AN173

UF UNIVERSITY of FLORIDA
IFAS Extension

Florida Cow-Calf and Stocker Beef Safety and Quality Assurance Handbook:Quality Control Points[1]

Todd A. Thrift, Matt J. Hersom and Max Irsik[2]

This publication is currently only available online in pdf format, http://edis.ifas.ufl.edu/pdffiles/AN/AN17300.pdf. This section includes pages 43-91 of the complete handbook.

Breeding and Genetic Selection

Utilization of Animal Health Products and Practices

Best Management Practices - Vaccination

Best Management Practices - Implant use

Processing/Cattle Handling

Best Management Practices - Cattle handling

Nutrition

Culling Management

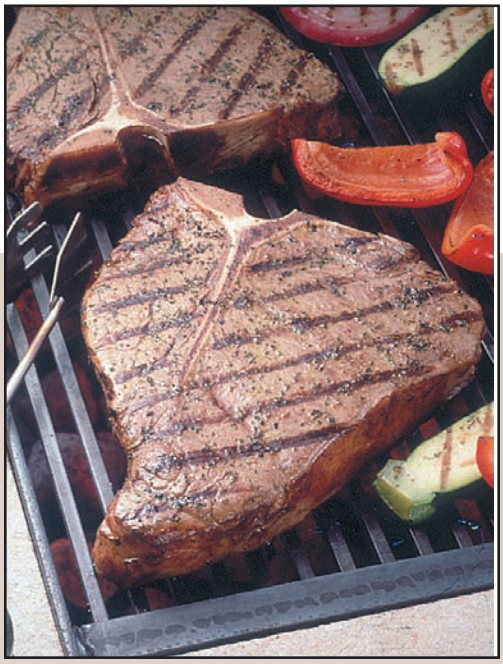
Best Management Practices - Culling management

All sections of the handbook are listed at http://edis.ifas.ufl.edu/TOPIC_BOOK_BSQA

1. This document is AN173, one of a series of the Animal Science Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. Original publication date October 2006. Revised October 2006. Visit the EDIS Web Site at http://edis.ifas.ufl.edu.

2. Todd Thrift, Assistant Professor, and Matt J. Hersom, Assistant Professor, UF Department of Animal Sciences; Max Irsik, Assistant Professor, College of Veterinary Medicine; Institute of Food and Agricultural Sciences, University of Florida, Gainesville, 32611.

QUALITY CONTROL POINTS



For years, our industry expected feeders and packers to "manage out" many problems created in the cow-calf and stocker segments. Over time, though, we discovered that management and handling by the feeder, packer, purveyor, retailer and consumer – at best – can only be as good as the product provided. The real impact on beef quality comes from daily decisions made at the cow-calf and stocker levels of our industry.

One example of this "it's not my problem" perspective is automatically laying the blame for cattle that don't grade USDA Choice on feedyard management, grain type, days on feed, improper chill time, poor USDA graders and so on.

Your role in quality management

Carcass characteristics, performance and eating quality are all established when bulls are purchased and breeding programs designed. That means cow-calf producers have the ultimate responsibility to provide calves and cull cattle that are as free of inherent defects as reasonably possible.

Regardless of the type of cows used in your breeding herd, sires must complement the herd to provide a sound genetic base for health, performance and carcass characteristics.

Management approaches for quality control points

Quality concerns fall under these five areas:

1. *Breeding and genetic selection*
   - (a) Benchmarking
   - (b) Breeding stock selection
     - i. Sire selection
     - ii. Replacement females
   - (c) Breeding system considerations

2. *Utilization of animal health products and practices*
   - (a) Injection site management
   - (b) Vaccine handling and administration
   - (c) Implant utilization and recommendations
   - (d) Parasite control

3. *Processing/cattle handling*
   - (b) Calf management practices
   - (c) Branding
   - (d) Cattle behavior and facility design

4. *Nutrition*
   - (a) Immune system
   - (b) General health
   - (c) Weaning nutritional management
   - (d) Nutritional stress

5. *Culling management*
   - (a) Cancer eye
   - (b) Horns
   - (c) Branding
   - (d) Lameness
   - (e) Inadequate muscling/excessive fat
   - (f) Bruising

It's not possible to utilize management (feed, vaccine, preconditioning, etc.) to overcome poor genetics; therefore, genetic decisions are the first step in quality control.

Stocker cattle operators should purchase calves with the potential to hit targets of the cattle feeding, packing and retailing segments, and manage them to maintain or enhance quality. Cattle purchased and managed in stocker operations should produce feeder cattle with minimal quality defects.

Management practices and decisions at both the cow-calf and stocker levels can influence carcass weight and cause defects. Temperament and behavior created by improper handling can affect feedyard performance, create bruising and dark-cutting carcasses.

Stocker operators and cattle feeders usually cannot *directly* affect breeding decisions, but their buying decisions affect the demand and price for different types of cattle. These market signals can *indirectly* affect the breeding and management decisions of calf producers. As an example, the number of "black" calves has increased in the last few years. Why?

Market studies in Kansas and Oklahoma have found that black calves received higher prices at auction. This signal (whether right, wrong or indifferent) is partially responsible for the increased use of sires with black color. This fact isn't an advertisement for black cattle; it simply illustrates how market signals are passed back down the system to cow-calf producers.

Obviously, there are numerous other signals in the market. The key is to recognize what the market is placing value on (or not) and determine what that means to your particular operation.

Identifying quality control points in cow-calf and stocker operations

Eliminating the possibility of food safety risks by management of critical control points has already been outlined in detail. The same thought and management processes need to be employed in quality management. The points in the production chain that can influence cattle health and performance and the eating quality of beef are referred to as "Quality Control Points."

Genetic decisions are the first step in quality control.

Without effective genetic, nutrition and health management, cattle are more likely to get sick and require treatment – exposing the operation and industry to potential food safety risks. Therefore, managing quality control points facilitates management of food safety control points.

The challenge is in identifying quality control points that your operation can control and adjusting your management strategies to maintain or enhance quality. Many common points exist for all operations. However, in addition to these common points, listed below, each producer should identify and manage other quality control points unique to his/her particular operation.

Process	Control Point	Potential Quality Concerns
Breeding/genetics	Calf evaluation Sire selection Replacement female selection Breed combinations/systems	Carcass characteristics Health Performance Temperament
Processing/cattle handling	Cow working Calf working Weaning calves Receiving breeding cattle Receiving stocker cattle Shipping cattle	Bruises Hide damage Injection site lesions Carcass characteristics Health Temperament Performance
Parasite control	Internal parasite control External parasite control Hide damage Liver damage	Injection site lesions Health
Nutrition	Forage management Supplementation: Mineral/Vitamin Protein/Energy	Health Carcass characteristics
Culling management	Timely marketing Shipping culls	Carcass characteristics Bruising Condemnation Hide damage Health

Breeding and Genetic Selection

Benchmarking

In developing breeding programs to meet industry and consumer demands for beef, it's first necessary to understand the targets established by the industry. These targets will allow the beef industry, overall, to meet requirements for portion size, different marbling preferences and efficiency in the packing industry. Luckily, these targets are within easy and reasonable reach of the cow-calf sector across a wide array of production areas.

Knowing where to aim is only part of the information necessary to develop a sound breeding program. All cattle do not have to hit *one* specific target. There are several targets in today's beef production system, including markets for high-yielding cattle, high-quality grading cattle, extra-lean cattle, "all-natural" cattle and other niches.

The majority of cattle needed to fit industry demands will be cattle that hit within desirable ranges for quality, yield and muscling. Producers throughout Texas can produce calves and yearlings that meet these targets. Furthermore, relationships between frame size and harvest weight allow producers to design breeding programs that produce calves for a specific target.

Feedyard industry trends point to an increasing number of fed cattle marketed in a system that values cattle based on carcass weight and USDA Quality Grades and USDA Yield Grades. This system penalizes cattle that don't hit specified targets.

Fed Cattle Targets

	Desirable	Undesirable
Carcass weight (lbs.)	650-850	<600 or >950
Quality Grade:	Select or Higher	Standard
Yield Grade	1s and 2s	4s and 5s
Ribeye area	11-16 sq. in.	<10 or >17

For example, price discrimination is increasing for Yield Grade 4 and 5 carcasses as the industry continues to emphasize red meat yield. Also, cattle producing carcasses that are too large or too small cause problems with retail portion sizes, so they are also discounted. And, obviously, carcasses that grade Standard are discounted.

Genetics vs. environment

Carcass traits are moderately to highly heritable. Higher heritability implies that predictable and permanent genetic change can result from selection for improved carcass traits. However, "environment" influences the expression of genetic potential. And, although selection can alter the genetic *potential* for carcass traits, management can influence *expression* of these traits as the calf moves from the ranch through finishing and harvest.

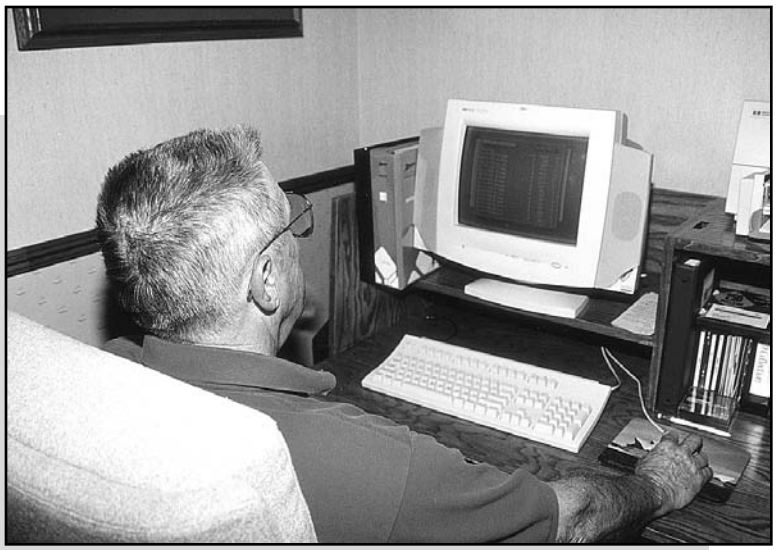
For instance, the genetic potential for carcass weight, red meat yield and marbling are set at conception. However, the age and weight when a beef animal is placed in a finishing program and the growth promotants used during that time can affect carcass weight. Similarly, cattle can be fed to different degrees of fatness, which affects red meat yield from the carcass.

Marbling is influenced by growth promotants, days on feed prior to harvest, health, genetics and other factors. So, cow-calf producers determine genetic potential with their selection and breeding programs. Management of the calf from birth to harvest then influences the expression of genetic potential; but, it's difficult, and in most cases impossible, to enhance desirable traits through management if cattle lack the genetic potential to do it.

