Health and Management Techniques

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

Requirements for a successful herd health program include:

- controlled breeding season
- adequate handling facilities
- adequate nutrition, especially with trace mineral supplementation
- working relationship between producer and veterinarian (valid Veterinary-Client-Patient Relationship)
- willingness to follow a program once it is established
- management level that reduces stress in cattle.

Several management techniques, including identifying, implanting, vaccinating, castrating, and dehorning, should be done in as timely and humane a manner as possible. As discussed in Section 3, adequate handling facilities are necessary to properly restrain the animals for vaccination and treatment. Work carefully when processing cattle. If you try to set a record for speed, you might end up unduly stressing or injuring your cattle. 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.

Precalving 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 things such as scours. Animals in poor condition before calving provide inferior colostrum and lower milk production. This can lead to lighter weaning weights or fewer pounds of calf to sell. Females that are 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 (rebreeding date).

Research has shown that when cattle are fed in the early evening (5 to 6 p.m.) during the last few weeks of pregnancy, more cows will calve between 6 a.m. and 10 p.m. Spring calving herds will also require a high magnesium supplement to prevent grass tetany (hypomagnesemia). (See "Forage-Related Disorders" later in this section for specific information on magnesium.)

Environment has an impact on calf survival. Calves born into a filthy environment (muddy lot) have the energy drained from them quickly since a calf has little stored energy reserves and needs to nurse shortly after birth. A clean, dry pasture for calving is ideal if there is shelter, and the cow can easily be moved if calving assistance is required.

Calving Difficulty

Observe heifers and cows for signs of calving difficulty. Allow a reasonable amount of time for her to deliver on her own, approximately 90 minutes from first straining to delivery or active straining for more than 30 minutes without making visible progress. Calving difficulty often occurs with calves presented backward (dewclaws are pointed "up"), breech (tail only and no legs), and malpositioned legs or head. If the heifer/cow is not making progress, she should be gently moved to a facility to adequately restrain her for examination. Clean the area around the vulva with soap and water. Either use a plastic obstetrical sleeve or wash your hands and arms well. Lubrication should be used to protect the vaginal area; do not use soap for a lubricant. A calf can generally be delivered with a 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 15 minutes of trying, you should call for veterinary assistance to assess the situation.

Just before calving, the teats may secrete a thick, yellow or honey-colored substance. This is colostrum, the first milk that is rich in antibodies. It is vital that the calf suckle colostrum in the first few hours after birth to be protected against disease during the first few weeks and months of life. Colostrum changes into milk after birth and with nursing. The calf is able to absorb the most antibodies from colostrum during the first few hours of life; this absorption decreases with time, and the calf usually cannot absorb any antibodies 24 hours after birth. Early suckling is vital.

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 adequate colostrum to the calf. The oral calf feeder (esophageal feeder) should be used on a calf with the head bent down at a slight angle (not pulled up), the ball should be lubricated (petroleum jelly or oil), and you should see or feel the ball on the left side of the neck. Colostrum from your farm is the best one to use. It has protection against the diseases found on the farm.

A mature cow has more concentrated antibodies (immunoglobulins) in colostrum than a heifer; a fall-calving cow usually has more antibodies than a spring calver. Colostrum can be frozen and kept until the next calving period. Be careful to freeze it in small amounts and not in one large gallon jug. Frozen colostrum must be slowly thawed out and not placed in the microwave to thaw. Be cautious about using another farm's colostrum, especially a dairy farm, because of the risk of acquiring Johne's disease and bovine leukosis virus.

There are numerous colostrum supplements on the market. Many are no better than doing nothing, so be cautious and work with your veterinarian. Product availability changes, and research improves our knowledge to make the best selection for colostrum replacements or supplements.

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

Annual Cow Evaluation

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 conformation and pendulous teats that make nursing difficult.
6. **Body condition score (BCS):** This should be between 5 and 6.
7. **Mouth:** Check if older cow or low BCS for teeth problem; "smooth-mouthed" or "broken-mouthed" will require feed supplementation.

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 work your cattle and the number of times you work them will influence the program for your herd. Table 6-1 is an example of a "Cattle Working Schedule" in which cattle are corralled five times a year.

Vaccination is a tool that is best utilized with other management tools such as proper nutrition, 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 killed or live organisms that do not cause disease but stimulate the animal's immune system to mount a response to the disease. The immune system will then "remember" how to mount a response against the organism if it is later infected with that organism. A vaccine cannot prevent infection but will allow the animal to respond more quickly or will lessen the severity of disease. If a vaccine is used correctly, it will increase the animal's disease resistance.

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. This has been termed a controlled infection. The organisms have been modified so that they do not cause the disease but stimulate the immune system. In general, MLV stimulate a longer-lasting immunity than killed vaccines. MLV may cause abortion if given to pregnant cattle.

Table 6-1. Cattle working schedule.

Time	Calves	Cows/Bull
Birth	• Identify • Record birth date, dam • Castrate	
Prebreeding	• Vaccinate 7-way Clostridial (Blackleg) • Pinkeye vaccine in the spring • Castrate/dehorn if needed • Implant male feeder calves	• Vaccinate IBR/PI-3/ BVD/BRSV, Lepto-5, Vibrio, *Haemophilus somnus* • Deworm • Sort into breeding groups • Bull breeding soundness exam
Midsummer[1]	• Deworm[2] • Reimplant steers	• Deworm[2] • Remove bull from breeding herd
Preweaning	• Vaccinate: IBR/PI-3/ BVD/BRSV • Booster 7-way Clostridial vaccine	• Pregnancy examination • Optional: Yearly blood test for Johne's disease and/or Brucellosis
Weaning	• 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.

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 6-2).

In the young animal being vaccinated for the first time, a second booster vaccination is often required a few weeks after the first vaccination.

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 a few vaccines are included in a routine vaccination schedule (Tables 6-3 and 6-4).

Proper handling of vaccines is important to prevent vaccine failure. Most modified-live vaccines (MLV) must be reconstituted by adding sterile water (diluent) to a dehydrated "cake" in a separate sterile vial. Once reconstituted, the vaccine organisms are fragile and survive for about 45 minutes if in direct sunlight and/or heat. Use a cooler to protect reconstituted and all vaccines from extremes of cold or heat and from sunlight. In a cooler, MLV organisms can survive about two to three hours.

Table 6-2. 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 • Could produce mucosal disease in BVD PI calf
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 • Usually 2 doses to protect • Shorter protection time

Table 6-3. Calf and heifer vaccination program.

Vaccine	At Birth	2-3 Months	4-6 Months	5-7 Months	12-14 Months	Comments
Scours	√					Better to vaccinate pregnant cow
Pasteurella/*Manheimia*		±		±		*P.* (*Manheimia*) *haemolytica* and/or *P. multocida leukotoxin*
7-way Clostridial		√	√			To prevent blackleg disease
Haemophilus somnus		?	?		±	"Gram negative" vaccine that can cause adverse reactions; debatable efficacy
IBR/PI-3/BVD/BRSV		?	√	√	√	
Leptospira 5-way					√	Prevent abortion, especially last trimester; short immunity
Lepto hardjo					±	Consult your veterinarian
Vibrio (campylobacter)					√	Prebreeding vaccination
Pinkeye		±			±	Give in spring
Mycoplasma			?	?		Prevent pneumonia and arthritis; debatable efficacy
Brucellosis			±			Heifers only
Footrot					±	Protect against footrot; short immunity

√ Proper timing: Follow vaccine label directions; ± Possible timing: Can do but not necessary; ? Questionable vaccine effectiveness.

Table 6-4. Cow and bull vaccination program.

Vaccine	12-14 Months	23 Months	Pre-Breeding	Before Calving	Bull	Comments
Scours		√ √		√		Follow directions; select based on farm problems
7-Way Clostridial				±		To prevent blackleg disease
Haemophilus somnus	±		±			Prebreeding vaccine
IBR/PI-3/BVD/BRSV	√		√	±	√	
Leptospira 5-way	√	√	√	±		Prevent abortion, especially last trimester; short immunity
Lepto hardjo	± ±		±			Consult your veterinarian
Vibrio (campylobacter)	√		√		√	Prebreeding vaccination
Pinkeye	±		±		±	Give in spring
Neospora			± ±			Prevent abortion
Footrot						Approved in beef cattle
Rabies						Approved in cattle

√ Proper timing: Follow vaccine label directions; ± Possible timing: Can do but not necessary; ± ± Possible timing: Booster is necessary in 3 to 4 weeks.

Diseases

Several diseases can be a problem in Kentucky beef herds. If you understand these diseases, you might be able to prevent them in your herd.

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 be caused by mass treatments, such as bleeding, dehorning, castrating, ear-tagging, and vaccination without changing the needle. Disinfect equipment and change needles to minimize spread of the disease.

Signs of anaplasmosis include anemia, pale mucous membranes, dehydration, and constipation. Most cases occur in late summer or early fall in older cattle (usually three years old) and lead to death.

