should be cleaned up promptly. Check field pastures closely

after custom applications to make sure "piles" are not left at the edges of the field due to incomplete turnoff of the applicator.

- Avoid grazing warm season grasses fertilized with high amounts of nitrogen (from fertilizer or manure) when growth ceases due to drought, cold damage, hail, or herbicide exposure. Warm season grass stands that have received multiple sources of nitrogen (such as nitrogen fertilizer, manure, previous legume crops) can occasionally show elevated nitrate levels without environmental stress. When in doubt, take the time to send samples for nitrate testing before introducing cattle to the pasture.
- Cool season grasses and small grain pastures that have been heavily fertilized with nitrogen may be high in nitrates during early spring when cool, overcast days retard growth. Test before grazing.
- Corn should be properly ensiled at least 4-6 weeks and tested for nitrates before feeding. Do not green chop forages suspected to be high in nitrates.
- All suspected forages including silage and hay should be tested for nitrate levels. A field test is available to give a quick indication if the forage is potentially dangerous. If the test strip reacts, a forage sample should be sent to a laboratory for an accurate analysis of nitrate and a feeding recommendation. Consult your County Extension Agent for Agriculture for information concerning sampling, sample preparation, field test, and location of a testing laboratory.
- Forage with high nitrate levels can be mixed with forage known to be low in nitrate to reduce the risk from feeding (Table 7-1).
- Feeding low nitrate forage or hay before turning cattle on to high nitrate forages will reduce the amount of nitrate consumed. Splitting grazing times will also allow nitrates to be utilized properly by the rumen microflora.
- Cattle have the ability to increase their tolerance to nitrates in their diet with time. A period of adaptation of at least a week is recommended. To aid in increasing this tolerance, the diet should be sufficient in vitamins and trace minerals.
- A gradual increase in the total energy content of the ration enhances metabolism in the rumen and helps cattle tolerate higher nitrate levels in their diet. This may be in the form of a high carbohydrate feed such as corn that helps microbes convert nitrates to protein.
- Delay harvest of high nitrate forages until nitrate levels are safe. If not feasible to delay harvest, raise the cutter bar to 18" to avoid the base of plants.
- Propionibacterium products are available in bolus or powder form that reportedly reduce nitrate and nitrite levels in the rumen by approximately 40%. These products must be established in the rumen for at least 10 days before allowing cattle to consume high nitrate feedstuffs.

For further information including testing guidelines, see ID-217: *Nitrate Poisoning* at http://www2.ca.uky.edu/agc/pubs/ID/ID217/ID217.pdf.

Cyanide or Prussic Acid Poisoning

Prussic acid, cyanide, or hydrocyanic acid are all terms relating to the same toxic substance. Cyanide is one of the most rapidly acting toxins that affect cattle.

Cause

The cause of cyanide poisoning in ruminants is the ingestion of plants containing cyanogenic glycosides. When plant cells are crushed, chewed, wilted, frozen, chopped or otherwise ruptured, the cyanogenic glycosides and the enzymes that convert them can physically come together and rapidly form free cyanide. As ruminants consume these plant materials, hydrogen cyanide gas is produced in the rumen and rapidly absorbed into the bloodstream. Cyanide prevents hemoglobin in red blood cells from releasing oxygen to the tissues and the animal dies from lack of oxygen.

Cyanide poisoning of livestock is commonly associated with Johnsongrass, sorghum-sudangrass, and other forage sorghums after frost, but poisoning can occur without frost. Choke-cherry or wild cherry, and elderberry are less frequent causes. Young plants, new shoots, and regrowth of plants after cutting often contain the highest levels of cyanogenic glycosides. Leaf blades are higher risk than leaf sheaths or stems, upper leaves are higher risk than older leaves, and seed heads are considered low risk. Hay is rarely hazardous if adequately cured. Ensiling plants will significantly reduce the cyanogenic glycoside content.

Clinical Signs

Cyanide is one of the most potent toxins in nature. Affected animals rarely survive more than 1-2 hours after consuming lethal quantities of cyanogenic plants and usually die within 5-15 minutes of developing clinical signs of poisoning. Signs may include rapid labored breathing, irregular pulse, frothing at the mouth, dilated pupils, muscle tremors, and staggering. The mucous membranes are bright red in color due to oxygen saturation of the hemoglobin. Diagnosis is difficult since cyanide is rapidly lost from animal tissues unless collected within a few hours of death and promptly frozen. Cyanide concentration determinations in suspect plants can be performed if samples are frozen immediately or sent on ice overnight to a diagnostic laboratory.

Treatment

Contact a veterinarian immediately if cyanide poisoning is suspected. The intravenous administration of sodium thiosulfate is an effective treatment for cyanide poisoning. Most animals that live after treatment will recover completely.

Prevention

- Graze sorghum, sorghum crosses, or Johnsongrass plants only when they are at least 18-24 inches tall. Young rapidly growing plants or regrowth have the highest concentrations of cyanogenic glycosides, especially in the newest leaves and tender tips. Do not graze plants with young tillers.
- Do not graze plants during drought periods when growth is severely reduced or the plant is wilted or twisted. Drought increases the chance for cyanide because slowed growth and the inability of the plant to mature favors the formation of cyanogenic compounds in the leaves. Do not graze sorghums after drought until growth has resumed for 4-5 days after rainfall.
- Do not graze potentially hazardous forages when frost is likely (including at night). Frost allows conversion to hydrogen cyanide within the plant. Do

not graze for two weeks after a non-killing (>28 degrees) frost. It is best not to allow ruminants to graze after a light frost as this is an extremely dangerous time and it may be several weeks before the cyanide potential subsides. Do not graze after a killing frost until plant material is completely dry and brown (the toxin is usually dissipated within 72 hours).

- Do not allow access to wild cherry leaves. After storms or before turnout to a new pasture, always check for and remove fallen cherry tree limbs.
- If high cyanide is suspected in forages, do not feed as green chop. If cut for hay, allow to dry completely so the cyanide will volatilize before baling. Make sure hay is completely dry because toxicity can be retained in cool or moist weather. Delay feeding silage 6 to 8 weeks following ensiling.
- Forage species and varieties may be selected for low cyanide potential.
- Test any suspect forages before allowing animal access. A rapid field test is available that can provide on-site results. Contact your county Agricultural Extension Agent for further information.

See ID-220: *Cyanide Poisoning in Ruminants* at http://www2.ca.uky.edu/agc/pubs/ID/ID220/ID220.pdf.