Most selection and breeding programs lack information about the performance and carcass traits of their calves and stocker cattle after they leave the ranch. Many breeding decisions are made without knowledge of what changes, if any, are needed or are the most beneficial to the operation.

To effectively measure change, benchmarks must be established. Benchmarking is accomplished by collecting performance and carcass information on calves and stocker cattle after they leave the ranch.

All cattle do not have to hit <u>one</u> specific target.



Networking with calf buyers, stocker operators and feedyards that purchase your calves and feeder cattle is another way to find out how your cattle perform past the ranch gate. In recent years, carcass traits have been the focus of many information feedback programs. However, performance characteristics, such as daily weight gain, feed efficiency and health are also "quality" factors that should be included in your portfolio of information. As the industry adopts electronic ID as a means of tracking animals through the production phases, collection of this performance and carcass information will become common place.

Selecting breeding stock

Sire selection

Practice balanced trait selection when designing breeding programs and purchasing herd sires. With the industry's focus on carcass quality, it's easy to forget the most important characteristic of the cow herd – reproductive and production efficiency.

It's been estimated that the relative economic value of reproduction is five times more important than production (growth) and 10 times more important than carcass merit. With the current emphasis on carcass traits, it's easy to forget that cows must match their production environment.

Emphasis should be given to sire selection because of the bull's ability to produce multiple offspring in one year. In mating systems that retain replacement females, 87.5% of the genetics in the cow herd (after three generations) can be traced to the sires utilized.

In a terminal crossbreeding system, bulls should be selected to best match industry targets for growth and carcass characteristics. If replacement heifers are being produced, sire selection should emphasize maternal traits, with secondary emphasis on growth and carcass traits.

Selection emphasis for specific traits should be based upon benchmark data collected by producers and the market for which cattle are targeted. If carcass traits need to be changed, information is available to help select suitable herd sires. For example, most breeds are collecting EPDs (Expected Progeny Differences) for carcass traits, such as carcass weight, marbling, ribeye area and fat thickness.

However, though EPDs are the best indicator of genetic potential, predictability of change depends on the trait, breed and number of progeny records.

Replacement female considerations

Although most carcass merit improvement results from sire selection, female selection and management also contribute significantly to uniformity and carcass traits in your calf crop.

Uniformity in a calf crop becomes increasingly important when you can market your calves in multiple-head lots and take advantage of higher prices that are generally paid for load lots.

Narrowing the breeding season, culling extremes in cow size and breed type, and selecting for a consistent color pattern can improve your calf-crop uniformity.

Breeding system considerations

All breeds have relative strengths and weaknesses. More rapid genetic change can be made by selecting a breed type that generally excels in traits of interest, as opposed to selection within a breed for the same traits. For instance, if you desire to increase the marbling ability of your calves, utilize sires from a high-marbling breed instead of searching for high-marbling sires in a breed that's not noted for marbling.

As a general rule, the following (documented) breed type characteristics allow producers to combine breeds to best suit their production environment. English breeds, on average, will produce calves with a greater propensity to marble. *Bos indicus* type cows, on average, are more fertile and have greater longevity. Continental breeds produce faster gaining, heavier muscled, larger framed cattle.

In much of Florida, a calf that is produced by a combination of two or three of these breed types can hit carcass targets and produce heifers that fit their production environment. The most appropriate combinations of breed type varies across the state.

As a general rule, logical breed combinations for market calves would include a minimum of 1/4 English, maximum 1/2 Continental, no more than 1/4 *Bos indicus* and no more than 1/4 Dairy. Calves with these breed specifications provide an acceptable mix of growth, muscling and marbling and avoid many of the discounts resulting from buyer perceptions.

Processes, Control Points & Quality Concerns Cow/Calf Production

CONTROL POINTS	Quality Concerns: Health	Uniformity	Growth/ Efficiency	Carcass Damage	Carcass Quality	Hide Damage	Behavior/ Temperament
Breeding & Genetic Selection							
Sire Selection	X	X	X		X		X
Culling/Replacement Females		X	X	X		X	X
Health Products & Practices							
Injection Site Management				X	X		
Vaccine Handling	X		X		X		X
Implant Utilization	X		X		X		
Parasite Management	X			X		X	
Processing & Handling							
Calf Management Practices	X	X	X	X	X	X	X
Branding				X			
Handling & Facility Design	X	X	X	X	X	X	X
Nutrition	X	X	X		X		X
Culling Management							
Health				X X			
Body Condition				X	X	X	

X - indicates there is likely an interaction between the corresponding Process and Quality Concern

The Target

Ribeye area	**14 sq in**
Carcass wt.	**775 lb**
Live Wt.	**1225 lb**
Backfat	**0.4 in**
Yield Grade	**2.0**
Quality Grade	**Ch**

14 in2 REA/1.8 in2 per cwt carcass = 778 lb
778 lb carcass/63.5 (DP) = 1225 lb live wt.

FRAME SCORE		MATURE WEIGHT[1]		CH HARVEST WT.[2]		CARCASS WT.	
		Cows	Bulls	Steer	Heifer	Steer	Heifer
4	45″	1110	1775	1105	945	705	605
5	47″	1200	1920	1200	1020	762	662
6	49″	1295	2070	1295	1100	822	722
7	51″	1400	2240	1390	1190	889	789

1- Estimated @ BCS of 5. Bulls = 160% of cow weight
2 - Determined by 0.5 in. backfat.
Numbers to right of frame score are hip height (in.) for heifers @ 12 mos. of age

Utilization of Animal Health Products and Practices

Injection site management

The administration of practically all injectable animal health products can cause tissue irritation and result in an injection site lesion. There are three types of lesions that result from injections: active fluid-filled, woody callous, and discoloration.

The first type, an active fluid-filled lesion, is the result of a) an accumulation of white blood cells and fluid (immune response to the product) or, b) an abscess due to improper injection techniques. Public perception often refers to these lesions "tumors." The incidence of active, fluid-filled lesions has dropped significantly since it was targeted with a national education and awareness campaign in 1991.

The second type, a woody callous lesion, is a connective tissue scar that remains after an active fluid-filled lesion has healed. These scars are visible for several months to years after the injection was given. Although the scar tissue looks like fat and can be removed by trimming, research has documented that tenderness of the surrounding muscle tissue is reduced significantly.

While the actual lesion may be small, tenderness will be affected in a 3-4 inch radius around the lesion. A single injection can negatively affect the tenderness of several retail portions. Injectable antibiotics, vaccines and anthelmintics can produce injection site lesions.

The third type of lesion is actually a discoloration of the muscle tissue. Apparently, components within certain vaccines react with gases in the modified atmosphere packaging used in retail meat cases today. This blemish is not apparent during the fabrication and packaging of retail beef products. Blemishes materialize during transport to the retail store and preclude the product from being displayed in the retail meat case. The primary retail cuts affected are top blade steaks and the beef clod, indicating that injections are being placed in the front or top of the shoulder rather than in the neck.

Injection site lesions are not limited to calves and fed cattle; it's also a significant problem in cull bulls and cows. Annual revaccination of breeding animals exposes them to numerous injections over their productive lives. The good news is that management through employee training can eliminate injection site lesions and related tenderness concerns.

Vaccine handling and administration

Calves moving through the production chain must stay healthy. Period. Sickness requires treatment and increases the probability of death loss, poor performance, injection site lesions and residues. Proper handling/administration of vaccines is a critical component of Beef Quality Assurance.

It's not uncommon to hear about ranches having poor results with their vaccination programs. There are numerous explanations for these failures; for example, exposure to high levels of pathogens, stress level, age, nutrition, genetics and vaccine failure. Generally, vaccination failure at the ranch level is the result of improper vaccine handling and administration.

The highest quality vaccine available is useless if it's not handled and administered properly. Even experienced producers overlook many key aspects when preparing and administering vaccines. With the increased use of Modified Live Virus (MLV) and Chemically-Altered (CA) vaccines, you need to re-evaluate how everyone involved with your operation handles products.

Both MLV and CA products must be reconstituted with a sterile diluent prior to being administered. These products are routinely used in the stocker and feeder segments of our industry with excellent response. However, their processing speed is considerably faster than on most cow-calf operations. Their processing facilities are also more likely to be sheltered from exposure to environmental hazards during processing. Most cow-calf operations lack covered or protected working facilities. Therefore, ranchers must exercise more caution when handling and administering MLV or CA products. Many common handling techniques can render MLV products inactive and even greatly reduce the effectiveness of Killed (K) vaccines.

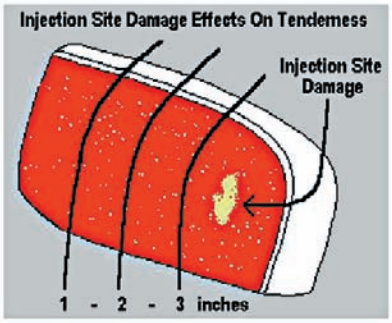
Remember, vaccination alone does not guarantee immunization.

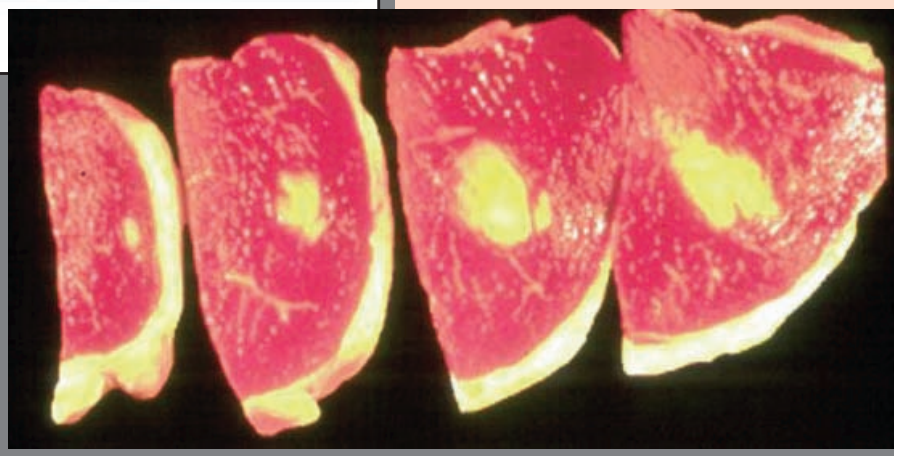
Purchase vaccines from a reputable dealer. A vaccine will be less than 100% effective if it has *ever* been stored improperly. Improper storage includes freezing and/or exposure to heat or sunlight. Maintaining a high level of efficacy is critical to establishing immunity in a majority of vaccinated cattle.