Oxytetracycline is the drug of choice for treating anaplasmosis. Treatment to control the disease requires an injection of long-acting oxytetracycline at 9 mg per pound of body weight. This will not eliminate the infection from carrier/infected animals but should prevent deaths in the same season. Oral consumption of chlortetracycline for *120 continuous days* at 0.5 mg per pound of body weight during the insect vector season has been demonstrated to prevent the disease. Currently no commercial vaccines are available against anaplasmosis.

Blackleg

Blackleg and malignant edema are part of the Clostridium complex. They are caused by Clostridial organisms that live in the ground and enter calves through ingestion or wounds. The bacteria are not spread directly from animal to animal but from the soil. These organisms produce toxins 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" clostridial vaccine is effective, inexpensive, and economical. All calves should be vaccinated around two to four months of age. A booster in four to six weeks is recommended especially if blackleg cases have been diagnosed on the farm. Calves that receive the vaccine at less than two months of age should be revaccinated.

Bovine Leukosis Virus

Bovine leukosis virus (BLV, bovine leukemia, bovine lymphosarcoma, and malignant lymphoma) is a viral disease primarily affecting dairy cattle, but it also can affect beef. This neoplastic disease affects lymph nodes and lymphocytes. Tumors may occur in the spinal canal, uterus, heart, abomasum, and/or lymph nodes. Economic losses are from inability to sell for export or to bull stud companies, condemnation of carcass at slaughter, and clinical disease.

The virus is usually transmitted through contact with blood from an infected animal. Less than 0.0005 milliliters of blood is needed for the virus to infect a healthy animal. BLV can spread through such procedures as intramuscular vaccination with same needle, surgical castration and/or dehorning, tattooing, rectal palpation, as well as through insect vectors such as horseflies. Calves may also be exposed while nursing their infected dam.

It has been suggested that less than 2% of BLV-infected animals will develop lymphosarcoma. 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.

Bovine Spongiform Encephalopathy

Bovine spongiform encephalopathy (BSE, which may also refer to the original abbreviation of breeding soundness examination) is a chronic degenerative disease of cattle that affects the central nervous system, first diagnosed in the United Kingdom in 1987 and rare in North America. BSE may be 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 (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 occur in cattle between three and six years of age, usually dairy cattle. Presently there are no tests that can detect the disease in live cattle. BSE is spread through oral consumption of a prion protein in central nervous tissue of infected cases.

Meat and milk are safe for human consumption. 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/B1 vitamin deficiency), 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 potential respiratory viral vaccines (IBR, PI_3, and BVD) and are available as modified-live or killed.

Bovine Viral Diarrhea Virus (BVD)

Bovine viral diarrhea virus (BVD) can cause a variety of clinical conditions, including abortions, weak calves at birth, pneumonia, death, and persistent infections. BVD is frequently diagnosed in Kentucky herds due to suppressed immune system and increased susceptibility to respiratory disease.

Persistently infected (PI) calves occur when a pregnant dam with inadequate protection is infected with BVD during 40 to 125 days in gestation. A PI calf can be born with an immunity tolerance for BVD and will continuously shed the virus during its life. A PI calf may be born undersized and have slower growth rates, or it may appear healthy. More than 50% of PI calves do not live to one year of age. The most efficient transmission source for BVD is contact with PI cattle. Bulls can introduce BVD into a closed herd of cattle through the semen or direct contact. Treatment for cattle with BVD is generally not effective.

Biosecurity plans should include isolation of newly acquired animals for at least two weeks and a limitation on the movement of cattle on and off the farm, especially pregnant animals. Vaccination programs are routinely used to limit disease from BVD infection, but vaccines do not produce complete protection against PI infections. The vaccination goal is to induce immunity that will limit infection in the animal or during pregnancy 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 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. Whether using modified-live or killed/inactivated vaccines, replacement heifers should be vaccinated at five to six months of age and boostered in two to four weeks.

Annual revaccination of the breeding herd is recommended at the prebreeding working to get maximum fetal protection. Consult your veterinarian about the appropriate use of this vaccine in your herd. New additions can be screened for PI cattle since PI animals serve as a continuous source of infection.

Brucellosis

Brucellosis (Bang's disease) affects cattle primarily by reproductive losses, such as abortions. An important point is that 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.

There is no cure for Brucellosis in cattle. Efforts are directed at control and prevention. Test and slaughter of infected animals is the only choice available for control. Prevention may include calfhood vaccination of heifer calves with RB51 strain vaccine between four to 10 months of age, preferably between four and seven months. Heifer calves must be vaccinated by an accredited veterinarian. Upon vaccinating a calf, the veterinarian will place an official tattoo in the right ear and record the vaccination with the state veterinarian. You can work with your veterinarian to have your herd certified Brucellosis free with annual blood testing.

Coccidia

Coccidia are intracellular parasites that can cause serious economic losses due to weight loss or reduced performance. The coccidian life cycle is complex. The single-cell oocysts are passed in the feces and sporulated to form the infective stage. The sporulated oocysts are ingested by the animal and released in the intestine. The development cycle in the intestinal tract destroys intestinal cells. The amount of damage done is directly related to the number of oocysts ingested. Outbreaks are associated with the stress of weaning, shipping, 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 or rectal prolapse. Standard management techniques are recommended to reduce exposure to oocysts with decreased stocking rates, minimize stress, and provide clean housing and feed. Preventive use of coccidiostats (Rumensin®, Bovatec®, or Deccox®) can be used in the management of coccidiosis.

Beware of horses consuming Rumensin® or Bovatec®. Cattle showing clinical signs of coccidiosis must be treated with drugs (Corid® or sustained-release sulfa) since coccidiostats will not cure clinical animals.

Cryptosporidia

Cryptosporidia is a minute coccidia-like parasite that invades the intestinal cells of the distal small intestine and large intestine. It is a major cause of calf scours/diarrhea. The disease is common in one- to four-week-old calves. Cross infection between animals and humans is possible, so washing hands is advisable after handling young scouring calves. Cryptosporidia are resistant to all commonly available antimicrobial/anticoccidial agents and most disinfectants. It can survive for long periods in the environment.

Footrot

Footrot is an infectious disease characterized by sudden lameness and inflammation of the tissues between the claws. It is caused by interdigital trauma and infection with the bacteria *Fusobacterium necrophorum* and *Bacteriodes melaninogenicus.* The tissue between the claws becomes swollen and painful, and only light weight is placed on the toe. There is a characteristic foul odor but little pus. Treatment consists of systemic antibiotics (penicillin, oxytetracycline, Naxcel, etc.) and local treatment of the interdigital area (copper sulfate, zinc sulfate, etc.). Prevention includes adequate nutrition and immunization with *F. necrophorum* vaccines.

Haemophilus somnus

Haemophilus somnus is a normal bacteria found in the upper respiratory tract of cattle. Haemophilus can cause respiratory (lung), brain, and reproductive disorders in cattle. Commercial vaccines are available but have limited success in inducing protection against respiratory disease.

Infectious Bovine Rhinotracheitis

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

All forms of IBR can be prevented by vaccination with products for intranasal or injection (subcutaneous or intramuscular) use. Modified-live virus vaccines, in combination with BVD and PI_3 for injection, are most effective but can cause abortion in pregnant animals. Calves should be vaccinated 30 days before weaning and boostered at weaning or vaccinated at weaning and boostered two to four weeks later. Replacement heifers should be vaccinated at weaning and boostered at least 30 days before breeding. The breeding herd should receive an annual booster.

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 paratuberculosis.* The bacteria can survive for more than a year in contaminated soil or water because they are resistant to heat, cold, and drying. Individual animals usually become infected at a very early age by exposure to fecal material or colostrum/milk from infected cows. Young cattle are more susceptible to infection than adults.

The incubation for disease is prolonged and typically longer than two years before the animal may show clinical signs. Infected cattle develop clinical signs of gradual weight loss progressing to diarrhea. They continue to eat but appear unthrifty; they do not have a fever. The disease typically enters a herd when infected but healthy cattle are purchased. The calves are exposed to the bacteria. Several years later, the producer begins to see signs of Johne's in the herd.

There is no practical treatment for Johne's. Cattle become subclinical shedders of the bacteria before they show clinical signs. Cattle can be tested for *M. paratuberculosis*. The feces can be cultured, but it can take as long as 16 weeks to get results. Fecal culture is the most definitive test. Blood tests can be done quickly. There can be a few false positives with the blood testing, and a negative blood test does not guarantee the animal is negative. Some animals with infection are never positive to the blood test.

The key to preventing, controlling, and eliminating Johne's disease in a herd is implementation of appropriate biosecurity measures.

Leptospirosis

Leptospirosis (Lepto) is a bacterial disease that produces 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 ponds.

All breeding-age female cattle should be vaccinated and boostered in one month for all available strains of Lepto. Annual revaccination is highly recommended, especially when cattle are two to four months pregnant to protect against the last half of pregnancy. Due to the short duration of immunity, some areas must vaccinate every three to four months to maintain adequate herd immunity. Recently a new vaccine against *L. hardjo* has been shown to protect against the strain and provide longer duration of immunity than the traditional Lepto-5 vaccines. The new vaccine does not eliminate carriers; treatment is necessary to eliminate carriers of leptospirosis.