Parasites/Worms

Internal Parasites

Internal parasites are present in most beef herds in Kentucky. The condition is often subclinical and results in hidden losses through reduced gain and feed efficiency in what appear to be healthy cattle. Cattle infected with a heavy load of internal parasites may show many of the following symptoms:

- Diarrhea
- Rough hair coat
- "Bottle jaw," or accumulation of fluid under the jaw
- Poor weight gain
- Unthriftiness

The life cycle of most intestinal and stomach worms works as follows. Mature female worms that live in the gut of animals produce a large number of eggs that pass out of the animal in the manure. The moisture and warmth of the manure pad helps the eggs hatch and develop into larvae. When they reach the infective stage, the larvae of most species move onto the forage where they are ingested by cattle. Once inside the animal, they grow to maturity, and the cycle begins again.

The medium brown stomach worm *(Ostertagia ostertagia)* is different in that the larvae may enter digestive glands in the stomach lining and become inhibited (hibernate) for as long as four months. This period of inactivity generally occurs in the summer and/or winter. The hibernation is a method of survival for the worms because the eggs are not deposited on hot, dry summer pastures or frozen ground where they would die quickly. However, when favorable weather resumes for development of worms on pasture, the larvae become active in the stomach lining. They grow much larger as they develop into adult worms and tear out of the glands, damaging them as they leave. They can emerge gradually or suddenly, causing much harm to the stomach (abomasal) lining.

Several products help control internal worms in cattle. They are in the forms of injectables, pour-ons, drenches, pastes, blocks, crumbles, and feed additives. Select the appropriate product based on management practices and veterinarian's recommendations. Dewormers used during the hot summer and cold winter should be labeled as effective against inhibited (hibernating) *Ostertagia ostertagia* larvae. Albendazole (Valbazen®), doramectin (Dectomax®), eprinomectin (Eprinex®, LongRange®), ivermectin (Ivomec®), moxidectin (Cydectin®), oxfendazole (Synanthic®), or a double dose (10 mg/kg) of fenbendazole (Safe-Guard®, Panacur®) removes the adult and inhibited Ostertagia (Table 7-10).

Most producers deworm their cattle when they have other working procedures scheduled. However, the traditional fall and spring working periods with pregnancy checking or cow-calf vaccination may not always be the best times to deworm as timing for deworming is dependent on the weather, grass growth, and pasture management.

Control of internal parasites should be accompanied by other measures, such as not overstocking pastures, pasture rotation, feed bunk management and sanitation, and an adequate level of nutrition.

Cattle Grubs

Cattle grubs are the immature or larval form of heel flies. These insects can cause losses in two ways. The first is in early summer when the bumble-bee like adult flies buzz around the lower legs of animals in order to glue their eggs to hairs. Cattle run with their tails up (sometimes called "gadding") to avoid the buzzing flight of these large insects. Cattle may injure themselves as they attempt to escape. The second, most obvious damage occurs the following spring when mature grub larvae emerge through nickel-sized

Table 7-10. Efficacy of common anthelmintics against internal parasites of cattle.[1]

Group	Drug	Product	Oster. Adult	Ostertagia Inhibited	Nematodes (Intestinal)	Lung worm	Tapeworm
Benzimidazole	Fenbendazole	Panacur/Safe-Guard	++++	+++	++++	++++	+++
	Oxfendazole	Synanthic	++++	+++	++++	++++	+++
	Albendzole	Valbazen	++++	+++	++++	++++	+++
Imidazole	Levamisole	Levasole, Tramisol	+++	+	++++	+++	-
Pyrimidine	Morantel tartrate	Rumatel	+++	-	++++	-	-
Avermectin	Ivermectin	Ivomec	++++	++++	++++	++++	-
	Eprinomectin	Eprinex, LongRange	++++	++++	++++	++++	-
	Doramectin	Dectomax	++++	++++	++++	++++	
Milbemycin	Moxidectin	Cydectin	++++	++++	++++	++++	-

[1] Adapted from *The Compendium*, April 1997.
+ = relative level of efficacy; - = not effective.

breathing holes cut in the skin along the back. Ultimately, the grub will squeeze out of the hole, drop to the ground to pupate, and emerge a few weeks later as an adult.

Small cattle grubs can be controlled with a systemic insecticide / dewormer applied between mid-July and the end of October. Products for control include pour-on products (Cydectin®, Dectomax®, Eprinex® and Ivomec®) and injectable dewormers (Dectomax® and Ivomec®). Treatments made too late (after November 1, the grub "cutoff date" in Kentucky) can kill large grubs migrating through tissues, producing an adverse reaction in cattle.

External Parasites

Attacks by biting flies, face flies and lice reduce beef producers' profits by lowering weight gains, reducing milk production, and in some cases transmitting pathogens. In addition, animals stressed by severe infestations may be more susceptible to diseases.

Flies

Cattle fly season begins in late spring and continues until early fall. The group includes horn flies, horse flies, and face flies.

Horn flies and horse flies are blood feeders. Horn flies stay on cattle almost continuously, leaving only when disturbed or to lay their eggs in fresh manure, their only breeding site. These flies sit on the shoulders, backs, and sides of cattle. Each one takes 20 to 30 small blood meals a day. Spring calves are most susceptible to attack. At the end of the summer, unprotected animals may be 12 to 20 pounds lighter than those on which horn flies are controlled. Losses occur when horn fly numbers exceed 100 per side.

Several species of horse flies can feed on pastured cattle. They breed in damp soil so problems are greatest around wet or wooded areas. It is difficult to protect animals from horse flies because they spend only a few minutes feeding. The flies are seldom on cattle long enough to be affected by an insecticide. Attempts of horse flies to feed are often interrupted because of their painful bite. These insects often have to visit several animals to get a complete meal; this increase the chances of them transferring blood-borne diseases such as anaplasmosis if there are infected animals in a herd or nearby.

Face flies have abrasive sponging mouthparts that they use to blot up tears from around an animal's eyes. Their feeding is very annoying; however, face flies also can spread the bacteria that cause pinkeye within a herd or to nearby herds. Face flies, which only breed in fresh cattle manure, only spend a few moments on animals and are easily disturbed. As with horse flies, this makes control difficult.

Insecticides can be applied to cattle by ear tags, dust bags, oilers, pour-ons, sprays, or in mineral or feed to treat manure. Each method has advantages and disadvantages. Insecticide-impregnated ear tags can provide excellent long term horn fly control and can suppress face fly numbers. In general, two ear tags per head gives better face fly protection than one. Apply tags in late May or early June when the horn fly population reaches 100 per side. Remove tags in September/October. Pour-ons or animals sprays give 2 to 3 weeks of protection and must be repeated as needed. Forced-use dust bags can keep the face treated to protect against face flies and also work well against horn flies. Follow directions for the application amount and timing and meat withdrawal time, and discard empty containers properly.

Horn flies can become resistant to some groups of insecticide if used for several consecutive years. The main groups are synthetic pyrethroids (P), organophosphates (OP), and abamectins. Alternate the insecticide type (P or OP) and/or methods of control to eliminate insecticide-resistant populations of flies.