For example, if the vaccine is only 80% effective, and 80% of the cattle respond to the vaccine, then only 64% (80% x 80%) of the vaccinated animals are protected against the targeted pathogen. Management practices can increase the percentage of cattle that respond to vaccine, and greater efficacy of the vaccine greatly enhances immune response. Reducing vaccine exposure, cattle stress and improved nutritional management, along with proper timing of vaccination, will increase the response rate to the vaccine.

He may have ruined 4 steaks.

- The lesion of scar tissue can be trimmed (at a cost), but the producer just caused this meat to be less tender up to three inches away from the injection site.





Series of woody or callous lesions

Active fluid filled lesions

Discoloration lesion

Keep it cold and in the dark

When purchasing an animal health product, always transport it in a closed, refrigerated container. Refrigerate your vaccine and shield it from ultraviolet light (UV) at all times until it's administered to an animal. Use cold packs during transport and chuteside storage of vaccine. These should be available to you at the point of purchase.

Protect vaccine chuteside

Most ranches fail to handle vaccines correctly at the time of vaccination. Always keep the vaccine cool while you process cattle. Keep the working bottle in a cooler with syringes. A working bottle is the mixed product from which the vaccine is drawn into a syringe. Store all unused and unmixed product in a closed, refrigerated container until it's needed.

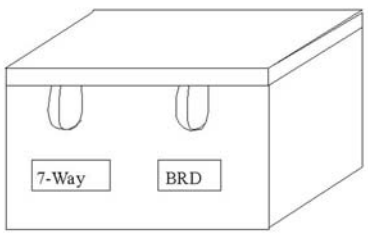
Never mix either MLV or CA product before it is needed. Mix only enough to be administered within one hour. Mixed vaccine begins to lose effectiveness in a relatively short period of time. On small operations, it's advisable to purchase vaccines in smaller containers (5-10 dose bottles) and mix as needed. Although larger-dose bottles are generally less expensive per dose, their use often results in leftover product. Partially used bottles should not be saved.

Protect vaccine from heat and light

Avoid exposure of vaccine and syringes to heat. Do not allow vaccine or syringes to sit in direct sunlight, even for a short time. Sunlight and ultraviolet light will destroy vaccines. Always cool syringes before the initial draw of vaccine. Carrying syringes in the cooler while going to the working facilities will allow sufficient time for the syringe to cool.

Do not leave syringes on top of working tables, barrels or tailgates while performing other processing chores at the chute. Figure 2 illustrates one method to keep syringes cool and out of direct sunlight while maintaining easy accessibility to them. A cooler, as shown, keeps syringes from prolonged exposure to UV light throughout processing. If any delay occurs in processing, place syringes back in a cooler immediately.

Figure 2



"Working Cooler" for holding syringes and vaccine.

Don't disinfect with chemical sterilants

Do NOT clean/disinfect syringes or needles with chemical sterilants or disinfectants. Many of these products will kill MLV vaccines and cause damage to Killed vaccines. Do NOT use products like alcohol, soap, Lysol, Betadine, Nolvasan or Chlorox to clean or disinfect the syringe.

Any sterilant other than boiling water will leave a residue in the syringe, altering the effectiveness of the vaccine it contacts. Although this contamination predominately affects the first draw, it could impact the immunization of several animals. A 50cc syringe would impact from 10 to 25 animals, depending on whether it was a 5cc or 2cc dose rate.

Disinfect syringe components in boiling water. Multiple-dose syringes need to be completely disassembled and cleaned after each working. After sterilizing, reassemble syringes and store in a clean, dry environment until needed. If not, resterilize prior to next use. Many continuous-feed syringes cannot be cleaned effectively because they cannot be disassembled and boiled. However, drawing boiling water through the syringes and feeder tubes can clean them.

Syringe selection, utilization and cleaning

Selecting the appropriate syringe is very important to developing a sound vaccination program. Plus, proper syringe handling does not add significantly to processing time. Multiple-dose syringes, such as shown in Figure 3, or sterile, disposable syringes, are appropriate for administering vaccines.

To help prevent contamination of the remaining vaccine in your working bottle, never enter a bottle with a used needle. When using multiple-dose guns, the needles should be changed each time the syringe is refilled. This practice prevents contamination of the bottle and ensures that you're using a sharp needle.

Continuous-feed syringes reduce the chance of contaminating vaccines by accidentally drawing product from the wrong bottle. These syringes are harder to clean and it's very difficult to keep all components of a continuous-feed syringe sheltered from exposure to the elements. If continuous-feed syringes are used, the bottle, hose and syringe must be protected from exposure to UV light.

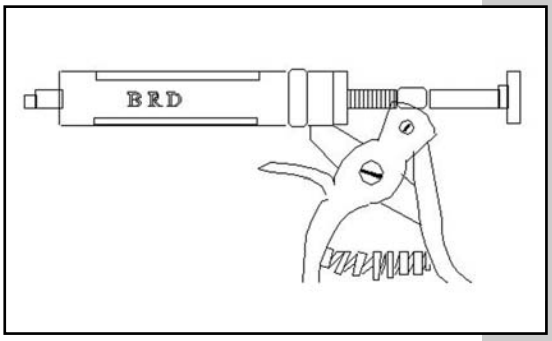


Figure 3. **Multiple-dose syringe**

Many times, these bottles and syringes are suspended chuteside in direct sunlight and exposed to heat during processing. This deteriorates the vaccine and animals are not immunized adequately. A better use of continuous-feed syringes is for administering less sensitive materials like dewormers.

Sterilized disposable plastic syringes ensure a sterile delivery instrument. These plastic syringes are a very accurate single-dose delivery system. It is best to utilize a syringe size that closely matches the dose, and draw a single dose for each individual animal. Disposable syringes are often used for multiple-dose delivery and result in inaccurate dose delivery.

For example, a 10cc syringe filled with vaccine is not appropriate for administering a 2cc dose to five head. Administering multiple doses in this manner often leads to over- or under-dosing. The problem is magnified when using larger-dose syringes. When using disposable or single-dose syringes for vaccinations, purchase vaccines in the smallest available bottle size to reduce the risk of contaminating product.

Lubricate with first vaccine draw (No petroleum-based products)

Use the first draw of vaccine to lubricate the syringe. Do not lubricate syringes with silicone, mineral oil, Vaseline® or any other lubricant. All of these lubricants may inactivate MLV or CA product. These products may also alter the quality of Killed products. If the plunger and stopper are difficult to move without lubricant, replace the syringe, or at least the stopper.

Inspect and maintain equipment

Always inspect syringes prior to processing. Check the barrels for chips or cracks that would lead to leakage and under-dosing. Check calibration and dosage setting prior to – and continuously throughout – the process. Some multi-dose syringes are not accurate enough for 2cc dose products.

Even slight changes in working components change dose rates. Dosage gauges on some multi-dose syringes can accidentally change volume settings, leading to under- or over-dosing. Adjust the tension on the plunger to prevent leakage. Always keep spare parts available in case something happens to the working syringe. Keep a supply of extra disposable syringes as a backup delivery system.

Mixing and drawing vaccines

When using vaccines that must be mixed prior to use, such as MLV products, mix only as much as can be used in one hour or less. MLV products MUST be used when mixed and CANNOT be stored for later use. Reconstituted Killed vaccines can be stored for short periods of time after initial use, but they should not be kept if anything other than a sterile needle entered the bottle during use.

Use a sterile transfer needle when reconstituting MLV and CA vaccines. Transfer needles can be sterilized and reused. Transfer needles ensure against product contamination during mixing. If a transfer needle is not available, use a sterile syringe to draw the diluent out of the plastic bottle and then place it in the glass vial.

When using a transfer needle, always place the transfer needle in the stopper of the plastic bottle first, then invert the needle and diluent as the other end of the transfer needle is placed in the stopper of the glass vial containing the freeze-dried fraction. After proper mixing, vaccine can be drawn from the glass vial into the dosing gun.

Never refill a syringe using a needle that has been in an animal. This introduces non-sterile matter into the vaccine and contaminates the remainder of the bottle. Adopt the practice of changing needles before filling a syringe to keep needles sharp and prevent contamination of the vaccine.

Label syringes and the cooler box prior to processing to prevent accidental mixing of vaccine when refilling syringes. Accidental mixing will result in under-dosing and may render one or both of the vaccines ineffective. Mixing MLV product with a non-water based Killed product destroys the MLV product immediately.

Never use one syringe to administer antibiotics or dewormers one time, and then MLV, CA or Killed products the next time. *Any* residue can potentially affect the product.

Read labels

Always read label and dosing instructions prior to processing to make certain you're administering the proper dose of each product. Many products have changed their dosage rate or approved route of administration. Some products are now administered in low-dose (2cc) volume to reduce injection site reactions.

Other products are formulated to be delivered in a 5cc dose. Some products may be 2cc when administered alone, but 5cc when additional antigens are included in the vaccine. One example is found in the CA products Cattlemaster®4 and Cattlemaster®4-VL5. Cattlemaster®4 is a 2cc product, while Cattlemaster®4-VL5 is a 5cc product.

Booster vaccines as outlined on the label. To establish immunity, almost all products require a second vaccination two to four weeks after the initial vaccination. If a booster is required, one initial dose will not achieve immunity; it will only provide a brief increase in resistance. Increased and sustained levels of immunity can only be established by boosting initial vaccinations. If the initial program is carried out properly, only an annual booster will be required after the first year.

Take time to become familiar with your products. Also, check for side effects and treatment should they occur. If cattle are affected, there may be little time for action before death occurs.

These are the main factors associated with the success or failure of immunization programs. The recommendations outlined above are meaningless unless the nutrition, stress and genetic components of the immune system are in proper balance.

Adopt the practice of changing needles before filling a syringe to keep needles sharp and prevent contamination of the vaccine.

Best Management Practices – Vaccination

1. Determine target pathogens.

2. Select the most effective vaccine.

3. Prevent exposure of vaccine to heat and UV light.

4. Draw from bottle with sterile needle.

5. Use quality syringes.

6. Inspect and maintain all working components.

7. Administer proper dose.

8. Use proper needle size.

9. Administer recommended route (IM or SubQ).

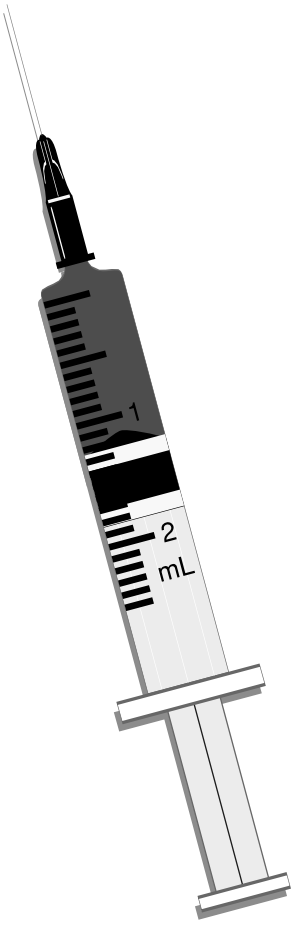
10. Administer in recommended site (neck region).