Listeriosis

Listeriosis (circling disease, silage disease) is caused by the bacterium *Listeria monocytogenes* that has worldwide distribution but is most frequent in temperate climates. Animals show neurologic disease with head pressing, drooped ear, and/or compulsive circling. The recovery rate is best if treatment is administered early in the course of the disease. Prolonged treatment with antibiotics of oxytetracycline or penicillin is recommended. Prevention includes discarding moldy feed, especially silage, and preventing access to contaminated areas. Rule out other diseases that can cause similar signs, especially rabies.

Neosporosis

Neosporosis is caused by a very small, one-celled parasite called *Neospora caninum.* The protozoa may affect the developing fetus, but it does not cause clinical illness in the adult. Infection may result in fetal death, abortion, stillbirth, or birth of weak calves. The disease is primarily a problem in dairy cattle but may affect beef cattle.

The dog has been identified as the definitive host 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 feces containing the oocysts. Exposure does not need to be during pregnancy to cause problems. Diagnosis of the infection is based on lesions in the aborted fetus and/or positive blood tests. Vaccines are available but have questionable effectiveness.

Parainfluenza Type 3

Parainfluenza type 3 (PI-3) primarily causes mild respiratory problems in cattle. It is considered to be a secondary factor in a lot of shipping fever outbreaks. Effective vaccines are available, including intranasal vaccines or modified-live and/or killed vaccines for injection. PI3 vaccines are usually given in combination with IBR.

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 severe decrease in weaning weight of calves with pinkeye. This decreased performance, coupled with a decrease in selling price of affected calves, can mean severe losses for Kentucky beef producers.

The common cause of pinkeye is the bacterium *Moraxella bovis*. The bacteria are generally spread by face flies but may not produce the disease until irritation of the eye occurs. During the summer months, tall grass with seedheads, dust, and pollen can cause trauma to the eye, thereby increasing the risk of penetration by *M. bovis*. Viral infections, such as that caused by IBR, are also thought to sometimes trigger an outbreak of pinkeye.

Be alert for early signs of pinkeye. Usually the first indication of the disease is watering of the eye. A short time later, the face on the affected side might be wet. The animal might try to stay in the shade, stand with the affected side away from sunlight, blink repeatedly, or keep the eye closed. As the disease progresses, the redness of the eye intensifies, and a whitish-opaque spot might appear in the center of the eye. If the eye is untreated, the white area enlarges and may ulcerate and rupture.

Treat pinkeye as early as possible. Early cases might respond to a variety of antibacterial preparations placed in the mucous membranes surrounding the eyes. Long-acting oxytetracycline or Nuflor® antibiotic injections given subcutaneously (under the skin, preferred site for Beef Quality Assurance) are also effective in treating pinkeye cases. Two doses of long-acting oxytetracycline or Nuflor® given at 72-hour intervals or one dose of Tetradure® were effective to stop cattle from shedding *M. bovis* and eliminate carriers.

If the eye is seriously damaged, cattle are frequently treated with a subconjunctival (under the eyelid) injection of penicillin antibiotic with/without corticosteroid. Tetracycline injections into the eye should be avoided due to the extreme irritation of the product. Affected eyes should be protected from irritants and flies. A patch can be cemented over the eye to provide shade and avoid flies. Leave the patch on for one to two weeks.

Do not look for a single, easy solution to control pinkeye. Instead, follow these suggestions to reduce costly outbreaks of the disease:

- Develop a program to control face flies.
- Reduce eye irritation by keeping pastures clipped. Keep cattle out of dusty lots, and provide plenty of shade.
- Consult with your veterinarian to develop a treatment or control plan; consider vaccinating for pinkeye. All cattle herds should be routinely vaccinated for IBR. Vaccination is most effective when done before fly season. Some commercial vaccines require a booster to give effective protection. Vaccines may not eliminate the pinkeye problem, but they do reduce the severity and duration of disease.
- Observe the herd regularly for early detection, and treat problems as they arise.
- Treating the cow herd with antibiotics in the feed or through injections may be needed in an outbreak of pinkeye to clear up the *M. bovis* infection and eliminate the carrier state. This is an expensive option.
- Recent eye cultures have indicated that *Moraxella (Branhamella) ovis* may also cause pinkeye. There is no commercial vaccine available to protect against *M. ovis* infection. Some veterinarians have developed autogenous vaccines to give immunity against *M. bovis* and *ovis.*

Pneumonia/Shipping Fever/Bovine Respiratory Disease Complex

Pneumonia/shipping fever/bovine respiratory disease complex (BRD) is caused by a complex interaction of bacterial and/or viral organisms in an animal, leading to infection and inflammation of the lung. Clinical signs include an increase in the rate and depth of respiration, cough, nasal discharge, and open-mouth breathing. BRD is often associated with stress or as a reaction to change. Change includes diet, environment, water, dehorning, castration, weaning, handling, confinement, and mixing with new groups.

Several viruses are major contributors to BRD. They are highly contagious and include bovine respiratory syncytial virus, bovine viral diarrhea, infectious bovine rhinotracheitis, and parainfluenza. Bacterial agents are responsible for the severe lung problems. Bacteria usually need stress and/or viral infection to cause pneumonia. *Manheimia* (Pasteurella) *haemolytica* is often referred to as "shipping fever" and a common cause of pneumonia, especially in stocker and feedlot cattle. These bacteria can cause severe pneumonia and result in immediate death if the animal is not treated with antibiotics quickly.

Pasteurella multocida, Haemophilus somnus, and *Mycoplasma* are other bacteria that can cause pneumonia (Table 6-5). In Kentucky, *H. somnus* has been diagnosed in nursing calves in the late summer with clinical history similar to *M. haemolytica.* Mycoplasma is an opportunist that can cause pneumonia and/or arthritis in stocker cattle, which are usually lightweight, stressed, from multiple sources, and not preconditioned. Mycoplasma is a slow-growing bacterium that lacks a cell wall. Prolonged treatment (nine to 10 days) with antibiotics is necessary to reduce Mycoplasma infection. Most antibiotic treatments are for three to four days.

Successful treatment of BRD involves early recognition of sick animals, appropriate treatment, follow-up, and record keeping. Clinical signs include depression (Table 6-6), decreased appetite (Table 6-7), abnormal breathing (Table 6-8), and usually a fever on examination (Table 6-9). Coughing is not always present in pneumonia. It is important to watch cattle at feeding time. Sick calves may walk to the bunk but not eat.

Antibiotic and other therapeutic agents should be selected on the basis of symptoms shown and with a protocol developed by you and your veterinarian. Sometimes bacterial organisms may be resistant to an antibiotic that has worked well in the past. Mass treatment should be considered if sickness is increasing rapidly. A hospital pen should be provided so sick animals can be closely observed and easily treated. Sick cattle should not be kept where contact with incoming cattle is possible.

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 weaned a minimum of 45 days and 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

Table 6-5. Common causes of pneumonia.

Viral agents	Bovine Respiratory Syncytial Virus	BRSV
	Bovine Viral Diarrhea*	BVD
	Infectious Bovine Rhinotracheitis	IBR
	Parainfluenza Virus Type 3	PI-3
Bacterial agents	*Haemophilus somnus*	
	Manheimia (Pasteurella) haemolytica	
	Mycoplasma spp.	
	Pasteurella multocida	

* Causes secondary pneumonia due to immune suppression.

Table 6-6. Depression (attitude).

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

Table 6-7. Appetite.

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

Table 6-8. Respiratory index.

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

Table 6-9. 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.

vaccination (IBR, PI-3, BVD, BRSV, and 7-way Clostridia) and treatment for internal (especially against inhibited Ostertagia) and external parasites. Some sales require specific vaccine and parasite products, so always check with the location for their requirements and timeline. There is a guarantee that the cattle do not include bulls or a pregnant heifer. Growth-promotant implants and Pasteurella vaccines are optional. The producer certifies that the procedures are done according to required BQA standards.

Salmonellosis

Salmonellosis is a disease that causes diarrhea in calves and/or adults. It can lead to multiple deaths in a herd. 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* (40% are reported to be contaminated in the United States). 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. Carrier cattle are especially important with *Salmonella dublin* since they shed numerous bacteria into the environment while appearing healthy.

There appears to be an association between intensive management practices, such as crowded conditions and high-protein diets, with an increased incidence of salmonellosis. 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 diseased with rota virus, corona virus, or cryptosporidia. If the challenge dose of salmonella is large enough, salmonellosis may occur as a primary disease in healthy cattle. The risk may be greatest when the infection occurs in a herd that is under environmental or nutritional stress and is close to calving.

Salmonellae survive for months in moist areas out of direct sunlight and in lagoons and drainage areas. Composting can decrease on-farm salmonella. Survival of salmonellae in composted cattle manure was less than seven days. The primary salmonella isolated in Kentucky is *Salmonella typhimurium*. *Salmonella typhimurium* infection does not usually produce chronic carriers. Cattle typically eliminate *S. typhimurium* within three months after infection. Salmonella spp. can persist in the environment.