Lice

Feeding and annoyance from biting and sucking lice can be costly. They can cause weight loss and general lack of thriftiness in cattle during the winter. Stress from heavy infestations can mean loss of body condition, increased susceptibility to or slow recovery from diseases, or just generally poor performance. Blood loss from feeding by large numbers of sucking lice can cause anemia. Biting lice use their chewing mouthparts to feed on dead skin, hair, and skin secretions. These very active lice irritate animals as they continually move over the skin to feed. The combined stress of lice with intestinal worms, or other conditions, can multiply losses.

Biting and sucking lice can spread quickly throughout a herd from a few infested animals. Infestations can result from new additions to the herd, cross fence mixing, or survival of lice over the summer on a few susceptible animals. Lice are most numerous, and usually present on more animals in the herd, during the winter. They thrive when temperatures are cold, cattle have longer coats, and their skin is less oily. Inadequate nutrition, compromised immune response, and shorter day lengths also can favor lice buildups.

Excessive rubbing, loss of hair clumps, and raw spots from constant grooming or scratching can mean lice. However, other possible causes include ringworm, dietary deficiencies, or mange. Careful examination of symptomatic animals for nits (louse eggs attached to hairs) or lice will help to diagnose infestations.

Lice can be controlled in the winter with pour-on or spot-on insecticides. Do not use systemic dewormers on cattle that were not treated in the fall for cattle grubs or if their treatment history is not known because these can cause adverse reactions if grubs are migrating in animals. Treat all animals in the herd for lice to prevent reinfestation from untreated cattle. Apply a second treatment 14 to 21 days later to kill lice that have hatched from eggs after the first application.

Administering Drugs to Cattle

No matter which method used to administer drugs, always use proper animal restraint to do a good job. Since most drugs are relatively expensive, take time to do the job right. If administration technique is sloppy, the biggest loss will be lack of response to the drug.

Injections are probably the most common method of administering drugs. Drugs that are injected act rapidly, are used efficiently, and may act longer than those given orally or applied topically. For the best results, take care to properly prepare the injection site, equipment, and product.

There are three types of hypodermic syringes: plastic disposable, metal pistol-grip reusable, and plastic pistol-grip disposable. Be sure to keep extras in case of breakage or malfunction. Convenient sizes to have available are 5, 10, and 20 cc. [*Note:* Milliliter (ml) and cubic centimeter (cc) are the same volume; that is, 1 ml =1

cc.] Larger sizes (for example 60 cc) can be used in administering large doses or for multiple doses (similar to pistol-grip syringes). When loading the syringe, pull back the plunger and fill with an amount of air equal to the drug to be put in the syringe. Inject the air into the bottle and withdraw the drug. Hypodermic needles also come in many lengths and sizes; remember that the diameter becomes smaller as the gauge number gets larger (for example, 14-gauge is larger in diameter than 22-gauge). Consider both length and gauge when you prepare to give various types of injections. Generally, 16- and 18-gauge needles are required for most injections. Smaller-diameter needles may not allow thick liquids to flow easily and may bend. Larger diameter needles make a large hole and may allow the product to flow back out. Needles are available with plastic or aluminum hubs; aluminum hubs are recommended for cattle because they do not easily break.

Dart guns used to administer medications to sick cattle in the pasture have become increasingly popular in the past few years. It is often easier, faster and less stressful to medicate an animal with a dart rather than having to get it up from a remote field to work through the chute. However, there are associated risks with remote drug delivery (RDD) to animal health, animal welfare, human safety, and the safety and quality of the food products produced from dart-treated animals. In situations where darts are used, producers should still comply with the National BQA Guidelines for injections including using the correct route of administration, needle selection, medication selection and volume, as well as meeting all record keeping requirements to properly observe withdrawal times.

Types of Injections

The most commonly used types of injections are subcutaneous (SQ), intramuscular (IM), and intravenous (IV).

Subcutaneous Injections

Subcutaneous injections (SQ) are made just under the skin but not into the muscle tissue. The side of the neck is the area to make injections in cattle. To properly administer the injection, lift the skin with your free hand, and insert the needle into the raised fold of skin at the base of the tent (Figure 7-2). Needles of 16- to 18-gauge and 5/8- to 1-inch are usually used. Do not give more than 10 cc at a single injection site. Separate injection sites by at least 5 inches. SQ is always the preferred route to use when a product can be given either SQ or IM.

A few new vaccines are now available in a pellet form delivered subcutaneously. Each pelleted implant dose contains a combination of immediate release (IR) and programmed release (PR) antigen pellets, and includes the antigen equivalent of two doses of vaccine but administered at one time.

Intramuscular Injections

Intramuscular (IM) injections are made directly into muscle tissue, generally with a 1- to 1½-inch needle. Do not inject more than 10 cc at an injection site. Too much drug in one area can cause muscle damage and reduce uptake. IM injections should be given in the triangle area in the neck. Recent beef audits indicate that injections should be made about 3 inches in front of the shoulder blade to avoid the infraspinatus (flatiron) muscle. Never make injections in the rump (see figures 7-3 and 7-4 for proper injection sites).

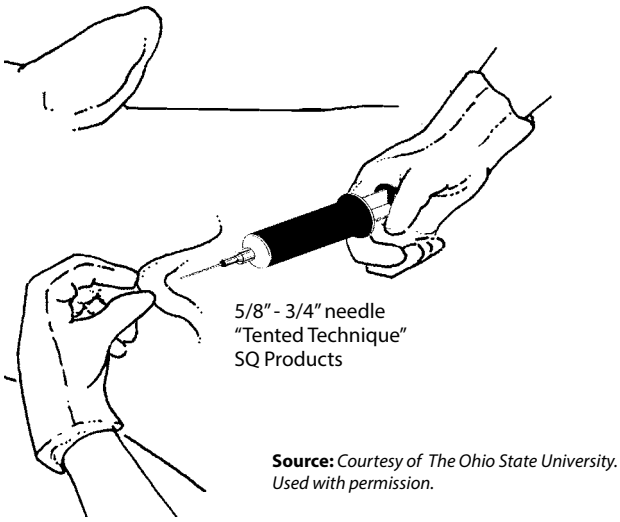


Figure 7-2. Proper subcutaneous (SQ) injection technique.