11. Change needles often to reduce tissue irritation.

12. Always follow label directions.

13. Booster all vaccines when label requires it.

14. Always read directions before starting.



NEVER

1. Leave vaccines in direct sunlight or UV light.

2. Leave vaccines unrefrigerated.

3. Place a used needle in a bottle of vaccine.

4. Place vaccine in hip or round.

5. Assume anything – always check the directions for use.

Implant utilization and recommendations

When used properly, growth-stimulating implants offer the commercial cow-calf producer a fast, easy-to-use method of increasing weaning weights. Implants have been proven safe and effective through both research and actual use in the beef industry.

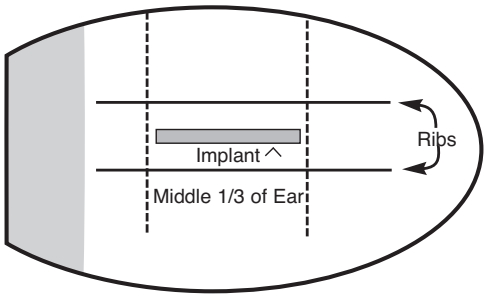
As a general recommendation, implant male calves when they are castrated. Do not implant bull calves. Implanting bulls can arrest the development of reproductive organs, causing sterility, and it does not increase efficiency or rate of gain. Always check label directions for age/weight recommendations for the use of specific implants.

Research has shown that there are no benefits to implanting heifers intended to be kept as replacements. However, there are no detrimental effects of implanting replacement heifers with a single implant after 60 days of age and before they are 6 months old.

Implants are placed under the skin on the back of the ear (See Figure 4 for proper implant placement). The potential benefit cannot be realized if the implant is administered improperly. For example, if the implant site becomes infected, an abscess can develop. The implant may become walled off – preventing absorption.

The abscess also has the potential to push the implant pellets out of the implant site. To prevent abscesses, the implant needle should be disinfected between animals. Sanitation is important, not from a potential impact on meat quality, but on product effectiveness.

Figure 4



Potential causes of implant failures:

- Improper site (in the cartilage)
- Abscess due to poor sanitation
- Missing implant (through the ear)
- Partial implant due to technique or implant gun failure
- Bunched or crushed pellets
- Improper implant storage (exposure to moisture, refrigeration)

Best Management Practices – Implant Use

1. All implants come with instructions for implanting and proper handling. Review all instructions carefully before implanting. There are no withdrawal periods for the implants currently approved.
2. Properly restrain the animal. If cattle are caught properly, just behind the ears in an unmodified head gate, no further restraint is necessary to properly place implants. If proper restraint is not possible with the head gate, use a halter.
3. 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.
4. Select the proper implant site on the back of the ear. Place the implant between the skin and cartilage in the middle third of the ear.
5. Clean the needle with a disinfectant to reduce contamination of the implant site. Use only sharp needles; burrs increase the chance of tissue trauma and infection.

6. Utilize disinfectant to clean the implant site when the site is contaminated with feces, urine or mud. Contamination increases the chance of abscessed implant sites.
7. When possible, implant all calves in the same ear to minimize confusion. Avoid placing implants in the same ear used for ear tags, tattoos or ear notching.
8. Grasp the ear with one hand while the other hand positions the needle parallel to and nearly flush with the ear. Put the point of the needle against the ear with the beveled part facing outward.
9. Use the tip of the needle to prick the skin, lift slightly and completely insert the needle under the skin. 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."
10. Depress the plunger of the implant gun and withdraw the needle.
11. Palpate the ear to determine if the implant was inserted properly.
12. Never sacrifice careful implantation technique for speed.
13. Proper employee training is essential. Cow-calf and stocker operators should be aware of the training programs offered by pharmaceutical companies.
14. Record the date and type (brand name) of implant administered. Stacking implants causes problems with prolapse in heifers. When implanting calves, transferring ownership or retaining ownership into the feedyard, it's important to review your records or inform purchasers or managers about past implant management to avoid future problems.

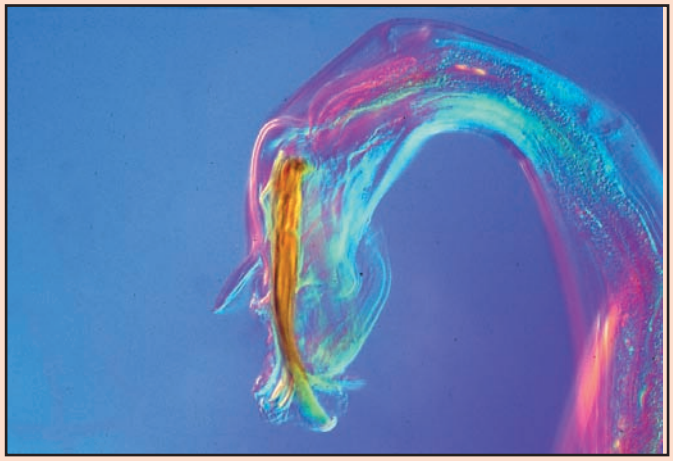
Ear notching can sometimes cause problems for other folks who buy your cattle and want to tag or implant those calves. If a large chunk of one or both ears is missing, as with this red steer, it's awfully hard to put tags and implants where they need to be.

Parasite control

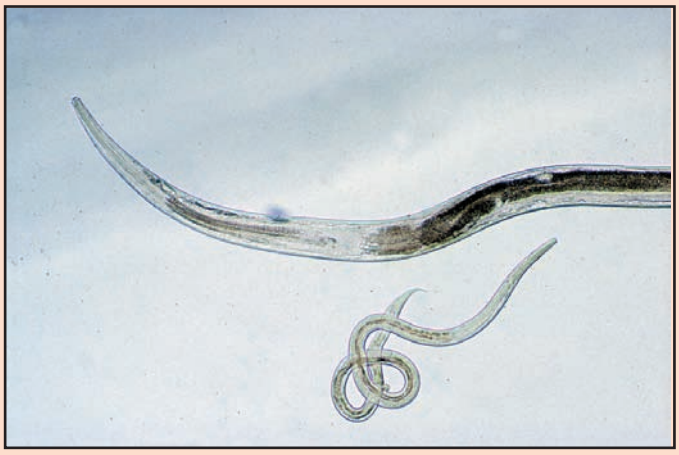
Both internal and external parasites can have an impact on cattle quality. In part, it will be an impact on nutritional status. But it will also impact condemnation of livers, hide quality and muscle damage through parasite migration.

Internal parasites, such as stomach worms, can cause extensive damage to the digestive tract of cattle. The damage can result in impaired digestive function and suppressed absorption of nutrients, leading to deficiencies in energy and protein. Nutrient deficiencies can lead to suppression of the immune system, resulting in poor animal performance and health.

Liver flukes are another common internal parasite in Florida. Infection is generally limited to cattle produced in areas that commonly have standing water, such as river bottom pastures and alkaline soils. Additionally, the presence of an aquatic snail is necessary to serve as the intermediary host for the liver fluke.



Ostertagia Ostertagi can make for a pretty picture under a microscope. However, the damage this parasite can cause to your cattle gets ugly before you can see the outward signs. The bottom photo shows how the worm can grow inside of a cow's gastric gland between day 3 and day ± 15.



Photos provided by Dr. Tom Craig, Department of Veterinary Pathobiology, Texas A&M University.

Many of the major river/flood areas in the southeastern United States are habitat for such snails, and pastures adjacent to these waters are sources of potential infection. A significant number of the stocker and feeder cattle shipped out of Florida originate from fluke-infected areas. A liver fluke infection can reduce animal performance and cause liver condemnation in fed cattle, cull cows and bulls.

External parasites, such as the horn fly and heel fly, are pests that can impact performance and hide quality. Horn fly irritation reduces gains in calves and yearlings and body condition in cows. Horn flies are biting insects that not only affect performance, but can also reduce hide quality due to scar tissue on the surface of the skin. This damage devalues the hide, because it can't be used to manufacture high-quality leather products.

Heel flies also cause annoyance during the spring fly season. Heel fly eggs laid on lower legs of cattle migrate to the skin surface and burrow through the skin. Larvae then migrate through the body and ultimately become encapsulated just beneath the hide, along the back.

At this stage the larvae, or "grubs," require oxygen for further development and burrow through the hide, creating a small hole. Eventually, the larvae migrate through the skin and drop to the ground where they pupate and emerge as heel flies in the spring.

The migrating larvae cause tissue damage, resulting in trim loss and reduced carcass value. The holes in the hides eventually heal, but the scar tissue devalues the hide. Treating cattle one to two months after heel fly activity ceases can control larvae from heel flies.

Beef Quality Assurance is Everyone's Job

Processing/Cattle Handling

Photo by Russell Graves

Processing involves management decisions when working cows or calves, receiving stocker cattle, weaning calves and shipping cattle. Castration and dehorning, immunization, branding, injections and cattle movement are all control points for management.

Not only do these chores need to be done, they must be done correctly. Management practices performed early in life will reduce the chance of stress-related sickness, carcass damage and carcass devaluation.

Calf management practices

Castration and dehorning are recommended management practices for cow-calf producers. On a national basis, castration and dehorning are performed routinely prior to the time calves are marketed. In the south-eastern United States, it's estimated that 50% of calves sold as "steers" are intact bulls.

There is no demand for intact males either in feedyards or stocker operations. Intact bull calves are always castrated prior to grazing or feeding. Intact bull calves gain faster than non-implanted steers, but there is no gain advantage when compared to implanted steers. Management of intact bulls is also difficult due to aggressive behavior. Beef from intact bulls has a coarser texture, lower marbling scores and more variable tenderness.

All bulls that are not herd sire prospects should be castrated as early in life as possible. Early castration is less stressful on bull calves. Preferably, castration should occur between birth and four months of age. Castration of older, heavier animals causes greater stress and increases the chances for surgical complications and bacterial infections. The additional stress can also suppress immune function and increase susceptibility to other diseases.

Regardless of coffee-shop perceptions, there are economic incentives to castrating bull calves prior to marketing. Analyses of auction sales show that lightweight bull calves (under 400 pounds) are discounted less than heavier bull calves and yearlings, but they *are* discounted.