Newer vaccines have improved efficacy against salmonellosis. The calf protection from passive colostral antibodies lasts only three weeks. Vaccines could be used to decrease clinical illness only in the early phases of a control program. Vaccination of cattle three months of age or older with two doses of killed salmonella bacterins is likely to be useful for preventing salmonellosis. Hyperimmune serum can be given to neonate calves in immediate danger during an outbreak.

Scours/Diarrhea

Scours (neonatal diarrhea) is the most common infectious problem of young beef and dairy calves. Scours/diarrhea is a clinical sign and is caused by a group of infectious diseases (Table 6-10). The three basic factors involved with scours are: (1) the environment where the animals are born and raised, (2) animals (dams and newborn calves), and (3) infectious agents. One or more of the infectious agents damage the calf's intestine and cause it to scour. Events leading up to infection and disease are the result of an interaction among all three factors.

Table 6-10. Common causes of calf scours.

Infectious Causes	Age Affected
E. coli	1-5 days
Clostridium perfringens	2-10 days
Salmonella	1-4 weeks
Rota virus	1-4 weeks
Corona virus	1-6 weeks
BVD	2-6 weeks
Cryptosporidia	1-6 weeks
Coccidia	> 4 weeks
Noninfectious Causes	
Inadequate or overabundant nutrition	

Calf Scours Treatment:

1. Identify, record information, and isolate the calf with its dam from healthy herd.
2. Electrolytes—Use oral calf (esophageal tube) feeder if the calf is weak. Use electrolytes to rehydrate calf and furnish electrolytes (especially bicarbonate) to help reduce the depression. Commercial electrolytes would be best, but a homemade electrolyte can be made in case of an emergency. *Never use table sugar in oral fluids.* Solutions should be warmed to body temperature.
3. Use 2 ounces of Kaopectate or other binders; can mix with electrolytes.
4. Consult with your veterinarian about the use of antibiotics in a calf less than seven days old (*E. coli* diarrhea is suspected) or if the calf is extremely debilitated.

Calf Scours Prevention:

1. 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 cows in the same area used for confined winter feeding. It is best to separate heifers calving for the first time from the older cows before calving and return together after breeding (Table 6-11).
2. Ensure that an adequate amount of colostrum is consumed at birth.
3. Provide adequate nutrition and proper amounts of trace minerals, especially copper and selenium to the cow during her pregnancy.
4. Vaccinate the dam at the end of pregnancy to protect the calf through colostrum for *E. coli*, rota, and corona virus, or vaccinate the calf at birth *before* the ingestion of colostrum.

Table 6-11. Producer's worksheet: Herd assessment for calf scours.

	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 moderate risk.

Vibriosis

Vibriosis (vibrio, or now known as campylobacter) is a sexually transmitted disease caused by *Campylobacter fetus* sp. *veneralis* that causes early abortions and temporary infertility in the cow. The disease is through venereal transmission from infected bull to virgin heifers and cows. 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 40 days.

Treatment is difficult. Prevention is accomplished by vaccinating cattle 30 to 60 days before the start of breeding. Bulls should also be vaccinated. Take precautions to prevent adding infected breeding stock to the herd and thus introducing the disease.

Forage-Related Disorders

Bloat

Bloat is caused by an abnormal collection of gas in the rumen. Bloat results when an animal cannot "belch up" gases produced in the process of rumen fermentation. Pasture bloat usually occurs in cattle grazing lush legumes, such as alfalfa, ladino, or red clover. The danger of pasture (frothy) bloat is greatest when pasture plants are young, lush, and high in soluble protein. Frothy bloat results from the production of a stable foam that does not allow gas bubbles to form free gas and be "belched" off. The disorder is due to the foaming properties of soluble leaf proteins, which are more prevalent in legumes.

A cow's inability to expel the gas allows pressure to build up in the rumen. As the pressure increases, the rumen becomes distended on the cow's upper left side between the last rib and the point of the hip. As the bloat becomes more severe, breathing

becomes difficult. After the cow is no longer able to stand, death follows within a few minutes.

In these severe cases, a ¾-inch to 1-inch rubber hose can be passed through the throat (with the use of a metal tube/speculum to prevent chewing the tube) into the rumen to provide relief. Since pasture bloat is frothy, a tube to the rumen may not be sufficient. If it is not adequate, a defoaming agent (oral bloat medicine, vegetable oil, or dish detergent) may be added through the tube. As a last resort, relief can be obtained by making a surgical hole in the rumen large enough to release the foam. An incision is made on the left side at a point halfway between the last rib and the hook bone. The incision must be sutured, and antibiotics must be administered.

The best plan is to prevent bloat. Bloat preventing products, such as Bloatguard®, are effective if consumed daily in adequate amounts. Rumensin® (monensin) has been demonstrated to reduce a large percentage of bloats.

These other management practices also can help prevent bloat:

- Fill cattle with hay or grass pasture before turning on to alfalfa or clover pasture. Do not turn hungry cattle on lush, immature alfalfa or clover.
- Once cattle are turned onto pasture, do not remove them at the first signs of bloat. Mild subacute bloat occurs frequently on alfalfa pasture, unless a bloat preventative is fed.
- Provide a grass-legume mixture for pasture.
- Feed grain or a grain-roughage mixture to reduce pasture intake.

Fear of bloat should not keep you from using high-quality legumes, such as alfalfa and clover, in your pasture program.

Fescue Toxicosis

Fescue toxicosis and summer syndrome 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 *Acremonium coenophialum.* 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
- rough hair coat
- more time spent in the shade and higher body temperature.

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

1. *Manage to minimize the effect.* Clipping seedheads eliminates a 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.
2. *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.
3. *Replace infected stands with low-endophyte varieties.* Several low-endophyte or endophyte-free varieties are now available. When you consider 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.

Grass Tetany

Grass tetany is a disorder caused by an abnormally low amount of magnesium in the animal's blood. Beef cattle producers in Kentucky have generally been successful in reducing the incidence of tetany with *daily* high magnesium supplementation. However, the potential still exists in most herds for this disorder to be a problem.

Grass tetany occurs most often in cows grazing lush spring forages—especially small grains and cool-season perennials, such as fescue. It is most common in spring-calving cows, especially if they are high producers in their third to fifth lactation. Several factors contribute to the increased incidence of tetany at this time. The magnesium requirement of cows doubles from late gestation to early lactation (from 9 grams to 21 to 22 grams). When this rapid change in magnesium needed by the cow is coupled with lowered magnesium in the plant, along with certain components that lower the availability of magnesium (such as high applications of nitrogen and potassium fertilizers), tetany can develop. Weather can also have an effect; the greatest threat is when temperatures are between 40°F and 60°F. Temperatures in excess of 60°F for a week markedly decrease the incidence of tetany. When all of these factors are combined, the risk can be high.

Cattle affected with grass tetany might isolate themselves from the herd and stagger. As the disease progresses, they may exhibit extreme nervousness, rapid breathing, and muscle trembling. They might become aggressive and charge anyone in the pasture. In the most severe stage, the animal collapses to the ground with muscular spasms. Treatment must be given rapidly as death can occur within an hour after the onset of convulsions.

For the cow down with tetany, treatment is the only option. Treatment consists of an intravenous (IV) injection of a solution containing magnesium, calcium, and glucose. This must be done correctly. If the IV solution is administered too rapidly, death can result. Consult a veterinarian familiar with the herd and its management about treatment procedures and whether you should keep emergency medication and equipment on hand. To prevent relapse, recovered animals should be removed from the pasture and fed a hay/concentrate mixture supplemented with magnesium oxide for at least a week.

As a producer, you should be concerned with preventing tetany. About 2 ounces of magnesium oxide (22 grams of magnesium) daily is recommended to meet the magnesium needs of lactating beef cows. Since legumes are higher in magnesium than grasses, feeding cows legume hay during the early spring may supply some magnesium. Cows grazing spring grass pasture should have magnesium in the mineral mixture; in high-risk situations, it may be supplied in a supplement.

Many commercial mixtures are available in various forms to prevent tetany. Before you make a purchase, determine if the product will give adequate magnesium intake. This depends on the magnesium content and the expected consumption of the product. Both should be listed on the tag. If it appears that magnesium intake will not be adequate, a product with more magnesium or greater intake should be used.

In high-risk situations where tetany is a frequent problem, it might be necessary to force feed the daily magnesium needs. Magnesium oxide can be included in a grain or protein supplement. Supplements for high-risk situations are shown in Table 6-12.

Table 6-12. Suggested supplements for preventing grass tetany in high-risk situations (where grass tetany has occurred).

Ingredient	Free-Choice Supplement (lb.)	Hand-Fed Supplement (lb.)
Grain	39	66
Soybean meal	19	17
Dicalcium phosphate	10	10
Magnesium oxide	7	7
Salt, plain	25	- -
Vitamin A premix	*	*
Total Mix	**100 lb.**	**100 lb.**
Expected intake/day	2 lb.	2-3 lb.

* Vitamin A should be added to any of the mixtures to provide approximately 30,000 IU daily to each cow.

