

HANDLE WITH CARE

Improper handling can decrease meat quality and your profits.

Story & photo by *Meghan Richey*

Forty percent of beef carcasses suffer discounts. While heavyweight carcasses and yield grade (YG) 4s make up roughly half the discounts, proper handling and welfare practices can prevent carcasses from being discounted even further. Meat quality — and prices received — can suffer when handling, physical or chemical, isn't optimum.

"Producers, transporters and meat processors all have responsibility for proper production, management and handling of animals in order to optimize animal welfare and meat quality," says Michael Dikeman, professor of meat science at Kansas State University (K-State).

Providing optimum animal welfare spans three general time frames, all of which affect meat quality, Dikeman says. The time frames are generally labeled long-term, short-term and very short-term.

"Long-term management and handling practices that influence meat quality occur months or weeks before harvest," Dikeman explains. "Short-term practices that influence meat quality occur days before harvest, and very short-term practices occur within the hours and even minutes before harvest."

Physical trauma suffered in any of the time frames has the potential to negatively affect meat quality, whereas stress affecting meat quality is most likely to occur in the short-term and very short-term categories.

Dikeman defines stress as "physiological changes in heart rate, respiration rate, body temperature and/or blood pressure when animals are exposed to stressors."

"Stressors occur when the animal perceives that the environment becomes uncomfortable or hazardous," he explains.

Stress leads to DFD beef

Dark-cutting beef [occasionally called DCB, but most commonly referred to as dark, firm and dry (DFD) beef] is the primary stress-related meat quality problem, says Mike Siemens, director of animal welfare and husbandry for Cargill Meat Solutions, who spoke at the American Meat Institute (AMI) Animal Care and Handling Conference, Feb. 15, in Kansas City, Mo., along with Dikeman.

"Consumers reject dark-cutting beef because they associate its color with old and/or dried-out meat," he says. "And the sting of their rejection travels back down the production chain, with dark cutters discounted on average \$200 per head."

In the United States, dark cutters occur in 0.5%-5% of beef carcasses.

DFD beef can be caused by a variety of stressful environmental factors, such as a dramatic, quick change in weather, as can often happen in fall or spring, or a long, stressful

transit involving overheating or extreme cold. But management and handling practices can be a source of stress, too, Siemens says.

"Rough cattle handling and overcrowding of holding pens and trucks can be stressors," Siemens says. "Holding cattle for more than 12 hours without feed and allowing them only limited access to water can also cause stress that affects meat's color and leads to DFD beef."

Regardless of the source of stress, meat color is largely a factor of pH, which is related to glycogen level. Glycogen, a carbohydrate, is stored in muscle and constitutes about 1% of the muscle by weight. Once the glycogen level falls below a certain point, dark meat will occur. Meat of

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acceptable color has a pH of less than 5.7, whereas DFD meat results when pH rises above 6.

"When stress hormones are released, anaerobic metabolism is favored, and when glycogen is broken down into individual glucose molecules through glycolysis, lactic acid is a byproduct," Dikeman explains. "When lactic acid cannot be transported and converted to energy rapidly enough by the liver, it builds up in muscle."

This usually occurs when animals survive stressful events, such as mishandling during transport, but are harvested before they have sufficient time to replenish their muscle glycogen stores. Consequently, changes in muscle color that would normally occur postmortem do not occur. Specifically, the muscle reflects less total light, and the pigments themselves reflect dark red or purplish light. The tissue has abnormally high water-binding capacity and is therefore sticky to the touch.

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its appearance and won't buy it," Siemens says. "With proper handling we can prevent many of the sources of stress that can lead to DFD beef, thus providing better welfare and ensuring better meat quality."

Prevent bruises at the source

The National Beef Quality Audit (NBQA) found that carcass bruises cause an estimated average loss of \$4.03 per animal. A bruise is the result of blood vessels bursting around a site of impact and bleeding into the surrounding tissues. Since they can take up to 30 days to heal, mishandling during the month before harvest is a sure way to cause bruises and decrease carcass quality and price received.