Research in Texas and Kansas has demonstrated that castration of a 550-pound bull calf reduces weight and increases morbidity (sickness), mortality (death rate) and treatment costs. Based on research, "cutter bulls" should be discounted $6 to $7 per cwt. as compared to the same weight steers due to lost production efficiency. Heavier (600 pound) or older (yearling) cutter bulls generally receive price discounts of $6 to $12 per cwt.

Dehorning is as stressful as castration. Horn buds should be removed sometime between birth and 4 months of age. Cattle with horns are the cause of a significant amount of bruising in fed and non-fed cattle. Groups of horned cattle have twice as many bruises as groups of non-horned cattle. Bruises from horns are trimmed out, resulting in lost carcass weight, devalued primal cuts and reduced carcass value.

Not only do horns cause substantial bruise damage (that has to be trimmed from the carcass) to other cattle in the pen, they often cause the head to be condemned during inspection by USDA-FSIS. Head condemnations result in a loss of approximately $18 per affected animal.

Obviously, the use of polled genetics is the easiest and least stressful way to dehorn cattle. Does that imply all producers should breed polled cattle? No. It means that if calves *are* born with horns, electric or surgical dehorners should be used to prevent horn growth (before the calves are 4 months old).

The younger the animal is when these procedures are done, the less it's stressed. Research has shown that dehorning or tipping older calves and yearlings is one of the most stressful management practices.

Like misconceptions about the reality of discounts for intact bull calves, it's also commonly believed that horned cattle do not receive a discount when marketed. Actually, auction market results indicate that horned heifers and steers are discounted $2 to $3 per cwt. As with bull calves, discounts for horns increase with age and weight.

It is likely that a 600 lb bull calf with horns has also received no other management such as, vaccinations, parasite control, etc., so the discount is really poor management!

Branding

For centuries, fire branding has been utilized as a method of animal identification. It is still a very acceptable means of permanent identification to establish proof of ownership. *Placement* of your brand is important because it affects the value of the hide. Ideally, brand placement (freeze brand or hot iron) should be located high up on the hip, close to the tailhead.

This allows the brand to be cut away from the hide without a significant loss of the most valuable portions. In many instances, butt-branded hides sell at prices similar to native (non-branded) hides. Rib brands and multiple brands devalue cattle $5 to $25 per head.

Freeze branding can also be used to identify cattle. However, *improper* freeze branding can scar, similar to a hot iron, which lowers the value of the hide. Improper branding procedures can also create beef quality problems. Brands that are too hot or held too long can result in scar tissue that toughens the underlying muscle tissue. In extreme cases, the brand is visible on the muscle tissue below the hide.

Cattle behavior and facilities design

Cattle handling and facilities design can impact beef quality. Many bruises, dark cutters and other damage to the meat product can be reduced if cattle are handled properly in correctly designed facilities.

Understanding cattle behavior facilitates handling, improves both handler safety and animal welfare, and reduces stress and bruising. Bruising due to improper cattle handling literally costs the industry millions of dollars each year in carcass trim at the packing house.

Low-stress handling decreases shrink and improves the immune system and rumen function, resulting in decreased respiratory disease and lower cost. Mishandling can also develop temperament and behavior problems that are retained throughout the animal's life.

Vision

Cattle have a visual field in excess of 300 degrees. Loading ramps and handling chutes should have solid walls to prevent animals from seeing distractions outside the chute. Moving objects and people seen through the sides of a chute can cause balking or frighten livestock. Solid sides on the crowd pen and alley are especially important if animals are not completely tame or unaccustomed to the facility.

Cattle have a tendency to move from a dimly illuminated area to a more brightly illuminated area, provided the light is not glaring in their eyes. A spotlight directed onto a loading chute that does not glare in the animal's face will improve cattle movement. General soft lighting inside the processing barn/shed will often facilitate entry.

In areas where animals are handled, illumination should be uniform and diffuse. Shadows and bright spots should be minimized. Livestock are sensitive to harsh contrasts of light and dark around loading chutes, scales and work areas. A zebra stripe pattern cast by slatted roof and fences will cause balking.

Cattle have poor depth perception. To see depth on the ground, the animal must stop and lower its head. The pattern of alternating light and dark caused by shadows has the same effect as building a cattle guard in the middle of the facility. Cattle are also likely to balk at sudden changes in color, which can affect depth perception. Handling facilities should be painted one uniform color.

Hearing

Cattle can be handled calmly and moved successfully with minimal amounts of noise. In facilities where cattle are handled, loud noises and other distractions should be avoided. Rubber stops on gates and squeeze chutes reduce noise. The pump and motor on a hydraulic squeeze chute should be located away from the chute. Employees should be encouraged not to vocalize.

Bruising due to improper cattle handling literally costs the industry millions of dollars each year in carcass trim at the packing house.

Flight zone

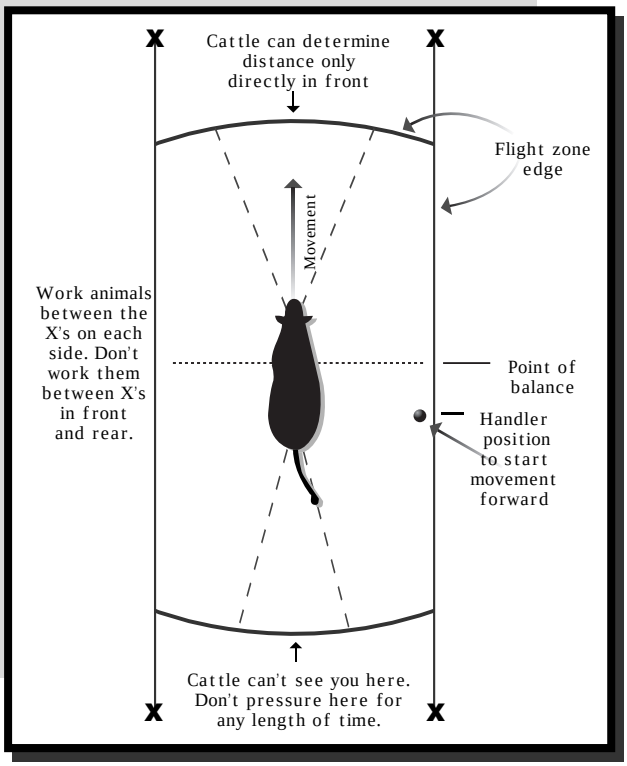
An important concept of livestock handling is the "flight zone." The flight zone is the animal's "personal space." The size of the flight zone depends on cattle disposition and prior handling. Cattle accustomed to frequent handling may have a small flight zone. Extremely tame cattle are often difficult to drive because they no longer have a flight zone.

But the flight zone of range cows may be as much as 300 feet. When a person enters the flight zone, the animals move away. Understanding the flight zone can reduce stress, prevent accidents and injury to handlers, and ease cattle movement and flow (See Figure 5).

The edge of the flight zone can be determined by slowly walking up to the animal. When the handler penetrates the flight zone, the animal will either bolt and run away, or turn back and run past the person. The best place for the person to work is on the edge of the flight zone. To cause the animal to back up, the handler should stand in front of the point of balance (the shoulder).

Cattle sometimes rear up and become agitated while waiting in a single-file chute. This often happens because a person leans over the chute, invading the animal's flight zone.

Figure 5



Herd instinct

Cattle are herd animals and they are likely to become highly agitated and stressed when they are separated from their herd mates. If an isolated animal becomes agitated, other animals should be placed with it. This will calm agitated animals as well as facilitate movement. Allow livestock to follow the leader and do not rush them. If animals bunch up, handlers should concentrate on moving the leaders instead of pushing a group of animals from the rear.

Curved chutes and solid fences

Curved, single-file chutes are especially recommended for moving cattle onto a truck or squeeze chute. A curved chute is more efficient for two reasons. First, it prevents the animal from seeing what is at the other end of the chute until it's almost there. Second, it takes advantage of the natural tendency to circle around a handler moving along the inner radius.

A curved chute with an inside radius of 13-16 ft will work well for handling cattle. Livestock will often balk when they have to move from an outdoor pen into a building. Animals will enter a building more easily if they are lined up in a single-file chute before they enter.

Again, solid sides are recommended on both the chute and the crowd pen, which leads to a squeeze chute or loading ramp. Facilities should also be designed to optimize cattle traction. Cattle remain calmer when they are able to obtain solid footing.

Handling Facility Dimensions for Corral and Working Facilities

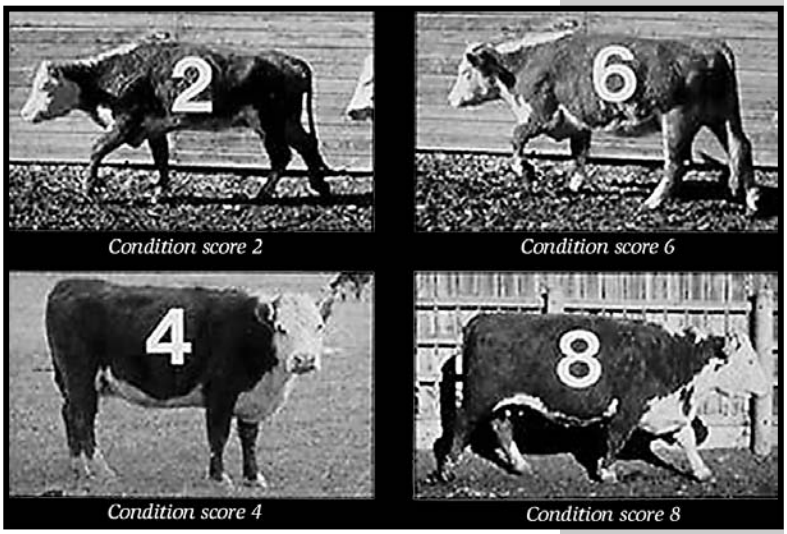
Holding Area (sq. ft. per head)	
Cows	**20**
Calves	**14**
Crowding Pen (sq. ft. per head)	
Cows	**12**
Calves	**6**
Working Chute with Vertical Sides	
Width	**28 to 30 inches**
Length (minimum)	**20 feet**
Working Chute with Sloping Sides	
Width at bottom, inside clear	**18 to 20 inches**
Width at 4 feet height, inside clear	**30 to 33 inches**
Length (minimum)	**20 feet**
Working Chute Fence	
Recommended height (minimum)	**50 inches**
Depth of post in the ground (minimum)	**30 inches**
Corral Fence	
Recommended height	**60 to 66 inches**
Depth of post in the ground (minimum)	**36 inches**
Ramp Height for:	
Stock trailer	**15 inches**
Semi tractor-trailer	**48 inches**
Double-deck trailer	**100 inches**
Loading Chute	
Width	**26 to 30 inches**
Length (minimum)	**12 feet**
Rise, inches per foot	**3 1/2**

Best Management Practices - Cattle handling

1. Using their natural flight zone, cattle can be moved quietly. To move forward, move toward their rear past their point of balance (shoulder). To stop or back up in chute, move forward past their point of balance.
2. Handling facilities should ideally have curved chutes and round crowding pens.
3. Use two or more sorting pens in front of the squeeze chute.
4. Never fill a crowding pen more than three-quarters full; cattle need room to turn around.
5. Cattle should move easily up the chute. If not, hanging chains, shadows, backstops, noises, dogs or people could be preventing movement.
6. Cover the sides of the squeeze chute, especially the back three-quarters, to reduce balking as they enter the chute.
7. Minimize your use of cattle prods (electric and others that bruise). Instead, wave sticks with plastic streamers on the end.
8. Reducing stress on the animal will reduce animal injuries and sickness, employee injury and increase overall efficiency.