Nitrate Toxicity

Nitrate toxicity can affect cattle that consume forages containing excessive amounts of nitrate. It also might occur if animals (especially those hungry for salt) have access to nitrate fertilizer. Under normal conditions, low levels of nitrate consumed by cattle are converted to ammonia and then to protein. However, high levels of nitrate interfere with the ability of red blood cells to carry oxygen. Thus, the animal dies from nitrate poisoning, but the death is caused by a lack of oxygen.

Forage crops most likely to collect nitrates are warm-season annual grasses, such as sorghum-sudan hybrids, sudangrass, corn, pearl millet, oats, and wheat. Avoid grazing these warm-season grasses, especially those heavily fertilized with high amounts of nitrogen, when growth ceases due to drought or cold damage. Suspect forage should be tested for nitrate level. Consult your veterinarian or county Extension agent for agriculture for information concerning sampling and how to send samples to a diagnostic laboratory.

Table 6-13 should help you interpret laboratory results. Results are generally reported on a percentage or parts per million (ppm) of nitrate on a dry matter basis. Be sure results are reported as nitrate levels.

Cattle being fed or grazed on suspect forages should be watched closely for these signs:

- labored breathing
- frothing at the mouth
- diarrhea
- frequent voiding of colorless urine
- staggering
- convulsions
- brown color of the membranes (mouth, vagina).

Remove animals showing symptoms from the feed or pasture, and feed them a high-concentrate diet. A solution of methylene blue can be given intravenously to help restore the oxygen-carrying ability of the red blood cells.

Do not bale forage that tests high in nitrate. The nitrate content of cured forage is stable. Corn fodder or sorghum-type plants have about the same nitrate content when fed as they did when baled. Properly fermented silage loses about half of its nitrate content. *Do not enter the silo during the ensiling process; gases that are given off are toxic.*

Hay that tests high in nitrate can be diluted with low-nitrate feeds. Feed a ration high in carbohydrates (such as grain). This especially applies to feed that is marginal in its nitrate content.

These are management guidelines for feed and forages that contain high levels of nitrates:

- Leave drought-damaged forage in the field as long as practical before harvest since nitrate diminishes as plants mature.
- Cut suspect forage higher than usual to avoid the higher nitrate-containing portion of the plant. Do not force cattle to eat the lower portion of the stalk during grazing.
- Avoid use of drought-stricken forage until three to five days after a rain.
- Regulate the intake of nitrate-containing feeds so that small amounts are fed initially and increases are gradual.
- Run an analysis on suspect feed to determine nitrate level.

Table 6-13. Nitrate levels in forages (dry matter basis).

Percent (%) Nitrate	PPM Nitrate	Comments
0 to 0.25	0 to 2,500	Safe
0.25 to 0.50	2,500 to 5,000	Caution. Generally safe when fed with a balanced ration. For pregnant animals, limit to one-half of total dry ration. Make certain water is low in nitrates. Prolonged feeding may result in a vitamin A deficiency. Do not feed with liquid feed or other nonprotein (NPN) supplements. Be cautious with pregnant and young animals.
0.50 to 1.50	5,000 to 15,000	Danger. Limit to one-fourth of ration. Should be well fortified with energy, minerals, and vitamin A. May experience decreased milk production in four to five days. Possible occurrence of reproductive problems.
More than 1.50	More than 15,000	Toxic. Do not feed free choice. Feed containing such high levels can only be used if ground and mixed with other feed. Limit to 15% of total ration.

Source: D. M. Ball, C. S. Hoveland, and G. D. Lacefield. *Southern Forages*. 1991. Atlanta.

Prussic Acid Poisoning

Prussic acid poisoning occurs in animals that have consumed plants containing cyanide-yielding compounds. The prussic acid (hydrocyanic acid) poisoning potential is affected by species and variety of plants, along with weather and soil fertility. Plants of the sorghum family (sudangrass, johnsongrass, and sorghum-sudan hybrids) and leaves of wild cherry trees have the potential to produce prussic acid poisoning. Pearl millet does not produce prussic acid. Prussic acid is most likely to be at dangerous levels immediately after a frost.

The first sign of trouble might be a dead animal. Symptoms from small amounts of prussic acid can be labored breathing, frothing at the mouth, and staggering.

You can lower the risk of prussic acid poisoning by following these management practices:

- Do not graze sorghum or sorghum-cross plants until they are at least 15 inches tall.
- Do not graze wilted plants.
- Do not graze these plants during or shortly after drought periods when growth is retarded.
- Do not graze for two weeks after a nonkilling frost.
- Do not graze until about 48 hours after a killing frost (until plant material is dry).
- Do not graze at night when a frost is forecast.
- Do not allow cattle access to wild cherry leaves.
- Check pastures after storms for fallen wild cherry trees or limbs.

Parasites/Worms

Internal Parasites

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

- rough hair coat
- "bottle jaw," or accumulation of fluid under the jaw
- poor weight gains
- 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 crawl 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 develop into adult worms and break out of the glands, damaging them as they leave. They can emerge gradually or suddenly, causing much damage to the stomach lining.

Several products help control internal worms in cattle. They are in the forms of injectables, pour-ons, drenches, pastes, boluses, blocks, crumbles, and feed additives. Select the appropriate product based on your management practices and veterinarian's recommendations. Dewormers used during the hot summer and cold winter should be effective against inhibited *Ostertagia ostertagia* larvae. Albendazole (Valbazen®), doramectin (Dectomax®), eprinomectin (Ivomec Eprinex®), 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 6-14).

Most producers deworm their cattle when they have other working procedures scheduled. The traditional fall and spring working periods with pregnancy checking or cow-calf vaccination may not be the best times to deworm.

Strategic deworming programs should be designed to work with the natural rise and fall of infective larval populations on pastures at various times of the year. The most important part of strategic deworming is timing and providing 12 weeks of protection from egg shedding. Timing for deworming is dependent on the weather, grass growth, and pasture management. Strategic deworming

Table 6-14. Efficacy of common anthelmintics against internal parasites of cattle.[1]

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

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

coordinates grazing pastures with several teatments in the early spring/summer. The timing between dewormings depends on the type of anthelmintic used. If long-acting (endectocides, e.g., Cydectin, Dectomax, Ivomec Eprinex, Ivomec, or FDA-approved generic equivalents), two treatments should be given six weeks apart. If the short-action dewormers (Rumatel®, SafeGuard/Panacur®, Synanthic®, Valbazen®, Levasole/Tramisol®) are used, three treatments are given three weeks apart (weeks 4, 7, and 10 of grazing).

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.

External Parasites

External parasites, such as flies, lice, and cattle grubs, cause losses to beef producers from lowered weight gains, reduced milk production, and diseases transmitted by parasites. Animals that are severely infested with parasites are more susceptible to disease.

Flies

Flies are pests of beef cattle and cause most problems during the warmer months. Most flies have either sponging or piercing-sucking mouthparts. Face flies have sponging mouthparts; hornflies, stable flies, and horseflies have piercing-sucking mouthparts.

Face flies usually feed on mucus secreted from the eyes of cattle. They spread the bacteria *Moraxella bovis*, or *M. (Branhamella) ovis*, which can cause pinkeye in cattle.

Hornflies are blood-sucking pests that stay on cattle continuously, leaving only when disturbed or when they move to fresh manure to deposit their eggs. They are usually found on the shoulders and backs of cattle. When 100 hornflies are counted on each side of the animal, there is an economic impact, and the animals should be treated.

Horseflies are severe blood-sucking pests of cattle that cause problems usually during late summer. Horseflies greatly irritate cattle by feeding on them, and they can spread anaplasmosis. The control of horseflies is difficult since they spend little time on the cattle.

You can control face flies and hornflies by using dust bags, back rubbers, insecticide-impregnated ear-tags, insecticide pour-ons, insecticide animal sprays, and feed-through insecticides (hornfly control only). Follow directions for the application amount and timing and meat withdrawal time, and discard containers properly. Ear-tags give the best fly control when you use two tags per animal, apply them in late May or early June when the fly population builds up, put tags on all animals in the herd, and remove tags in September/October.

Flies can become resistant to chemicals used in insecticide ear-tags when they have been used for long periods. There are synthetic pyrethroid (P), organophosphate (OP), and combination OP-P ear-tags. If resistance is suspected, alternate the insecticide type (P or OP) and/or methods of control to eliminate insecticide-resistant populations of flies.

Lice

Lice occur primarily during the winter months when cattle have longer coats and less oily skin. Two types of lice infest cattle in Kentucky: biting lice and sucking lice. Biting lice (little red lice) do not suck blood but use their chewing mouthparts to feed on dead skin, hair, and skin secretions. These lice are very active and cause irritation to animals by their movement and feeding. Biting lice are usually found around the tailhead and the top of the shoulder. Sucking lice have piercing mouthparts that they use to feed on blood. Sucking lice are bluish or slate-gray in color. They are often found in colonies, which look like patches of dirt or manure against light-colored hair.

Symptoms of lice infestation are licking the hair to soothe the irritation, rubbing, and scratching. Severely infested cattle often rub off patches of hair. The rubbing can cause damage to fences or injury to the cattle.