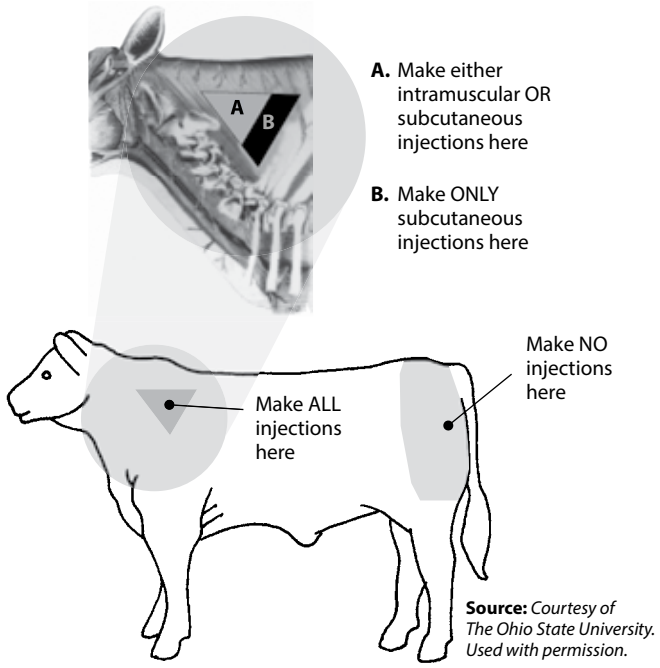


Figure 7-3. Proper injection sites.

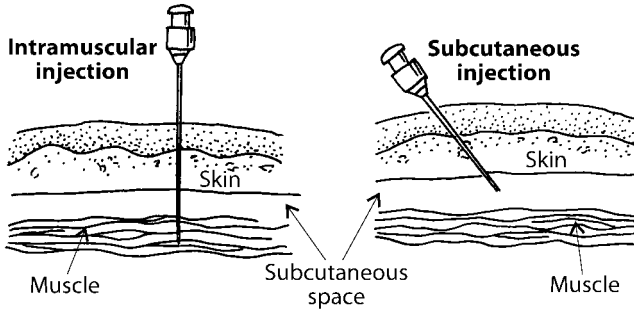


Figure 7-4. Illustration of intramuscular or subcutaneous injections.

Intravenous Injections

Intravenous injections (IV) are useful when a large volume must be given (for example, when treating milk fever or grass tetany), when the drug must not be deposited outside the vein, or when rapid treatment is necessary. These injections are made directly into a blood vessel, usually the jugular vein. Because some knowledge of anatomy and experience is needed, intravenous injections should be performed only by an experienced person following recommendations and instructions by a veterinarian.

An injection site can be found on the side of the animal's neck by placing the thumb or forefinger of your free hand firmly onto the area where the jugular vein is located. The vein should bulge between your thumb and the animal's head so that it can be seen and felt. The needle must be sharp and inserted with a quick thrust to hit the vein. Do not stick the needle in until you can see the vein.

Intranasal Administration

Intranasal refers to inside the nostril; drugs administered intranasally (such as the intranasal IBR/PI-3 vaccines) are "squirted" inside the nostril using a special plastic applicator tip. Only a small amount of the product needs to come in contact with the mucous membranes to cause the animal to develop immunity. Expect a small amount of vaccine to flow out of the nostril after administration. Intranasal vaccines do not have a long duration of immunity (average is approximately 1-2 months of coverage).

Precautions

When using injectable drugs:

- Never exceed the recommended volume per injection site. This could cause:
  - » Tissue damage, soreness
  - » Extended withdrawal times due to altered absorption
  - » Increased possibility of "leakage" of the product
- Never use a needle on an animal and then insert it back into the bottle. Have a clean needle to use in the bottle for withdrawing the drug.
- Always take plenty of time, handle drugs properly, and make injections correctly.

Adverse reactions (anaphylactic shock or allergic) can occur, especially to "Gram negative" bacterial vaccines (examples: *E. coli, Histophilus somni,* leptospirosis, pinkeye, Pasteurella/Mannheimia, and Vibrio). These are more likely to occur during hot weather or when given at the same time as a vitamin A and D injection. Epinephrine (available by prescription only) should always be available to treat cases in an emergency.

Administering Drugs Orally

Another method to administer drugs is orally. In this case, the product is either fed to a group of animals or given directly to an individual animal through the mouth. Balling guns are used to give boluses, capsules, and tablets. Drenching equipment is used to give liquid to cattle. Feeding of drugs requires that all animals eat an adequate amount to be effective. Therefore, the product must be palatable, and adequate feeding space must be allowed so that all animals eat the proper amount in the required time. The use of medically important antimicrobials in feed is under veterinary oversight. This was accomplished by changing previously labeled over-the counter (OTC) drugs used in feeds to Veterinary Feed Directive (VFD) drugs. VFD drugs are defined by FDA as "drugs intended for use in or on animal feed which are limited to use under the professional supervision of a licensed veterinarian". This means for a producer to obtain a feed or mineral containing a VFD drug (for example-chlortetracycline in medicated mineral), a veterinarian must write a VFD order (similar to a prescription) for the feed mill to fill according to the drug label.

Beef Quality Assurance Issues

- **Injection technique:** Use 5/8-inch or 3/4-inch 16- or 18-gauge needles for subcutaneous injections (SQ). For IM injections, use 16- or 18-gauge needles 1-inch long for calves and 1.5 inches for cows. Make sure needles are sharp, and discard in an appropriate container when needles become dull, bent, or burred. All injections should be in front of the shoulder blade. Follow label directions carefully and consult a veterinarian if in doubt. Always use SQ products when available. Do not inject more than 10 ml (cc) of an antibiotic in one site.
- **Injection equipment:** Disposable syringes and needles are recommended. Any disinfectants, including alcohol, should not be used as they will neutralize vaccines (especially modified-live) and will chemically react with some antibiotics.
- **Drug residue avoidance:** Observe label directions and withdrawal times carefully. If dosages are increased (extra-label drug use), withdrawal times are significantly increased as well. When using drugs in any manner differently than stated on the label, this must be under the order of a licensed veterinarian. Never use a veterinary drug in an extra-label manner without consulting a veterinarian. Doing this without direction by a licensed veterinarian is illegal. Some drugs (chloramphenicol, diethylstilbesterol, clenbuterol, furacin spray, and others) are illegal and cannot be used in food animals with no exceptions.
- **Drug and vaccine storage: Store vaccines under refrigeration as soon as purchased.** Note the expiration date and discard outdated and leftover product. Use a transfer needle to reconstitute vaccines.
- **Records:** Careful records should be kept for all treatments and vaccinations. The records should include the group of cattle vaccinated, date, product used, dosage, route of administration, injection area, and withdrawal date.

See the publication, ID-140: *Kentucky Beef Quality Assurance Program* at http://www2.ca.uky.edu/agcomm/pubs/id/id140/id140.pdf for more specific information.

Biosecurity Protection

Biosecurity management practices are designed to reduce or prevent the spread and movement of infectious diseases on to an operation and among the cattle. Biosecurity can be very difficult to maintain because the interrelationship between management, biologic organisms, and vectors (dogs, cats, rodents, biting flies, birds, wildlife, etc.) is complex. Although developing and maintaining biosecurity may be difficult, it is the most effective means of disease control available. No disease prevention program will work without it.