Nutritional Management

Nutrition is a broad category involving management of energy, protein, vitamins, minerals and water. Nutritional status of the cow herd has a direct impact on production efficiency, immunity and carcass characteristics of calves.



General health and immune system function

Proper cow nutritional management includes utilizing Body Condition Scores (BCS) to monitor herd nutritional status. Target a BCS 5 or higher at calving for optimum production and for cow and calf health. Cows calving below a BCS 5 produce less volume of colostrum, lower-quality colostrum and decreased milk production.

Additionally, calves born to these cows are slower to stand and nurse and are more susceptible to cold stress. This results in decreased colostrum consumption, reduced antibody absorption and reduced passive immunity. For maximum passive transfer, calves should nurse within four hours. Although some absorption can occur during the first 24 hours, efficiency of antibody absorption decreases after the first two hours.

Lower body condition will affect passive transfer, resulting in lower maternal antibody protection and decreased neonatal calf resistance to disease. Calves born to thin cows have increased susceptibility to calf scours and lower stores of brown adipose tissue, resulting in higher morbidity and mortality during the first two weeks of life. Immunocompromised calves have an increased risk of sickness when exposed to stress and pathogens throughout their life.

Nutritional stress can and will mask the expression of immunity in cattle exposed to infectious pathogens. The most critical nutritional consideration is the protein and energy balance. When adequate protein and energy are available, digestion is enhanced and mineral digestion and absorption is adequate in most instances. Adequate levels of most B vitamins are synthesized when microbial activity is high.

In most cow-calf production systems, protein is the first limiting nutrient. Deficiencies in protein intake affect total forage intake, energy digestion, microbial protein synthesis and vitamin synthesis by rumen microflora. It is important to stress that protein and energy requirements must be met before the impact of minerals or vitamins can be determined.

Minerals are necessary for microbial synthesis of protein and energy, maintenance of forage digestibility and electrolyte fluid balance in the animal. Minerals also play an important role in metabolic pathways and immune system function. Imbalances in mineral intake interfere with the development and function of the immune system, even when adequate levels of protein and energy are supplied.

Trace minerals known to be involved in immune system function include copper (Cu), zinc (Zn), selenium (Se), iodine (I), iron (Fe), molybdenum (Mo) and sulfur (S). Other trace minerals may have an indirect affect on immunity because of antagonistic interactions with essential minerals. For example, elevated levels of S, Fe or Mo will interfere with the digestion and absorption of Cu. Copper is critical in the function of the immune system.

The accompanying graph (Figure 6) illustrates how trace mineral deficiencies impact the immune system before affecting growth or fertility. Immune function, growth and fertility are depressed before clinical symptoms normally associated with mineral deficiencies are evident. Producers cannot afford to wait until clinical symptoms are expressed before initiating changes in nutritional management.

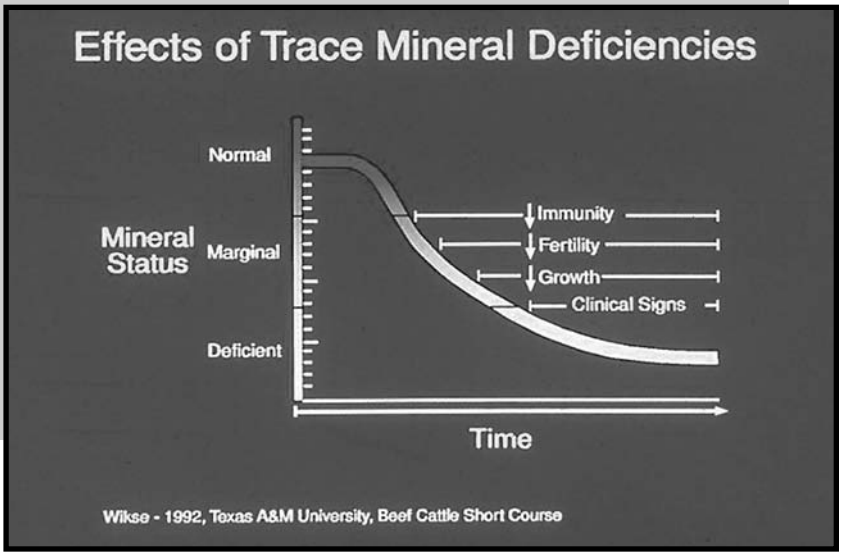


Figure 6

Cows must have adequate trace mineral intake during the last trimester of pregnancy so the fetus can deposit adequate stores of copper and zinc in the liver prior to birth. Milk is an inadequate source of copper or zinc for the newborn calf. Calves with inadequate liver stores have a compromised immune system at birth, making them more susceptible to neonatal infections like calf scours.

Vitamins that appear to be the most critical in immune system function are vitamin A (betacarotene) and vitamin E. Selenium and vitamin E function as antioxidants and reduce the accumulation of compounds produced as cells in the immune system response to invasive organisms.

Weaning nutritional management

One of the most stressful periods in a calf's life occurs during the weaning process. Stress suppresses the immune system. Commonly, calves are sold or shipped to market within 24 hours of removal from the cow. Removal from the cow, introduction to a new environment and commingling with cattle of different origins are stressful events.

This stress is accompanied by reduced feed and water intake and exposure to pathogens. These stressors result in a high percentage of freshly weaned calves requiring treatment for respiratory disease. These problems can be managed if calves are weaned and held at the ranch for a minimum of 45 days.

The Texas A&M University Ranch to Rail Program has documented that health management practices at the ranch are often inadequate to prevent these calves from becoming sick. It's not uncommon for 25 to 50 percent of fresh-weaned calves to require treatment.

Ranch to Rail and other steer feed-out programs have documented that calves requiring treatment not only have higher medical costs, but also reduced performance, increased death loss and decreased carcass quality (See Table 2).

In an effort to enhance immunity, and thereby performance of stocker and feeder cattle, vaccination and nutritional management programs were designed for weaning programs on the ranch. Preconditioning programs with a 45 day post-weaning period have been accepted by the industry to improve animal performance, health and carcass quality.

It's not uncommon for 25 to 50 percent of fresh-weaned calves to require treatment.

Table 2. Ranch to Rail Cattle - Healthy vs. Sick

Year	92-93		93-94		94-95		95-96		96-97		97-98		98-99	
	Sick	Healthy	Sick	Healthy	Sick	Healthy	Sick	Healthy	Sick	Healthy	Sick	Healthy	Sick	Healthy
# head	347	1235	1133	2155	667	2206	857	2017	298	1774	507	1394	159	978
Death loss	2.9%	0.5%	2.2%	0.8%	1.7%	0.5%	3.5%	0.3%	7.7%	0.6%	4%	0.6%	5.7%	1.8%
ADG (lbs)	2.68	2.88	2.69	2.9	2.99	3.02	2.91	3.01	2.4	2.96	2.54	2.84	2.64	3.07
Medicine	$27.36	0	$37.9	0	$20.76	0	$34.05	0	$23.36	0	$22.73	0	$21.39	0
Quality Grade														
Choice +	28%	40%	19%	26%	33%	39%	32%	38%	26%	40%	23%	42%	24%	41%
Select	70%	55%	73%	67%	63%	59%	56%	54%	60%	55%	60%	51%	65%	54%
Standard	2%	4%	8%	7%	4%	2%	12%	8%	14%	5%	17%	7%	11%	5%
Value Difference* $/cwt (arrival)	$16.00		$15.70		$8.65		$10.33		$19.87		$10.58		$13.42	
Avg. Profit/Loss	$155.56		($27.47)		$64.66		($28.32)		$96.28		($54.44)		$71.10	

**Difference in net return + medicine divided by initial weight*

15,727 calves involved in the TAMU Ranch to Rail program

The practice of preconditioning calves has received a lot of attention in the last few years. *Preconditioning* can mean many different things to different people. It's important that everyone has the same program in mind as this topic is addressed.

Preconditioning is the process by which calves are weaned and "conditioned" before moving them to grass or a backgrounding yard for growing or sending them straight to a feedyard for finishing. Preconditioning can be done at the ranch or at preconditioning facilities that specialize in managing fresh-weaned calves. We will focus on the preconditioning of weaned calves before they leave the ranch of origin.

The preconditioning process improves the likelihood that a calf can deal with future stressors and exposure to pathogens without health complications. Bridging the management gap from suckling calf to weaned calf is not that difficult when it's done at the ranch. It involves enhancing and managing the immune system, controlling stress and preventing overexposure to pathogens during this brief period of time.

Calves that have fewer health problems after they leave the ranch will (1) require less medication, which reduces costs but also lowers the potential for injection site lesions and residues; (2) suffer less death loss; (3) perform more efficiently; and (4) potentially have higher-valued carcasses.

So, preconditioning is a *value-added* management practice. In the past, it's been difficult for a calf producer to realize the added value in preconditioned calves they've sold. However, this appears to be changing, and there are more opportunities through both direct sales and auction markets for calf producers to receive extra value for preconditioned calves. The following are just a few of the things to consider about preconditioning calves.

Plan ahead

Locating markets, allocating pasture, shopping for feed and health products, scheduling other farm and ranch activities, and finally the preconditioning process itself, takes time. So allow adequate time to plan, evaluate and implement your program.

Identify your market

In agriculture, producers are good managers, but they often fall short with their marketing efforts. A key to realizing the added value in preconditioned calves is finding the outlets that have buyers seeking preconditioned calves and pursuing those markets. These may be auction venues or direct sales to buyers. This effort must start well in advance of the time calves are weaned.

What does the market require?

Once market outlets have been identified, determine the buyers' expectations in those outlets. These may include specifications for vaccination and parasite control practices, nutritional management, number of days weaned, weight and cattle type and individual animal identification. Know what is expected and plan to deliver.