Lice can be controlled easily in the winter by using pour-on or spot-on insecticides, either those used for cattle grub control or those designed specifically for lice control. Keep lice in check by using backrubbers or dust bags throughout the year. The endoctocide dewormers (Cydectin, Dectomax, Ivomec Eprinex, and Ivomec) kill sucking lice and grubs. The pour-on endectocides will also provide protection against biting lice if all animals are treated at the same processing time.

When treating for lice, treat all animals in the herd to prevent re-infestation from untreated cattle. To rid the herd of lice completely, you will need a second insecticide treatment 14 to 21 days after the first (to kill lice that have hatched from unkilled eggs). All new animals should be treated in the winter before joining the herd.

Cattle Grubs

Cattle grubs are the immature or larval form of heel flies. Producers are likely to be aware of these parasites at two stages of their life cycle: first, when heel flies try to deposit their eggs on cattle, causing them to run with their tails up (this is sometimes called "gadding") and, second, when grubs appear on the animal's back after about nine months.

Control of these insects is important because of losses due to disturbed or "gadding" cattle, reduced vigor of cattle while larvae are migrating through the body, and damage to loin muscle and hide when slaughtered. Control can be accomplished while the larvae are small and in the "wandering" stage in the body. In Kentucky, this is from mid-July until the end of October. Systemic insecticides are applied as pour-ons, spot-ons, and sprays. Pour-on endectocides (Cydectin, Dectomax, Eprinex Ivomec, and Ivomec) and injectable dewormers (Dectomax and Ivomec) also control cattle grubs.

Administering Drugs to Cattle

Drugs used by producers and veterinarians are generally classified broadly as pharmaceuticals (used for treatment), biologicals (used for prevention), parasiticides, and disinfectants. All are necessary for a herd health program.

Types of pharmaceuticals used for treatment include antibiotics (antimicrobial agents), anticoccidials (coccidiostats), anti-inflammatories, hormones, and implants. An example of a biological used for prevention is a vaccine, which stimulates immunity against specific diseases. (*Note:* Vaccines should be refrigerated and are sensitive to light. Do not reconstitute them until they are to be used. Observe the expiration dates printed on the labels.)

No matter which method you use to administer drugs, always use proper animal restraint to do a good job. Since most drugs are relatively expensive, take your time and do the job right. If your technique is sloppy, your biggest loss will be caused by a 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 (about 50 cc) can be used in administering large doses or for multiple doses (like 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. Then inject the air into the bottle and withdraw the drug. This should be done in a dust-free environment.

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 might let the product flow back out.

Types of Injections

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

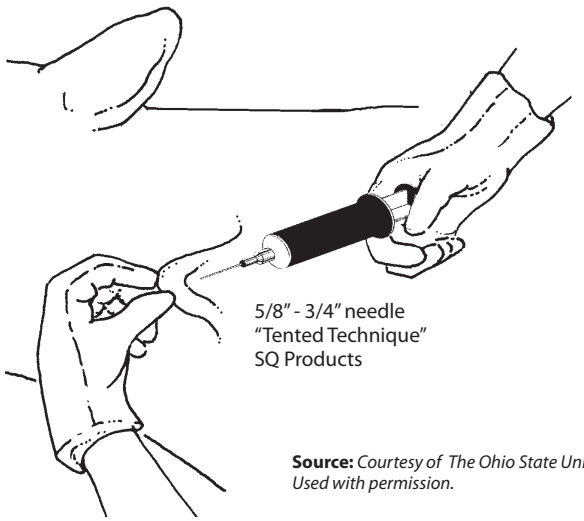
Subcutaneous Injections

Subcutaneous injections (SQ) are made just under the skin but not into the muscle tissue. The side of the neck is the best 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 6-1). Needles of 16- to 18-gauge and 5/8- to 3/4-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 SQ or IM.

Intramuscular Injections

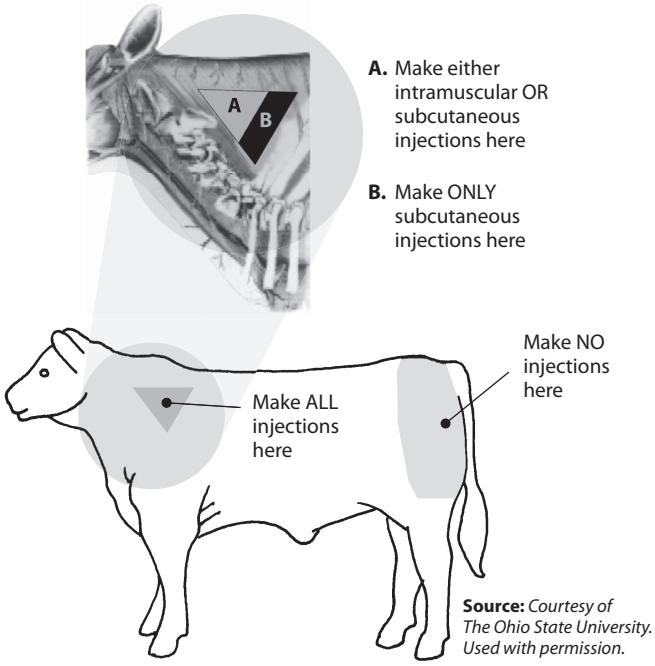
Intramuscular (IM) injections are made directly into muscle tissue, generally with a 1- to 1½-inch needle. Do not inject more than 10 cc at an injection site. Too much drug in one area can cause muscle damage and reduce uptake. IM injections should be given in the triangle area in the neck. Recent Beef 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 6-2 and 6-3 for proper injection sites).

Figure 6-1. Proper subcutaneous (SQ) injection technique.



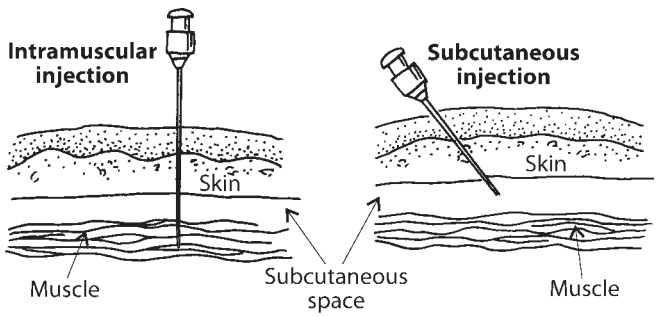
Source: *Courtesy of The Ohio State University. Used with permission.*

Figure 6-2. Proper injection sites.



Source: *Courtesy of The Ohio State University. Used with permission.*

Figure 6-3. Illustration of intramuscular or subcutaneous injections.



Source: John Johns and Lee Meyer. *Backgrounding Beef Cattle*. ID-62. Lexington, KY: University of Kentucky Cooperative Extension Service.

Intravenous Injections

Intravenous injections (IV) are useful when a large volume must be given (for milk fever or grass tetany), when the drug must not be deposited outside the vein, or when it might be irritating to tissues. These are made directly into a blood vessel, usually the jugular vein. 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.

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.

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.

Subconjunctival Injections

Subconjunctival injections involve injection of a drug into the eyelid. This type of injection might be needed for treating pinkeye. Invert the top eyelid of the infected eye and make an injection under the pink lining of the eyelid.

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 your 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, Haemophilus somnus,* leptospirosis, pinkeye, Pasteurella, and vibrio). These are more likely to occur during hot weather or when given with a vitamin A and D injection. Epinephrine should be used to treat cases in an emergency.

Administering Drugs Orally

Another way to administer drugs is orally. In this case, the product is fed or given directly through the mouth. Feeding of drugs requires that all animals eat an adequate amount. 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. Balling guns are used to give boluses, capsules, and tablets. Drenching can also be used to give liquid to cattle.

Beef Quality Assurance Issues

1. **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 when using pharmaceuticals or vaccines. Always use SQ products when available. Do not inject more than 10 ml (cc) of an antibiotic in one site.
2. **Injection equipment:** Disposable syringes and needles should be used. They can be heat sterilized with boiling water. Any disinfectants, including alcohol, should not be used as they will neutralize vaccines (especially modified-live) and will chemically react with some antibiotics.
3. **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 extra-label drugs, work closely with your veterinarian on dosages and withdrawal times. Never use an unapproved veterinary drug in an extra-label manner without consulting your veterinarian. Doing this without direction by a licensed veterinarian is an illegal act. Some drugs (chloramphenicol, diethylstilbesterol, clenbuterol, furacin spray, and other drugs) are illegal and cannot be used in food animals.
4. **Drug and vaccine storage:** Purchase fresh vaccines and store in a refrigerator. Examine expiration date. Use transfer needle to reconstitute vaccines.
5. **Records:** Careful records should be kept for all treatments and vaccinations. The records should include the date, product used, dosage, route of administration, injection area, and withdrawal date.

See the Cooperative Extension publication, ID-140, *Kentucky Beef Quality Assurance Program* manual for more specific information.

Biosecurity Protection

Biosecurity management practices are designed to reduce or prevent the spread and movement of infectious diseases onto your operation. 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. 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
- blistering around an animal's mouth, nose, teats, or hooves (must rule out foot and mouth disease)
- large numbers of animals suddenly going off feed.

Isolation

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 three weeks. Always isolate sick cattle and return them to their original group when they have recovered.