A biosecurity plan has three major components: traffic control, isolation, and sanitation.

Traffic Control

To protect the food supply, many feedlots, meat packers, and food processors have restricted access to their facilities and increased security. Livestock producers should consider restricting access to their property and remain vigilant to protect the nation's food supply. Check livestock regularly, and immediately report signs of disease or anything out of the ordinary to a veterinarian. The following signs that could be symptoms of different, serious diseases:

- Sudden, unexplained death loss in the herd
- Severe illness affecting a high percentage of animals
- Blisters appearing around an animal's mouth, nose, teats, or hooves
- Large numbers of animals suddenly going off feed

Isolation/Quarantine

Isolation prevents contact between animals within a controlled environment. The most important step in disease control is to minimize commingling and movement of cattle. This includes isolation of new purchases for at least two weeks and preferably four if possible. Isolate sick cattle and return them to their original group when they have recovered.

Sanitation

Good sanitation reduces exposure to infectious agents. Do not use instruments and equipment on healthy animals following their use on sick or infected animals without thorough disinfection. Be aware when working sick animals, and try to work healthy animals prior to sick animals if possible. Rodents and other wildlife are capable of carrying diseases within a herd. Keep feeding areas clean, and keep feed in enclosed bins or containers to reduce contamination. Place dead animals in a location that allows rendering trucks access without coming into contact with healthy cattle.

Minimum Biosecurity Measures

- Maintain a visitor book. Visitors should avoid livestock areas, pens, and barns unless it is necessary. Allow no entry to your farm if visitors have been exposed to the foot and mouth disease virus (or any foreign animal disease) within the past five days.
- Offer boots to all visitors. Disinfect shoes or boots on arrival if disposable boots are not used. Wear clean, disinfected boots when visiting other farms and stockyards.
- Isolate all new animal additions by at least 300 yards from your herd for 14-21 days. Test and/or vaccinate before they enter the herd.
- Remove and promptly dispose of dead animals (have removed, bury, or compost).
- Report all suspicious activity and events to local authorities.
- Control rodents and wildlife, especially in the feed areas.

Identification of Cattle

Animal identification is important in beef cattle herds for effective record keeping, performance testing, and artificial insemination, as well as routine observations. The three most common methods of identification are ear tagging, tattooing, and branding.

Regardless of the method used, a numbering scheme must be decided on for meaningful records. Each animal should have a unique number. Herd size determines how many digits are necessary, but each digit should have some meaning.

In a four-character number, this is a common scheme: the first number or letter denotes the year of birth; the second character identifies the sire or breed crossed; and the last two numbers are the order of birth. Or a letter can be used to denote the year of birth using the international year/letter designation (see Table 7-11).

For example, the tattoo "5 2 14," read from the left, could be:

5 = 2005 birth year
2 = sire No. 2
14 =14th calf born in 2005

Or the calf could be tattooed R214 and have the same meaning.

Ear Tagging

Ear tagging is probably the most common method of identification. It is not permanent because tags are frequently lost. Ear tags are best used in combination with a permanent form of identification, such as a tattoo or brand. Pre-numbered tags are available or, if numbering, be sure to use ink that will bond to the tag, and allow adequate time for it to dry.

Table 7-11. International year/letter designations.

Year	Letter	Year	Letter*
2014	B	2021	J
2015	C	2022	K
2016	D	2023	L
2017	E	2024	M
2018	F	2025	N
2019	G	2026	P
2020	H	2027	R

* This system skips the letters I, O, Q, and V.

Step-by-step procedure for ear tagging:

1. Select the tag and numbering system to be used.
2. Number plastic ear tags with a marking fluid or ink that bonds to the ear tag.
3. Insert the ear tag into the appropriate applicator. When two-part tags are used, be sure they line up correctly and that you are using the correct pin in the tagger for the type of tag.
4. Select the tagging site on the ear. Place one-piece plastic tags between the cartilage ribs, approximately one-half the distance from the base to the tip of the ear. You may place two-piece tags between the cartilage ribs or below the ribs. Place metal tags into the top of the ear near the ear's base.
5. Insert the ear tag. Apply the two-part tag with the plier-type applicator by squeezing the handles until the ear tag snaps together. Metal types are applied in the same manner. The knife-like applicators (for one-piece tags) are forced through the ear using extreme care. Be sure the knife is turned so that the tag hangs straight down or at an angle away from the base of the ear.
6. Keep instruments clean and disinfected to prevent infection.

Tattooing

Tattooing is a permanent means of identification, but it cannot be read from a distance.

Most purebred organizations require that animals be tattooed in one or both ears before registration. The tattooing

Table 7-12. Growth-promoting implant products available for utilization in beef cattle.

Product Name	Suckling Calves	Weight Restriction	Age Restriction	Grazing	Steers	Heifers	Replace-ment Heifers	Back-grounding Confined	Feedlot Confined	Approx. Effective Days
Ralgro	X		> 30 d	X	X	X	X	X	X	70-100
Revalor H						X		X	X	100-140
Revalor S					X			X	X	100-140
Revalor G				X	X	X		X	X	100-140
Revalor IS					X			X	X	100-140
Revalor IH						X		X	X	100-140
Revalor 200					X	X			X	100-140
Revalor XS					X				X	200
Revalor XH						X			X	200
Finaplix-H			63 d preharvest			X			X	60-100
Synovex S		> 400			X			X	X	80-120
Synovex H		> 400				X		X	X	80-120
Synovex C	X	< 400 Suckling	> 45 d	X	X	X	X	X	X	100-120
Synovex Choice					X	X			X	100-140
Synovex Plus					X	X			X	100-140
Synovex One Feedlot					X	X			x	200
Synovex One Grass					X	X		X	x	200
Component E-C w/Tylan	X	< 400 Suckling	> 45 d	X	X	X	X	X	X	100-140
Component E-H w/Tylan		> 400				X		X	X	120
Component TE-IH w/Tylan						X			X	120
Component TE-H w/Tylan						X			X	120
Component E-S w/Tylan		> 400			X			X	X	100-140
Component TE-IS w/Tylan					X				X	120
Component TE-S w/Tylan					X				X	80-90
Component TE-200 w/Tylan					X	X			X	80-90
Component TE-G w/Tylan				X	X	X		X	X	100-140
Compudose	X Steers			X Steers	X	X		X	X	170-200
Encore	X Steers			X Steers	X	X		X Steers	X	400

Note: Information summarized from product labels. Please read and follow label recommendations when using these and any other products.

instrument consists of a pliers-type device with numbers and/or letters. These numbers or letters are made of needle-like projections that pierce into the ear when the handles of the tattoo instrument are squeezed together. An indelible ink is then rubbed into the small punctures. After healing, the tattoo is permanent.