Siemens cited a 1992 report by renowned animal behaviorist Temple Grandin, who made the following observations regarding bruising of cattle at packing plants:

- ▶ If there is a sudden occurrence of bruises, look for recent changes in personnel and/or for broken equipment.
- ▶ Back bruises almost always are caused by gate, truck deck or personnel problems.
- ▶ Loin bruises result from horns on cattle, narrow entryways, protrusions into alleyways or rough handling.
- ▶ Shoulder bruises are caused by horns on cattle, protrusions into alleyways or rough handling.

- ▶ Cattle can still be bruised after stunning and prior to bleeding. Bruising can occur until the blood pressure is zero.

Although these observations were specific to the packing plant environment, Siemens says the principles apply equally at other points in the production chain, including the ranch.

"Bruises are best prevented by looking for the source and eliminating it," he says. "Personnel's mishandling of the cattle and equipment/facility problems are the two main things to look at."

Metabolic modifiers decrease marbling, tenderness

Metabolic modifiers can also affect meat quality, namely marbling. Siemens defines metabolic modifiers as "compounds fed, injected or implanted in cattle to improve growth rate, feed efficiency, dressing percentage, meat yield percentage, visual meat quality or meat palatability."

"Aggressive implants used within 70 days of harvest and/or the use of more than three implants can negatively affect marbling," Siemens says.

A well-known beta-agonist, zilpaterol, has come under heat recently, he says. A beta-agonist basically redirects existing nutrients toward increased muscle growth or slows muscle degradation. Consequently, beta-agonists can yield more net muscle, either by maintaining muscle or actually building more muscle.

"Zilpaterol, marketed under the name Zilmax,[®] can negatively affect marbling," Siemens says. "Specifically, it can lead to a 6.7% decrease in marbling, according to information released through the Freedom of Information Act."

Ractopamine hydrochloride (marketed in the beef industry as Optaflexx[®] and in the pork industry as Paylean[®]) can also negatively affect marbling when used improperly, he says. DFD beef is also a likely effect of improper implant or beta-agonist use. Very hot temperatures during loading and transporting increase this susceptibility.

Tenderness can also be negatively affected by metabolic modifiers — and again, zilpaterol is guilty.

"Meat tenderness is approximately 40% heritable in cattle, but it can be affected by improper implant strategies and beta-agonists," Siemens says. "Specifically, research shows zilpaterol makes beef less tender, increasing its shear force score 22%."

Transportation checklist

Loading, transporting and unloading cattle can be stressful — for both you and the cattle. Without proper handling practices, the transportation process can negatively affect meat quality, namely causing bruising and dark cutters. Here's a checklist of proper handling to help you preserve meat quality.

Pre-trip inspection

- Driver physically and mentally ready
- Truck and trailer appropriately prepared for summer or winter travel
- Trailer in good operating order
- Bedding provided if required
- Trailer properly decked and set to receive the load
- Trailer properly cleaned to prevent dumping of manure on road

Inspection of facilities

- Chute/ramp in good condition and able to withstand weight and pressure of animals to be loaded
- Chute/ramp width accommodates animals to be loaded
- Check for and fix protruding sharp objects, broken gates, fences, latches, etc.
- Check for and fix traction problems that could affect both you and the animals, such as ice or mud

Line-up and docking

- Back into the chute slowly
- Align properly with chute, leaving no gaps or holes between chute and trailer

Loading

- All actions should be slow and quiet
- Lead animal may hesitate because of glaring light, shadows or dark entry; steep, slippery, or unsteady chute or ramp; and unfamiliar noise. Anticipate and address these items during your pre-trip inspection of facilities.

- Segregated animals should be loaded last and put in the back compartment of the trailer
- Don't slam a gate closed to stop an animal that is trying to go through it
- Don't drop your tailgate on animals when loading
- Use prods judiciously. If an animal is already moving or has no room to move, prodding devices should not be used, as they can contribute to bruising.
- Keep in mind the AMI guideline for electric prods use: "The use of [electric prods] are discouraged. However, when they are used and required to move cattle, do not use [electric prods] on the genital or anal areas or in front of the shoulders."

When loaded

- Verify that space requirements are met
- Load density may change depending on weather, type, physical condition and distance to destination

Before you actually hit the road

- Secure the load
- Check the animals
- Check the tailgate
- Know the axle weight restrictions in all states that you will travel
- Complete required paperwork

On the road

- Ease away from the chute
- Start, stop and turn slowly
- Check your load every few hours