Sanitation

Sanitation reduces/eliminates exposure to infectious agents. Beware of using instruments and equipment on healthy animals following their use on sick or infected animals (for example, Anaplasmosis). Be aware when working sick animals, and try to work healthy animals before sick animals during the day. Rodents and other wildlife are capable of carrying diseases within a herd. Keep feed areas clean, and bait to hold down the population of rodents. Place dead animals in a location that allows rendering trucks access without cross-contaminating healthy cattle. Employees and vehicles should not travel from dead cattle without cleaning and disinfecting.

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 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 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 you use, you must decide on a numbering scheme if your records are to be meaningful. 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, you could use this 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 6-15).

Table 6-15. International year/letter designations.

Year	Letter	Year	Letter*
2004	P	2011	Y
2005	R	2012	Z
2006	S	2013	A
2007	T	2014	B
2008	U	2015	C
2009	W	2016	D
2010	X	2017	E

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

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. You can purchase prenumbered tags. If you number your own, be sure to use ink that will bond to the tag, and allow adequate time for it to dry.

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. Number tags no later than the day before they are to be used.
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 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 (for example, chlorhexidine) 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 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 you wish 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. You can apply the ink with a roll-on applicator, or rub it in with your thumb or an old toothbrush.

Branding

Brands used for individual animal identification usually consist of three or four numbers. Hot-branding permits quick identification of an animal from a distance. 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 seem to be: (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.

1. 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).
2. Put irons in Styrofoam cooler(s), cover the head of the irons with alcohol, then add chunks of dry ice.
3. Wait until frost creeps up the shaft of the iron (around 10 minutes).
4. Then put cattle in the chute.
5. Brush and clip the brand site.
6. Saturate the brand site with alcohol.
7. 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.
8. Return iron to the cooler. Do not re-use an iron until the iron has been re-chilled for at least a minute.
9. 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.

Hot-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 helps discourage cattle rustling and serves as the cattle owner's trademark. It has the disadvantages of lowering the value of the hide and is painful to the animal.

Step-by-step procedure for hot-branding:

1. Restrain the animal. Place the animal in a squeeze chute with a head gate. Apply tension to the squeeze mechanism to prevent the animal from moving.
2. Heat the irons. Electric irons may be used; these require a 110-volt outlet. Electric irons heat in about 90 seconds and maintain a constant heat. A set of electric irons consists of three irons with three numbers on each iron; thus, three outlets are required to keep all irons hot. Regular irons (iron or steel) may be heated with a propane gas burner or a wood fire. The gas burner is usually built inside a drum to help contain the heat and is hooked to a propane tank for a constant fuel source.

A properly applied freeze-brand on dark-colored cattle makes an effective method of identification.

3. Check the temperature of the irons. A properly heated iron looks ash-gray in daylight but glows when held in a dark place, such as the bottom of a 5-gallon bucket. A black iron is too cold. It might be hot enough to burn the hair but will not form a permanent brand. A red-hot iron is too hot and should be allowed to cool until the ash-gray color appears.
4. Apply the iron. Firmly press the branding iron against the hide, and rock the handle gently to vary the pressure and obtain uniform application of the entire character.

The iron should be applied to the hide just long enough to burn the hair and outer layer of skin. This generally requires about five seconds, depending on the age, hair cover, and iron temperature. New brands should be the color of saddle leather (light tan).

Repeat this step until the animal is branded with all the desired characters.

Tips for better brands:

- **Do not** brand wet animals. An iron applied to wet hair loses temperature rapidly and tends to scald rather than burn the hide; this results in a scar that is slow healing and hard to read.
- **Do not** permit the iron to slip or slide during application, or a blotch will result.
- Clip hair over the brands in fall or winter before the calving season begins.

Implants for Beef Calves

Growth-stimulating implants offer the commercial producer a fast, easy-to-use method of increasing weight gain of calves (Tables 6-16, 6-17, and 6-18). They have been proven effective through research as well as in the beef industry. Implants are approved by the U.S. Food and Drug Administration for use in beef cattle. There is no meat withdrawal time for any implants.

Implants are placed underneath the skin on the back of the ear. They appear to exert a positive effect by increasing growth hormone and insulin, resulting in increased formation of muscle tissue and decreased fat. Growth hormone is naturally produced by the pituitary gland and is an important regulator of growth. Implants generally increase the rate of gain by 4 to 8%.

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. Research has shown that suckling male calves implanted at castration weighed as much at weaning as nonimplanted bull calves of the same age. Although bull calves weigh more at weaning than nonimplanted steers

Table 6-16. Implants for nursing calves available in the United States (January 2005).

Product	Ingredients	Dosage (mg)	Indications
Component E-C (VetLife)	Estradiol benzoate Progesterone	10 100	Suckling steer and heifer calves > 45 days old, < 400 pounds
Component E-C with Tylan (VetLife)	Estradiol benzoate Progesterone Tylosin	10 100 29	Suckling steer and heifer calves > 45 days old, < 400 pounds
Compudose (VetLife)	Estradiol Oxytetracycline	25.7 0.5	Suckling and pastured growing steers; reimplant in 200 days
Encore (VetLife)	Estradiol Oxytetracycline	43.9 0.5	Suckling and pastured growing steers; reimplant in 400 days
Ralgro (Schering-Plough)	Zeranol	36	Suckling calves, including replacement heifers > 30 days old; reimplant in 100 days
Synovex C (Fort Dodge)	Estradiol benzoate Progesterone	10 100	Suckling steer and heifer calves > 45 days old, < 400 pounds

Table 6-17. Implants for weaned stocker and feeder cattle available in the United States (January 2005).

Product	Ingredients	Dosage (mg)	Indications
Component E-H (VetLife)	Estradiol benzoate Testosterone	20 200	Stocker or feedlot heifers
Component E-H with Tylan (VetLife)	Estradiol benzoate Testosterone Tylosin	20 200 29	Stocker or feedlot heifers
Component E-S (VetLife)	Estradiol benzoate Progesterone	20 200	Stocker or feedlot steers
Component E-S with Tylan (VetLife)	Estradiol benzoate Progesterone Tylosin	20 200 29	Stocker or feedlot steers
Component TE-G[1] (VetLife)	Estradiol Trenbolone acetate	8 40	Pasture cattle: slaughter, stocker, and feeder steers and heifers
Component TE-G with Tylan[1] (VetLife)	Estradiol Trenbolone acetate Tylosin	8 40 29	Pasture cattle: slaughter, stocker, and feeder steers and heifers
Compudose (VetLife)	Estradiol Oxytetracycline powder	25.7 0.5	Pastured growing steers; confined steers and heifers; reimplant in 200 days
Encore (VetLife)	Estradiol Oxytetracycline powder	43.9 0.5	Suckling and pastured growing steers; confined steers and heifers; reimplant in 400 days
Ralgro (Schering-Plough)	Zeranol	36	Suckling calves, including replacement heifers > 30 days old; reimplant in 100 days
Revalor-G[1] (Intervet)	Estradiol Trenbolone acetate	8 40	Pasture cattle: slaughter, stocker, and feeder steers and heifers
Synovex H (Fort Dodge)	Estradiol benzoate Testosterone	20 200	Heifers ≥ 400 pounds; not in replacements
Synovex S (Fort Dodge)	Estradiol benzoate Progesterone	20 200	Steers ≥ 400 pounds
Synovex T40 (Fort Dodge)	Estradiol benzoate Trenbolone acetate	8 40	Pasture cattle: slaughter, stocker, and feeder steers and heifers

[1] Products that have Trenbolone acetate (TBA) require refrigeration and protection from light.

(castrated male calves) of the same age, they generally bring a lower price per pound when sold as feeders.

Research has shown that calves respond to re-implanting. With the exception of Compudose® or Encore®, calves should be implanted every 90 to 100 days. The best approach is to implant calves after 30 days of age when the males are castrated and re-implant midway through the suckling phase, unless a longer-acting implant is used.

If a heifer is to be retained as a breeding replacement, she should not be implanted at or shortly after birth. Two commercial implants are currently approved for use in heifers to be used for breeding, Synovex® C and Ralgro®. Synovex C is restricted to use in heifers 45 days or older and weighing less than 400 pounds. Ralgro is restricted to use in heifers 30 days of age and older.

The active ingredient in Ralgro is zeranol, derived from a mold commonly found in corn. Although it functions through the hormonal system, it is not a hormone itself. Ralgro is approved for suckling calves (from birth) of either sex that are not intended for use as breeding animals; in replacement heifers once between 30 days of age and weaning; weaned beef calves; growing beef cattle, feedlot steers, and heifers.

The more aggressive the implanting program (higher potency, i.e., suckling calf < stocker cattle < feedlot), the greater the effect 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:

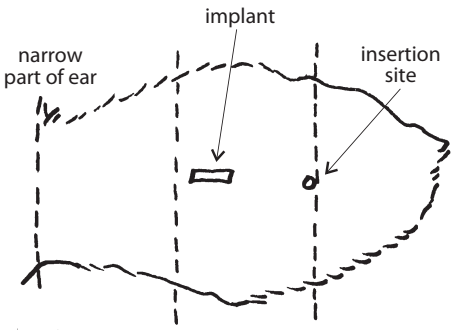
1. Properly restrain the animal.
2. Determine which ear you want to implant, and adjust the implant instrument so the needle can be positioned next to and parallel to the ear, with the slant side of the needle facing outward. Implant all calves in the same ear to minimize confusion.
3. Select the proper implant site on the back of the ear (Figure 6-4). 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).