Step-by-step procedure for tattooing:

1. Restrain the animal.
2. Locate the area of the ear to tattoo. Two ribs of cartilage divide the ear into top, middle, and lower thirds. Place the tattoo in the top of the ear just above the cartilage rib. It is generally best not to tattoo between the two cartilage ribs as this area is frequently used for ear tags. Also, the area between the two ribs on the right ear of heifers is reserved for Brucellosis vaccination tattoos.
3. Clean the inside of the ear where the tattoo is to be placed with a cloth soaked in alcohol.
4. Position the tattooing instrument so that the numbers are in the proper position. Squeeze the handles together completely and quickly.
5. Rub tattoo ink into all needle marks. Apply the ink with a roll-on applicator, or rub it in with the thumb or an old toothbrush.

Freeze Branding

Brands used for individual animal identification usually consist of three or four numbers. The most common location of brands is the hip. Brands can be applied easily to these locations when animals are restrained in a squeeze chute. Each character is generally 3 or 4 inches high. Numbers that are 3 inches are generally used on young cattle; 4-inch numbers are used on mature cattle.

Freeze-branding of cattle with super-chilled irons (copper or copper alloy) is considered more humane than hot-branding, with less damage to the hide. When applied properly, the cold brand destroys the color-producing cells in the hide, and the hair grows out white. The visibility of these brands is much better on black or dark-colored cattle and not as good on white or light-colored cattle.

Freeze branding frequently gives inconsistent results, especially when using liquid nitrogen as the coolant. Liquid nitrogen is readily available, but dry ice and alcohol give more consistent results. The most critical steps are: (1) using dry ice and alcohol, (2) allowing adequate time for the irons to chill prior to use, (3) allowing adequate time for irons to re-chill after each application,

(4) using a liberal amount of alcohol on the brand site, (5) proper application time, and (6) not branding on a rainy day (or windy day, if possible).

If the following steps are carefully applied, the brands should be very legible. Brands should appear in about two months.

- Line up supplies ahead of time:
  - » Dry ice (50 hd. = 50 lb. ice and 2½ gal. of alcohol)
  - » Alcohol (denatured, 95 to 99%)
  - » Styrofoam cooler(s)
  - » Spray or squirt bottles
  - » Clippers, extra blades (these do not have to be surgical)
  - » Brush
  - » Time clock
  - » Branding irons (copper)
- Put irons in Styrofoam cooler(s), cover the head of the irons with alcohol, then add chunks of dry ice.
- Wait until frost creeps up the shaft of the iron (around 10 minutes).
- Put cattle in the chute.
- Brush and clip the brand site.
- Saturate the brand site with alcohol.
- Apply branding iron firmly for 45 seconds. Tap the fresh brand with your fingernail; it should feel as if you are pecking on wood or pipe.
- Return iron to the cooler. Do not reuse an iron until the iron has been re-chilled for at least a minute.
- Put alcohol on brand site again before doing the next number/letter. Then repeat branding.

The calf usually jumps and squirms for the first 10 seconds after the brander is applied to the hide. The reason for this is that the extreme cold activates the nerve endings. After about 10 seconds, the nerve endings are frozen and inactivated, and the animal usually stops moving. You should be ready for this and keep the brander in the same position the entire time to ensure a good, clear freeze brand.

Branding is used for two basic reasons: to establish ownership of an animal and to identify an individual animal. Like many states, Kentucky registers ownership brands through the Department of Agriculture. The use of a registered ownership brand discourages cattle rustling and serves as the cattle owner's trademark.

Implants for Beef Calves

Utilization of growth-promoting implants in the beef cattle industry provides an opportunity for improving production efficiency. These products have been extensively studied for safety and efficacy. Growth-promoting implants promote protein synthesis, resulting in a 10% to 30% increase in growth along with a 5% to 10% improvement in feed efficiency. These products mimic naturally occurring compounds produced by the animal. There is no meat withdrawal time for any implants.

There are a number of growth-promoting implant products available on the market (Table 7-12). Products are often categorized based upon type of compound contained and whether or not it is in combination with a testosterone or equivalent product. Table 7-12 contains a listing of available products, compounds, and concentrations as well as projected payout period. When choosing a product, consider the sex of the animal to be implanted and the duration of ownership. Always read the label before using the product to ensure the appropriate use. To date, no implants are approved for use in calves intended for the production of veal. As a general recommendation, male calves should be implanted when they are castrated. Do not implant bull calves that you intend to save for breeding. The more aggressive the implanting program (higher potency, i.e., suckling calf < stocker cattle < feedlot), the greater the effect is on carcass marbling score and carcass maturity. As the implanting program becomes more aggressive, seeking to increase liveweight gain and feed efficiency in the feedyard, marbling score decreases. As marbling score decreases, quality grade will also decrease. Two important considerations for deciding which implant program to use in the feedyard are how cattle are to be sold (on the rail based on carcass grade and yield or live on pen average) and the spread between Select and Choice.

Step-by-step procedure for administering implants:

1. Properly restrain the animal. When implanting, head restraint is most important for proper implant placement. Implant cradles or nose bars on chutes greatly aid in limiting head movement.
2. Determine which ear to implant, and adjust the implant instrument so the needle can be positioned next to and parallel to the ear, with the slant side of the needle facing outward. Implant all calves in the same ear.
3. Select the proper implant site on the back of the ear. The implant will be placed between the skin and cartilage in the middle third of the ear.
4. Clean the needle and implant site with disinfectant to reduce contamination of the needle wound; lay the implant gun on a paint tray so that the needle will rest on a sponge with disinfectant solution (diluted chlorhexidine mixed at recommended dilution rate).
5. Cattle that have manure- and/or dirt-covered ears should have the back of the ear lightly scrubbed with a brush and disinfectant. Wipe the back of the ear dry with a clean paper towel or cloth before inserting the needle to reduce the risk of introducing foreign material and pathogens.
6. Grasp the ear with one hand while the other hand positions the instrument parallel to and nearly flush with the ear. Put the point of the needle against the ear with the beveled part facing up.
7. Use the tip of the needle to prick the skin, lift slightly, and completely insert the needle under the skin. Little resistance should be felt as the needle slides under the skin. Moderate resistance or too steep of an angle likely means the needle is going into the cartilage of the ear and not the preferred location. When inserting the needle, avoid piercing the large ear veins.
8. Do not crush the implant while administering it. To avoid crushing implants, slowly retract the needle as pressure is applied to the trigger if the gun does not have a self-retracting needle. Crushed or improperly administered implants can increase the risk to riding activity or "bulling."
9. Depress the plunger of the implant gun, and withdraw the needle with the plunger still depressed.
10. Feel the ear to ensure that the implant has been deposited in the proper location. Improperly placed implants reduce your return on your investment. Never sacrifice implant technique for speed.