Evaluate the economics

Just because it seems easy to do and it's beneficial to the calves and the industry, that doesn't mean preconditioning will automatically be profitable to your ranch. If cattle are being prepared for retained ownership, then preconditioning is a necessary production step.

However, if cattle are being preconditioned for sale, the economics must be carefully considered. The ranch should be ready and willing to retain ownership in the cattle if they cannot receive adequate compensation for their preconditioning efforts. Likewise, suffering a loss at the end of preconditioning might be the best alternative if retained ownership doesn't appear to be profitable.

Identify your costs

It's critical for producers to take time to evaluate the costs of preconditioning. Many producers fail to adequately project the costs of a program and then are disappointed when they don't recoup their costs at marketing. Buyers' requirements dictate a portion of the costs. Feed (purchased feed, raised feed and grazing) and opportunity costs account for the larger part of the preconditioning costs.

Be certain to charge interest against the value of the calves the day they are weaned. If you borrow operating money, this interest is the cost of not paying down the loan when the calves were weaned. If you do not borrow operating money, the interest represents income you could have realized by putting the money in savings.

If you graze your own pasture, charge the preconditioning program a reasonable rate for use of the pasture. Some may question this expense; but this ensures that money is being set aside to pay land rent or payments. If your stocking rate has to be lowered to support preconditioning, it will add expense to the enterprise.

If the land is owned and debt-free, this charge represents income for the ranch enterprise. If the preconditioning program breaks even, the ranch still pocketed some income. Some may prefer to leave this cost in the cow herd expenses. Likewise, account for use of equipment and facilities, fuel, labor, utilities and other costs.

One simple accounting method is to assign a daily yardage charge for each calf in the program. Again, some may question this expense and prefer to allocate the expense to the cow herd. As well, don't forget to add in marketing costs like commissions, freight and other expenses.

What will the preconditioned calves be worth?

In order to evaluate a preconditioning program, it will be necessary to project the weight and sale price of the calves at the end of the preconditioning program. Many producers are concerned with the premiums they will receive for their preconditioned calves. This is a factor to consider, but an equally important consideration is seasonal market fluctuation. Does the market typically go up or down during the period of time the calves are being preconditioned?

Feed and opportunity costs account for the larger part of the preconditioning costs.

The difference between the calf's value the day it's weaned and at the end of the preconditioning period is the money available to pay for the preconditioning program and provide some extra income to the ranch. Projecting this margin allows you to determine if the program is feasible.

Control your costs

Shop for animal health products. Check with the market outlets to see if they have purchase arrangements for the required products. As mentioned, feed is one of the major costs of preconditioning. So, it's important to utilize on-site forage and feed resources as much as possible.

This means utilizing excess forage and feed resources to add value to calves. If pastures can be managed to provide good-quality forage to weaned calves, then preconditioning becomes a viable option. Quality can be supplemented, but *quantity* of available feed resources is important to the success of your program.

Although it will vary from region to region, the most economical way to manage calves during the preconditioning period will involve forage and supplement. In some areas, raw feed commodities and by-products are relatively inexpensive and fit well in a preconditioning program.

In other areas, manufactured feeds are the only option and a relatively higher cost. If harvest forage has to be purchased for feeding any time other than the first five days post-weaning, carefully evaluate the profit potential. Minimize feed purchases and scrutinize the cost of these purchases closely.

In order to evaluate a preconditioning program, it will be necessary to project the weight and sale price of the calves at the end of the preconditioning program.

The objective of preconditioning is not to get cattle on feed; it's to harden them up and prepare them for the stresses to come. There are some real limitations as to the amount of feed that can be purchased and fed to ranch-weaned calves. Weaning on the ranch is different from preconditioning purchased and stressed calves in a preconditioning yard. Ranch calves will not need mixed feed to maintain a positive plane of nutrition or to maintain their health.

Use Best Management Practices and don't cut corners

Always follow Beef Quality Assurance guidelines. Don't cut corners on the nutrition and health programs or the calves may still have problems once they leave the ranch. This will reflect badly on the ranch and the whole concept of preconditioning.

Preconditioning has routinely been done over a period of 14 to 45 days. The standard has been 21 to 30 days. Only recently have the benefits of 45-day programs been documented. There are instances where shorter programs may work effectively; but keeping the calves for 45 days, as opposed to 30 days, offers additional insurance against sickness at relatively little more expense, especially when the calves diet is predominately forage.

Ranch to Rail has documented feedyard performance of steers relative to how many days they were weaned and what vaccination programs were used in the preconditioning process. Calves weaned for 45 days had the lowest medical expense and loss of production, while calves weaned for less than 30 days had the highest treatment rates and the greatest reduction in performance.

Don't expect too much from the calves

Be realistic in estimating the performance of your calves during preconditioning. Rate of gain can vary from less than 0.5 lbs/day to more than 2 lbs/day, depending on feed resources and how the calves respond to weaning. In most preconditioning programs, achieving an average daily gain of 1 pound per day during the 45 days will be adequate.

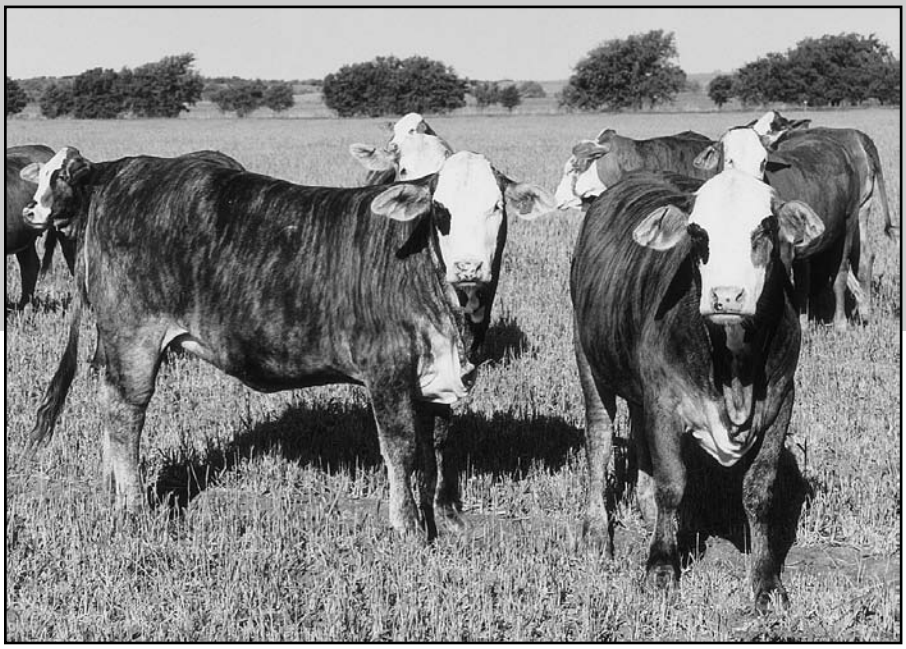
Calves weaned for 45 days had the lowest medical expense and loss of production, while calves weaned for less than 30 days had the highest treatment rates and the greatest reduction in performance.

This rate of gain can be achieved economically with a wide range of nutritional programs. Higher rates of gain can be achieved but the cost of gain may not be economical. If calves are contracted, calculate the desired rate of gain to meet the target and always make sure the target is realistic.

From a practical standpoint, cow-calf producers should set a goal to maximize immune system response. This can be done by enhancing the immune response through nutritional management of the cow herd. Managing your cows to be in a Body Condition Score 5 at calving and providing the cow herd with adequate level of minerals, particularly during late gestation and lactation is crucial.

Strengthen passive transfer and antibody response in the calf through supplementation of the cow in late gestation and early lactation. Passive transfer can also be enhanced through proper vaccination programs targeted at the cow in late gestation. Develop your heifers, stockers and/or feeders by maintaining a positive plane of nutrition throughout the weaning and growing phases.

Maximum immune response will be achieved when proper vaccinations are administered in conjunction with proper nutritional management. Nutrition is not what makes the immune system work; but deficiencies can prevent the immune system from working properly.



Culling Management

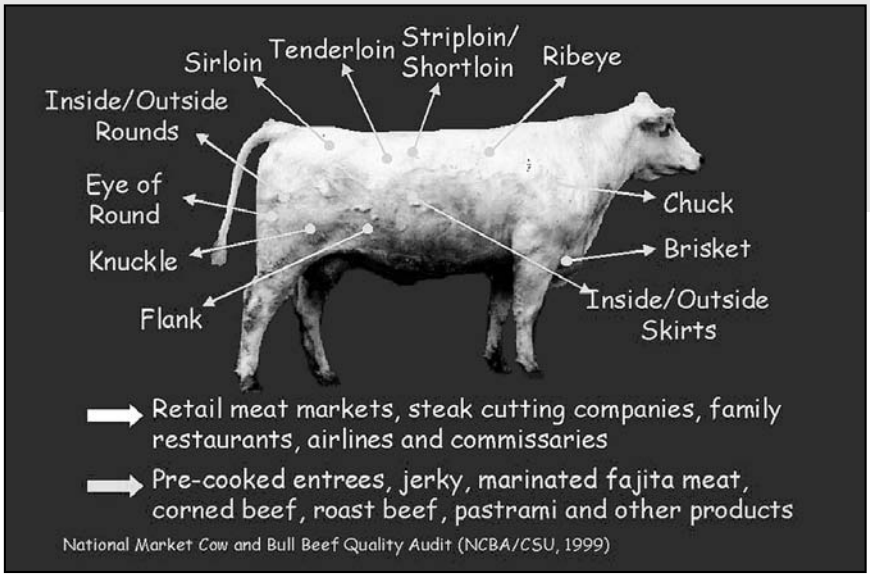
Regardless of herd size, all beef cow operations produce some cull animals. Many times, these are older cows past their prime producing years. Other culls may result from failure to reproduce in a given breeding season. Cull cows and bulls represent 15% to 20% of producer revenue. With proper management and timely marketing, the value of market cows and bulls can be increased.

Cull animals (non-fed beef and dairy animals) supply between 15% and 20% (depending on market conditions) of total U.S. beef production. Most producers assume that the major product from cull cows is ground beef marketed through fast-food restaurants.

While ground beef is a very important product of cull cattle, it's only one of many beef products from cull animals. Cull cow packers utilize tenderloins, ribeyes and strip loins, particularly from younger cows. These cuts are merchandised through family steakhouses.

The outside round is often pressed into deli-style meats and inside rounds are routinely used for beef jerky. Many of the individual muscles are utilized for specific manufactured products.

Not all cull animals are suitable for processing into higher-valued products. Some are condemned, resulting in losses to the industry that are ultimately passed back to the producer. Quality defects in mature cows and bulls include things like inadequate muscling, excessive fat trim, lightweight or heavyweight carcasses, lameness, "cancer eye" and "downer" animals.