Table 6-18. Implants only for feedlot cattle[1] available in the United States (January 2005).

Product	Ingredients	Dosage (mg)	Indications
Component TE-H[2] (VetLife)	Estradiol Trenbolone acetate	14 140	Feedlot heifers
Component TE-H with Tylan[2] (VetLife)	Estradiol Trenbolone acetate Tylosin	14 140 29	Feedlot heifers
Component TE-IH[2] (VetLife)	Estradiol Trenbolone acetate	8 80	Feedlot heifers
Component TE-IS[2] (VetLife)	Estradiol Trenbolone acetate	16 80	Feedlot steers
Component TE-S[2] (VetLife)	Estradiol Trenbolone acetate	24 120	Feedlot steers
Component TE-S with Tylan[2] (VetLife)	Estradiol Trenbolone acetate Tylosin	24 120 29	Feedlot steers
Component T-H[2] (VetLife)	Trenbolone acetate	200	Feedlot heifers
Component T-H with Tylan[2] (VetLife)	Trenbolone acetate Tylosin	200 29	Feedlot heifers
Component T-S[2] (VetLife)	Trenbolone acetate	140	Feedlot steers; reimplant once after 63 days
Component T-S with Tylan[2] (VetLife)	Trenbolone acetate Tylosin	140 29	Feedlot steers; reimplant once after 63 days
Component TE-200[2] (VetLife)	Estradiol Trenbolone acetate	20 200	Feedlot steers
Duralease (Merial)	Estradiol benzoate	20	Feedlot steers and heifers
Finaplix-H[2] (Intervet)	Trenbolone acetate	200	Feedlot heifers; last 63 days prior to slaughter
Ralgro Magnum (Schering-Plough)	Zeranol	72	Feedlot steers
Revalor-H[2] (Intervet)	Estradiol Trenbolone acetate	14 140	Feedlot heifers
Revalor-IH[2] (Intervet)	Estradiol Trenbolone acetate	8 80	Feedlot heifers
Revalor-IS[2] (Intervet)	Estradiol Trenbolone acetate	16 80	Feedlot steers
Revalor-S[2] (Intervet)	Estradiol Trenbolone acetate	24 120	Feedlot steers
Revalor-200[2] (Intervet)	Estradiol Trenbolone acetate	20 200	Feedlot steers and heifers
Synovex Choice[2] (Fort Dodge)	Estradiol Trenbolone acetate	14 100	Feedlot steers
Synovex Plus[2] (Fort Dodge)	Estradiol benzoate Trenbolone acetate	28 200	Feedlot steers and heifers
Synovex T80[2] (Fort Dodge)	Estradiol benzoate Trenbolone acetate	16 80	Feedlot steers
Synovex T120[2] (Fort Dodge)	Estradiol benzoate Trenbolone acetate	24 120	Feedlot steers

[1] Implants listed in Table 6-17 can also be used in feedlot cattle.
[2] Products that have Trenbolone acetate (TBA) require refrigeration and protection from light.

Figure 6-4. Site of insertion for implants.



Source: Burris et al., 1990. Growth Stimulating Implants for Beef Cattle. ASC-25. Lexington, KY: University of Kentucky Cooperative Extension Service.

5. Determine whether the ear is clean or dirty. If the ear is dirty:
   a. Scrape surface contamination with serrated knife.
   b. Use a clean sponge to wash site with disinfectant solution.
   c. Use a brush/toothbrush with disinfectant solution to make two to three brush strokes in one direction at implant site.
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 you.
7. Use the tip of the needle to prick the skin, lift slightly, and completely insert the needle under the skin.
8. Pull the instrument and needle back to create a space for the implant, unless using an implanter with a retractable needle.
9. Depress the plunger of the implant gun, and withdraw the needle with the plunger still depressed.
10. Feel the ear for the implant under the skin to see that it is inserted properly.

Precautions

- When the ear is grasped and the needle inserted, the animal may throw its head. This can be prevented by using a headgate equipped with a head and nose bar or a halter.
- Avoid piercing or cutting ear veins with the needle.
- Do not allow the needle to gouge or pierce through the cartilage. If you feel resistance as you insert 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 gain.
- Never sacrifice a careful implantation technique for speed.
- All implants come with instructions for implanting and proper handling. Review all instructions carefully before implanting.

The products named in this section should be available through animal health and farm supply stores or your veterinarian.

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.

Growth-stimulating implants offer the commercial cow-calf producer a fast, easy-to-use method of increasing weaning weight of calves.

Bull calves should be castrated as soon after birth as possible. You can castrate calves at birth when they are ear-tagged. In some herds, it is not easy or practical to castrate that early because herd sire prospects will not be selected until weaning. However, older and heavier bulls generally bleed more and suffer more setback in weight gain.

- **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 not** keep calves in a barn on a filthy manure pack after castration because of increased chances of infection.

There are several methods of castration. All of the surgical methods accomplish successful removal of the testicles but not all of them permit the scrotum to drain properly while healing.

Knife castration is the most common method used. Two variations are generally used: cutting off the lower third of the scrotum or slitting the scrotum down the side. A scalpel blade or sharp and sterile pocketknife works fine for making the incision. However, specially designed castration knives are available, such as the Newberry® knife, which cuts side to side.

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 your hands to prevent introducing infection. Stretch the scrotum tightly and cut off the bottom one-third of the scrotum. Frequently after the bottom of the scrotum is removed, 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 your 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 have been removed, you can 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 may become staggy (have some of the physical characteristics of a bull) if the procedure is not done properly.

Clamping is best done 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. 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 decreased carcass value when finished. Tetanus may occur, so a tetanus toxoid vaccine should be given when applying the band. If the calf is banded at less than three weeks of age, the tetanus toxoid vaccine may not be necessary. When the bands are old or have been improperly stored, they may not be effective in cutting the circulation. If the bands are properly applied, the entire scrotum will drop off, resulting in a small or nonexistent cod in the finished animal, which is not desirable. Because of all of these potential problems, this method is not recommended.

Additional bloodless methods involve using the Callicrate bander or EZE bloodless castrator. Both are similar and have their best use on older, larger bulls. Both methods use elastic tubing that is drawn very tightly around the scrotum above the testicles. When using the EZE castrator, 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 both methods include tetanus and the possibility of a large infected, painful, necrotic, and flyblown scrotum if the tubing is not tight enough. Tetanus toxoid vaccine should be given before or at the time of castration with both 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 best when based on age. However, if you do not know how old a cow is, it is sometimes possible to estimate its age. For example, if you were to purchase a group of "4- or 5-year-old" cows, it would be an expensive lesson to learn they were actually 10 years old or older. The appearance of the teeth gives an indication of how old cattle are.

Only the front "cutting" teeth (incisors) are important in calculating age. Of course, the cow has no upper incisors. The eight incisors on the lower jaw appear at different times and exhibit varying degrees of wear depending on age.

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 19 to 20 months of age, the first permanent incisor tooth appears. By 24 months, the center incisors are fully erupted and in line. The following pattern of growth and wear appears after two years of age.

- 2 years—the central permanent incisors (pinchers) attain full development.
- 2½ years—the second set of incisors (one on each side of the pinchers) is cut. They are fully developed by age 3.
- 3½ years—the third set of incisors is cut. They are fully developed and begin to wear at age 4.
- 4½ years—the fourth set (corner teeth) is replaced. By age 5, they are fully developed.

Age determination past 4½ years is less accurate and is mainly related to wear on the surface of the eight incisor teeth. 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 7; that is, the gum begins to recede from the base of the teeth. By the tenth year, the corner teeth show noticeable wear. By the twelfth year, the row of teeth appears to be in a nearly straight line, as opposed to the normal arch, and shows 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.

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 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. Do it early when little or no cutting is required!

The central permanent incisors (pinchers) attain full development in a 2-year-old heifer.

The second set of incisors (one on each side of the pinchers) are fully developed by age 3. Note the "baby" teeth on the outside of the four permanent teeth. This pair of teeth will be replaced at 3½ years and fully developed by age 4.

This cow is 7 years old. She has four pairs of permanent teeth. The center pair begins to wear at 5, the second pair at 6, and the third pair at 7. The corner teeth will begin to wear at age 8.

It is also best 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.

A caustic paste or stick can be used on very young calves (up to two or three weeks of age), where only a button can be felt. Clip the hair around the base of the horn. Then clip off the end of the horn button with a sharp pocketknife so the dehorning chemical can penetrate the horn. Apply a ring of petroleum jelly around the base of the horn button to protect the skin. Apply the caustic stick or paste according to label directions. Rub the caustic stick on the horn until blood appears. Keep the calf away from its dam until the treated area has hardened and dried.

Spoon, tube, or knife 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 plus 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.