For more information, see ASC-25: *Growth-Promoting Implants for Beef Cattle* at http://www2.ca.uky.edu/agc/pubs/asc/asc25/asc25.pdf.

Precautions

Common implant administration mistakes include:

- Implant is improperly placed. Do not allow the needle to gouge or pierce through the cartilage. If resistance is felt when inserting the needle, it is quite probable that the cartilage has been gouged, and pellets may be covered with scar tissue and "walled off," resulting in poor drug absorption and decreased expected gain.
- Needle pierces through the other side of the ear due to the needle angle being too steep at entry.
- Poor sanitation results in an abscess.
- Implant is crushed or misaligned.
- All implants come with instructions for implanting and proper handling. Review all instructions carefully before implanting.

Castration of Bull Calves

Castration is the removal or destruction of the testicles of a bull by surgical or nonsurgical methods. The castrated male calf is then referred to as a steer. Steers are preferred in the marketplace and bring more per pound than bull calves because they have a better disposition and their meat is preferred over that from bulls. Implanted steer calves weigh as much at weaning as bull calves.

Bull calves should be castrated as soon after birth as possible. It is best to allow time for the calf to nurse and to bond with the dam before doing any procedures. In some herds, it is not easy or practical to castrate early because herd sire prospects will not be selected until weaning. However, older and heavier bulls generally bleed more and gain weight much more slowly after castration.

- **Do** castrate/dehorn as young as possible.
- **Do** castrate/dehorn in cool weather to avoid flies and heat stress.
- **Do not** castrate/dehorn in extremely hot weather.
- **Do not** castrate/dehorn at weaning because the procedure increases stress at an already stressful time.
- **Do** keep calves in a clean environment after castration because of increased chance of infection.

There are several methods of castration. All of the methods accomplish successful removal of the testicles if done properly; seek professional advice from a veterinarian before attempting any of the procedures described below.

Knife castration is the most common method used. Two variations are generally used: cutting off the lower third of the scrotum or slitting down both sides of the scrotum. A scalpel blade works well for making the incision. However, specially designed castration knives are available, such as the Newberry® knife, which cuts on both sides of the scrotum at once.

Make castration the last step in processing the calf. When the calves are released from the chute, they should be able to go to a clean, dry area to lie down. Clean hands help to prevent introducing infection. Stretch the scrotum tightly and cut off the bottom one-third of the scrotum or use a Newberry knife to cut down the sides of the scrotum to gain access to the testicles. Frequently after the scrotum is opened, the testicles will be drawn up high into the neck of the scrotum. To find the spermatic cords, one testicle can be held and pulled down while the scrotum is pushed up with the other hand. A second technique is referred to as "milking." Both testicles are held, and one is pushed forward (not upward) while the other is pulled back. Reverse the process until some of the tissue holding the spermatic cords is broken down. Do not place hands inside the scrotum as this can lead to infection. Sever the spermatic cord as high as possible by physically pulling, scraping with the knife blade, using an emasculator that crushes as it cuts, or using a Henderson castrating tool with a standard 3/8-inch variable-speed cordless drill. Once both testicles are removed, apply an effective fly repellent if needed.

The bloodless emasculatome (Burdizzo®) is one method of nonsurgical castration for use in a muddy or wet environment. It can be used at any time of year without concern for an open wound. "Clamped" bull calves frequently become stags (exhibiting some of the physical characteristics of a bull) if the procedure is not properly executed. Clamping is best accomplished with the calf standing and a tail-hold applied (grasp the tail near the base and bend it sharply upward and over the back toward the calf's head). Be sure the emasculatome closes properly. Each cord should be crushed separately. Position one cord against the outside of the scrotum then clamp approximately 2 inches above the testicle. It is good practice to clamp each cord twice. Repeat the procedure on the other cord, making sure to leave the middle (septum) unclamped for adequate circulation to the scrotum. If you clamp all the way across (including the septum), the scrotum can slough off and expose the testicles. The crushing of the cord should make the testicle atrophy and become nonfunctional.

Several other methods are available for nonsurgical or bloodless castration. Elastrator bands are applied to the neck of the scrotum above the testicles at as young an age as possible. The elastrator band is placed on the instrument and opened. Both testicles must be drawn down through the open band and held there while the band is released. The band is closed on the neck of the scrotum. This cuts off blood circulation to the testicles and scrotum. The tissue dies, dries up, and eventually drops off. There are several potential problems with this method. It is easy to leave a testicle in the body cavity or not place the band high enough so that male hormones are still being produced, resulting in stag behavior and decreased carcass value when finished. Tetanus may occur, so a tetanus toxoid vaccine should be given in advance of castration or tetanus antitoxin when applying the band. When the bands are old or have been improperly stored, they may not be effective in cutting off the circulation.

Additional bloodless methods involve using the Callicrate Bander™, California Bander® or EZE bloodless castrator. These items are similar and have their best use on older, larger bulls. All three methods use elastic tubing that is drawn very tightly around the scrotum above the testicles. When using the EZE castrator or the California Bander, a metal clip is placed on the tubing to pinch it off and hold it in place after drawing tight. The Callicrate Bander uses preformed loops of solid core tubing with the clips attached. The testicles are placed through the open tubing, and it is ratcheted tight

against the scrotum. The entire scrotum will usually fall off in three to four weeks. Complications with these methods include tetanus and the possibility of a large infected, painful, scrotum if the tubing is not drawn tightly enough. Tetanus toxoid vaccine should be given before or tetanus antitoxin at the time of castration (consult a veterinarian for clarification) when using any of these instruments.

Remember, castration should be done as early as possible in the calf's life. This will create less stress on the calf and reduce the possibility of complications.

Estimating Age of Cattle by Their Teeth

Decisions on purchasing or culling commercial cattle are easier when age is known. However, if unknown how old an animal is, it is sometimes possible to estimate its age by appearance of the teeth.

Only the front teeth (incisors) are important in calculating age (cattle have no upper incisors—see Figure 7-5). The eight incisors (four pairs) on the lower jaw appear at different times and exhibit varying degrees of wear depending on age, genetics, and diet. By the time a calf is about a month old, it has eight temporary incisors. These temporary teeth are shed and replaced by permanent teeth, in pairs. The first pair is the two central incisors in front. The second pair is the two teeth on either side of them, and so on for the third and fourth pairs.

At 18 to 20 months of age, the first permanent incisor tooth appears. By 25-26 months, the center incisors are fully erupted and in line. The following pattern of growth and wear appears at two years of age and above:

- 2 years: The central permanent incisors attain full development.
- 2½ years: The second set of incisors is cut. They are fully developed by age 3. The U.S. Food Safety and Inspection Service (FSIS) will call a calf 30 months of age if the second set has erupted.
- 3-3½ years: The third set of incisors is cut. They are fully developed and begin to wear at age 4.
- 3.5-4 years: The fourth set (corner teeth) is replaced. By age 5, they are fully developed.