In 1994, the National Cattlemen's Association (now NCBA) conducted a study in cooperation with Colorado State University to look at quality shortcomings in cull cows and bulls. In 1999, the study was repeated to see if progress had been made in improving the value of market cows and bulls.

Table 3 summarizes some of the quality defects and the potential number of cattle that would be affected based on the 1999 slaughter figures. The 1999 Non-Fed Quality Audit revealed that 96% of market cows and bulls have clear eyes; 96% are without abscesses; 85% are sound or have only minor structural problems; and 97% have a Body Condition Score of 3 or higher.

In general, producers do a fair job of managing and marketing surplus animals.

But the 1999 audit also identified specific areas where the quality of market cows and bulls could be improved. Realizing that some of these defects are impossible to avoid completely, producers should pay close attention to marketing in order to return maximum value from their cull livestock.

Cancer eye

Cancer eye can't always be avoided. But proper marketing avoids loss of value. The 1999 audit revealed that 0.4% of cull cattle had a tumor that involved the bone or lymph tissue around the eye. These advanced stages of tumor development generally result in the head of the animal being condemned. Head condemnations result in a loss of approximately $18 per affected animal.

The most severe stages of cancer eye, involving a prolapsed eye, were detected in 0.2% of cull cattle. The good news is the incidence of this advanced stage had been significantly reduced from the 1.1% incidence detected in the 1994 audit.

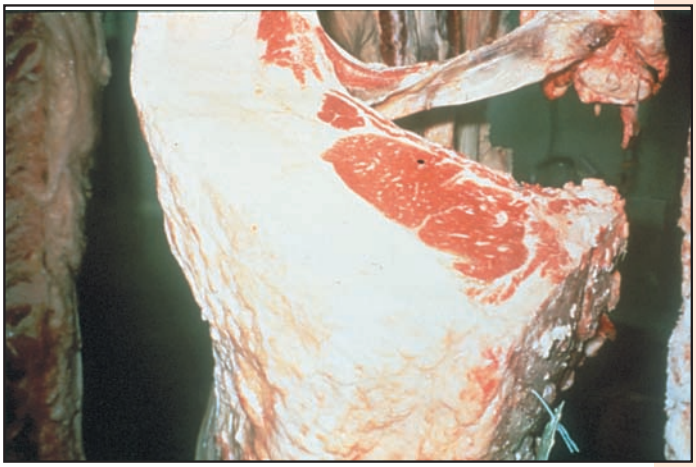
This indicates that producers are marketing cows in a more timely fashion prior to advanced stages, and/or cows with advanced stages are being euthanatized at the ranch. Cows with advanced stages of cancer eye are a primary cause of whole carcass condemnation. As such, packers are unwilling to purchase these cows at times.

When cancer eye is detected, the eye should be removed immediately, or the animal should be marketed as quickly as possible.

Table 3. Results of the 1999 Non-Fed Quality Audit

Quality Defect	Incidence Rate	Head Affected[1]
Cancer eye		
Bone or lymph involved	0.4%	27,760
Prolapsed eye	0.2%	12,380
Horns (large protruding)	13%	804,700
Brands		
Shoulder brands	5.6%	346,640
Rib brands	21.1%	1,306,090
Hip brands	36.4%	2,253,160
Multiple brands (2-3)	19.6%	1,213,240
Four or more brands	1.6%	99,040
Lameness		
Beef cows	11.9%	412,502
Beef bulls	18.1%	117,641
Dairy cows	14.5%	251,314
Arthritic joints		
One joint	7.37%	456,203
Two joints	3.97%	245,743
Inadequate muscle		
Beef cows	44.4%	1,539,082
Dairy cows	72.5%	1,256,570
Too thin (BCS=1-2)		
Beef cows	2.3%	79,727
Dairy cows	4.5%	77,994
Too fat (BCS=8-9)		
Beef cows	4.5%	155,988
Dairy cows	1%	17,332
Bruises		
Minor	72.4%	4,481,560
Medium	38%	2,352,200
Major	19.4%	1,200,860
Extreme	2.2%	136,180
Whole carcass condemnation		
Prior to slaughter	0.12%	7,428
After slaughter	1.06%	65,614
Liver condemnations	24.1%	1,491,790
Head condemnations	6.7%	414,730
Cow carcasses too light (<500lbs)	43%	2,235,828

[1]Based on a projected slaughter of 6,190,000 head of market cattle in 1999. Estimates corresponding to beef vs. dairy and bulls vs. cows are based on a slaughter mix that is 56% beef cows, 28% dairy cows, 10.5% beef bulls and 2% dairy bulls.



The audit results projected that 155,988 head (4.5%) of beef cows were overly fat, producing carcasses like the one shown here with 2.0 inches of external fat. On the other hand, 79,727 head (2.3%) of beef cows were too thin, generating poor meat yield relative to pounds of product.

Horns

Horns were identified as a quality defect in the 1999 audit for two reasons: horns are a major cause of carcass bruising (which was the No. 1 concern of cow packers), and horns must be removed prior to the removal of the hide. This leaves the sinus cavities exposed to hair or foreign material contamination. If the inspector suspects contamination of the sinus cavities, the head must be condemned, resulting in a loss of value.

Dehorning at a young age is a good animal husbandry practice that should be routine on all operations.

Cattle exhibiting an arthritic or stifled condition are a major concern to the packer. Estimates show that 701,946 head were affected by one or more arthritic joints in 1999, which would indicate a total trim loss of 37,338,946 pounds for this quality defect alone!

Brands

Brands continue to be a quality concern relating to hide value of culls. Branding is the only permanent, easily readable means of identification that is currently available. *Placement* of the brand is an important decision that affects hide value. Rib brands reduce the value of the hide as much as $5 to $15 in cull cows. When considering placement of brands, the optimum place is high up on the hip, close to the tail head.

The 1999 audit revealed that 28.8% of beef cows had a rib brand, 29% had multiple (two to three) brands and 1.6% had four or more brands. These trends are very similar to the 1994 audit.

Lameness

Lame and disabled cattle are a perception problem for the industry. The 1999 audit showed that nearly 12% of beef cows and 18% of beef bulls had arthritis or a stifle injury. Some of these problems are unavoidable, particularly with bulls. However, many problems with lame cattle are easily avoidable if producers will cull animals before they age excessively and develop feet and leg problems.

The packer is required to remove all tissue associated with an arthritic joint. In the 1999 audit, the average trim loss associated with an arthritic joint was nearly 40 pounds. More than 7% of cattle had at least one arthritic joint, and nearly 4% had two bad joints.

Downer cattle still represent a significant problem to beef producers with 0.7% of beef cows (nearly 25,000 head) classified as disabled. This group of cattle typically receives special attention from inspectors. Additionally, excessive bruising results in large trim losses. Disabled cattle should either be merchandised directly to the packer or euthanatized at the ranch. Current regulations require that downer cattle must be condemned and tested for BSE (Bovine Spongiform Encephalopathy) with no exceptions!!

Inadequate muscling /excessive fat

Lean beef products are the principal end products of cull cattle. It's important that cull animals have adequate muscling without excessive amounts of fat. The 1999 audit suggested that 44.4% of beef cows had inadequate muscling. Poor muscling is often a result of emaciation. As Body Condition Score drops below 5 (on a scale of 1 to 9), losses are comprised of both lean and fat.

The 1999 audit revealed that more than 40% of beef cows were at or below a BCS 4, suggesting that some of the "inadequate muscling" was actually due to thin condition. Extremely thin cows (BCS 1 to 2) accounted for 2.3% of beef cows surveyed. These cows produce a product that is greater than 90% lean, but their lean yield is extremely low, which limits the salvage potential.

Emaciated cows are also more prone to bruising because they have no fat to serve as padding, and they are more likely to be disabled upon arrival at the packing plant. Thin cows will not make a long trip prior to harvest. Consequently, the number of buyers for emaciated cattle is limited.

At the other extreme, excessively fat cows (BCS 8 to 9) are also a problem. These cows often yield cuts that can be salvaged and merchandised for a higher value (strips, ribs, tenderloins), but there is an excessive amount of waste fat. The 1999 audit revealed that 4.5% of beef cows were excessively fat.

The ideal condition to merchandise cull cows would be somewhere between BCS 4 and 5. And because these cows have optimal red meat yield, they generally bring the highest price per pound at the auction market.

Bruising

The No. 1 concern of packers in the 1999 audit was the high incidence of bruising - 88.2% of cow carcasses had bruises. Minor, medium, major and extreme bruises result in an estimated 0.69, 1.42, 4.78 and 15 pounds of trim loss, respectively.

Using these estimates, more than 14 million pounds of product were lost due to bruising.

Incidence of Bruising

	Bulls	Cows	Trim Loss
	%		Pounds
No Bruises	47.1	11.8	
Minor Bruises	44.4	77.2	0.66
Average Bruises	16.7	41.7	1.42
Major Bruises	6.9	21.6	4.78
Extreme Bruises	1.0	2.4	15.00
Total Trim/Carcass Harvested in 1999			0.98 lb

National Market Cow and Bull Beef Quality Audit (NCBA/CSU, 1999)

Unfortunately, the bruises do not just occur on the lower-valued portions of the carcass. The 1999 audit revealed that similar trim loss was observed in the top sirloin, loin, rib, round and chuck.

Handling practices at the ranch are very important in minimizing bruises. An estimated one-third of bruises occur on the ranch, and the other two-thirds occur in transport and marketing. Close scrutiny of handling facilities to eliminate sharp, protruding corners and employee training can help reduce bruising. Producers should also merchandise cull cattle before they become emaciated and are more susceptible to bruises.

Overall, the 1999 audit suggests that nearly $70 is lost for every cull cow or bull that is merchandised. Most of this loss comes from merchandising thin, emaciated animals that are more susceptible to bruises, trim loss and have poor yields. A portion of this loss can be captured through better management/marketing of cull animals at the ranch level.

Best Management Practices - Culling management

1. Do not market cull animals that pose a public health threat.
2. Be certain that ALL animals shipped to market have cleared proper withdrawal times.
3. Do not market cull animals that have a terminal condition.
4. Do not send cull animals to market that are disabled.
5. Market cull animals BEFORE they become severely emaciated.
6. Do not market cull animals with advanced eye lesions.

Beef quality and consistency begins on the ranch. Everyone involved in the production system - from the producer to the packer - bears a responsibility for ensuring that cull bulls and cows are not handled roughly on trucks, at auction markets and in other sales facilities, as well as in packing plant premises.

It is every producer's obligation to utilize management and judgment that ultimately lead to a positive eating experience for the consumer.