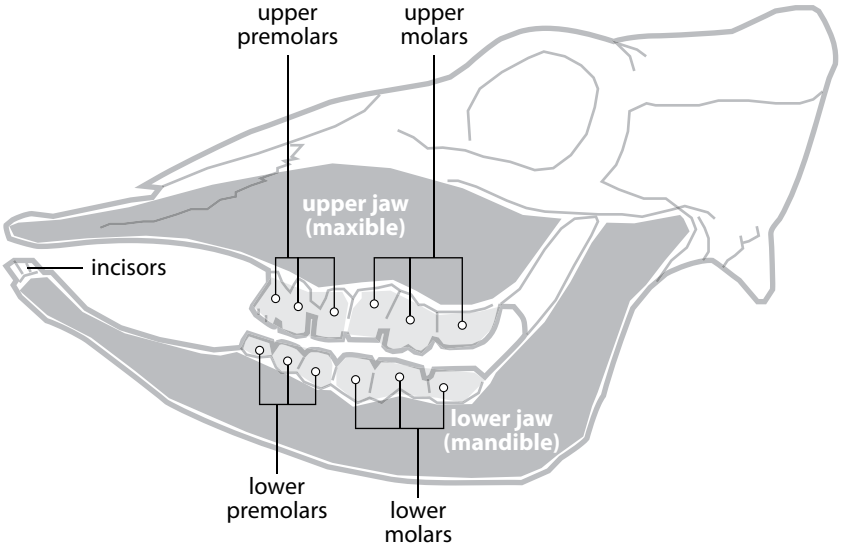
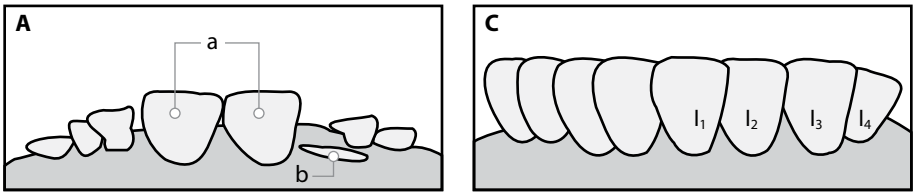


Figure 7-5. Cattle have no upper incisors, only lower.

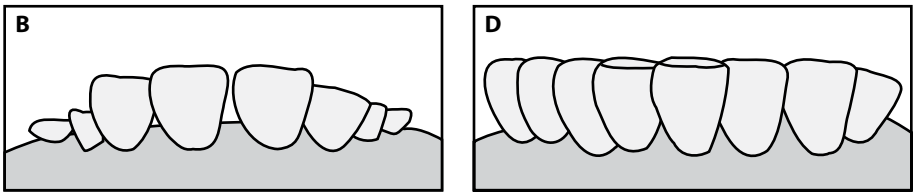
Age determination past 4½ years is less accurate and is mainly related to wear on the surface of the eight incisor teeth. The amount of wear also depends on the diet of the animal. Generally, the center pair begins to show wear at age 5, the second pair at age 6, the third pair at age 7, and the corners at age 8. The teeth begin to take on a "pegged" appearance at age 8-9 years; that is, the gum begins to recede from the base of the teeth. If looking at the teeth from above ("dorsally"), the teeth appear round and have lost the "spatula" or scoop shape. By the tenth to twelfth year, the teeth show progressive wearing to stubs. The animal may then become "smooth-mouthed," when the teeth are worn to the gums, or "broken-mouthed," when some teeth are lost. The food safety inspection service (FSIS) branch of USDA published an excellent guide to using dentition (teeth) to age cattle under the bovine spongiform encephalopathy (BSE or "mad cow disease") information tab. The link to the publication is: https://www.fsis.usda.gov/OFO/TSC/bse_information.htm.

Figure 7-6.



a. Permanent incisors. b. Erupting third permanent incisor, top of tooth **not** above gum line, animal less than 30 months of age.

Full set of permanent incisors, animal over 48 months of age.



Two sets of permanent incisors (with top corners of the second set above the gum line), animal 30 months of age or older.

Age 72 months, central incisors showing wear and leveled tops.

Adapted from *Guidelines For Age Verification In Cattle,* Hernan Ortegon, Alberta Agriculture and Rural Development, 2013

Dehorning Calves

Buyers of feeder calves prefer calves without horns. Dehorning reduces the possibility of injury and bruising of animals. Hornless cattle require less space at the feed bunk and in transit. Horned animals are more difficult to catch in a headgate and more likely to injure the handler or other cattle during processing.

It is best to dehorn animals as early as possible to minimize stress, preferably at less than two months of age. As calves get older, the process causes more trauma, more bleeding, and an increased chance of infection. When calves have matured enough to have a "horn" sinus, cutting the horn out leaves an open hole into the sinuses of the head. It is best to dehorn early when little or no cutting is required. It is also recommended not to dehorn cattle by a method requiring cutting during either the fly season or extremely cold weather. Maggots can be a problem during hot weather, and the exposed sinuses can lead to respiratory problems during extremely cold weather.

Calves can be dehorned genetically with the use of polled animals in the breeding herd. If calves are born with horns, however, dehorn them as early and humanely as possible, using one of the following methods along with local anesthesia to numb the site.

Spoon, or tube dehorning works on horn buttons or small horns just emerging. These tools separate the horn from the adjoining tissue with very little bleeding. Clean the area around the horn with a disinfectant. The cut should be made around the base of the horn to include about ⅛ inch of skin and should be about ¼ to ½ inch deep. After removing the horn, apply an antiseptic and insect repellent if needed.

An electric dehorner is an excellent tool for removing horns from calves of any age when the horn is still small. Most electric dehorners have cupped ends of different sizes that are placed over the horn. Select the "cup" that fits best over the base of the horn, and hold it on long enough to destroy the ring of growth cells around the base of the horn. The skin will look copper- or bronze-colored when completed. The horn or button can then be knocked off with the hot iron, or it will drop off in a few weeks.

Barnes-type dehorners may be necessary if dehorning is delayed until weaning. The instrument should fit over the horn and include a ring of skin and hair. The dehorners are available in calf and yearling sizes. The older the calf, the greater the potential for complications with this method. Close the handles to fit the blades around the base of the horn. To remove the horn, spread the Barnes handles open and twist while applying considerable pressure. A hot iron (electric dehorner) may be used to cauterize small blood vessels. Treat the wound with an antiseptic spray, and fly repellent if needed. Do not use blood-clotting powders if there are openings into the sinus cavity. Place a thin layer of cotton over the exposed cavity to keep out foreign particles, such as dust.