



Cattle Producer's Handbook

Animal Health Section

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Identifying and Minimizing Stress in Cow-Calf Operations

*Carolyn L. Stull, Veterinary Medicine Extension
University of California, Davis*

*Donald Hansen, D.V.M., Extension Veterinarian
Oregon State University*

What is stress? Stress is an easily understood concept, but difficult to define in scientific terms. One definition of stress is the sum of adverse effects in the environment and/or management system that force a change in the normal balance of the body's biological systems. If the animal's compensating changes to stress are inadequate or inappropriate, disease and possibly death may occur.

Animals respond to stress by several interacting mechanisms that may affect their behavior, physiology, biochemistry, and immunity. Although pain and stress are commonly linked, their responses are somewhat different. Pain is initiated by stimuli transmitting information to the central nervous system via receptors located in the skin, muscles, viscera, or joints. The body then responds by changes similar to those exhibited during stressful situations. However, pain symptoms are often more acute and have a sudden onset. Identifying and minimizing stressful situations enhances well-being, growth, and reproductive efficiency of the animal as well as economic benefits for the producer and consumer.

Common Types of Stressors

A satisfactory environment for beef cattle provides for thermal comfort, physical comfort, behavioral needs, and minimal disease or adequate health. Each of these four areas is a potential source of stress.

Thermal Comfort

Cold or heat stress can affect young or sick animals much more severely than mature, healthy cattle. The optimal thermal (temperature) range for calves is 50° to 85°F, while 30° to 60°F is optimal for mature cows. These temperature ranges promote maximum performance with the least amount of stress for the animal. In these ranges, cattle can maintain body temperature by constriction or dilation of the blood vessels, modification of postures and behavior, or changes in hair elevation.

As air temperature falls below the lower critical temperature (50° and 30°F for calves and cows, respectively), food energy is diverted from production or growth to produce additional body heat and maintain body temperature. This ultimately leads to a reduced feed efficiency. Cold stress also decreases the rate of absorption of colostrum in newborn calves and may depress their immune system.

The upper critical temperature, approximately 85°F for calves and 60°F for cows, is reached when the animal cannot dissipate enough metabolic heat to the environment to maintain body temperature.

Food intake is reduced, thereby lowering heat production generated by digestion and absorption of nutrients. This decreases the growth rate in cattle. Excessively high temperatures may cause panting that can compromise tissues of the upper respiratory system

increasing risk of pneumonia. Further, periods of excessive high temperature can reduce estrus cycling in female cattle. When cattle are unable to maintain body temperature, death may result. Other factors such as humidity, wind-chill, and moisture due to rain or mud, raise or lower critical temperature zones.

Physical Comfort

The physical components of an animal's environment include the air quality, available space, and the surfaces with which the animal has contact. Shelters, enclosures, ground surfaces, feeders, and water sources are examples of physical components. All physical components should be designed and/or maintained to avoid injury to the livestock and handlers.

Poor air quality may place additional stress on all animals. For example, clouds of dust stirred into the air by winds and/or cattle working practices can make breathing difficult and affect the exposed animals' airways. Further, improper waste management of intensive-managed systems with high stocking rates may continually expose cattle to toxic gases, especially elevated ammonia levels. These conditions and others can damage the lung tissues interfering with oxygen exchange and stressing both the respiratory and circulatory systems.

Inadequate space such as for feeding, calving, and resting may produce stress effects in cattle populations. For example, when feed is spread on the ground with limited space for all members of the herd to eat at once, stress may lead to increased aggression and fighting as well as nutritional deficiencies for the less successful of the group.

Ground surfaces that are unsuitable for adequate rest (or other necessary activities) can cause long term stress effects that then affect the health of the animals so deprived. Slippery or otherwise unstable surfaces can cause stress and injury, especially to animals forced to move at a pace other than their own.

Behavioral Comfort

Many behavioral stressors that effect cattle are related to management and handling. Cattle facility designs have taken into account maintenance behaviors such as eating, drinking, ruminating, and resting since these are vital to production and performance. However, other behaviors such as exploratory, social, and reproductive behaviors are not as easily accommodated. Exploratory behaviors are often minimized in environments that offer little novel stimuli, such as feedlots and corrals.

Disruption of social order and herd stability is a common behavioral stress in cattle operations. Changing the social order increases the number of disputes and aggression within the group. Cattle recently introduced to a herd, and sick or injured animals, may experience social stress. Behavioral stress can cause depressed

fertility rates, lowered milk production, and decreased weight gains.

Other behavioral stressors include weaning, isolation, and crowding. The removal of sick or injured cattle from the herd may invoke stress and can hinder rehabilitation. Reintroduction to the herd can also present another stressful situation. Crowding increases aggression and the potential for injury.

Effects of Stress

The reaction of the animal to stressors depends on the duration and intensity of the stressors, previous experience with them, physiological status, and the immediate environmental restraints. The effects of individual stressors are additive. An animal may react either by a behavioral or a physiological response, but most often a combination of both. The duration and intensity of stress can impact the animal's capacity to grow, reproduce, and maintain health.

A normal behavioral response to an immediate and acute type of stress is easily observed. A calf or cow usually will exhibit a fleeing response if it is not restrained. An example of an acute stressor is a loud noise or a short term, painful procedure, such as administering injections.

Physiological responses to stress have been investigated more extensively than behavioral reactions. However, no one physiological parameter has been identified to quantify a stress response. A short term stressor, such as injection administration, increases heart rate and may cause constriction of the blood vessels.

A long term, chronic stress, usually 24 to 48 hours, can occur in cattle that are shipped or experience thermal discomfort. This longer term stress influences a number of body processes including immunity, digestion, and reproduction. Long term stress depresses the production and release of hormones essential to energy metabolism, the immune response to disease or infection as well as reproduction and growth. These deficiencies may continue after the causing stressor has been diminished or eliminated. Thus, populations of stressed cattle may show increased morbidity and/or mortality, decreased weight gains, and/or lower reproductive performance for a time after a stressful event.

Some behavioral-stress responses have been categorized as "stereotypies." Stereotypies are sequences of movements that are repeated over and over without any apparent function. Examples of stereotypical activities in cattle are tongue rolling, head butting, and repetitive licking and/or scraping of objects. Stressors that induce stereotypic behaviors can be situations in which cattle are isolated from herd mates for extended periods of time or deficiencies in feeding programs.

Minimizing Stress

The first step to minimizing stress on the production facility is to be able to identify the signs and symptoms of stress in both the individual animal and the herd. This will include observations on appropriate or abnormal behavior, indicators of sickness, and changes in feed efficiency and subsequent growth. While difficult to quantify, there are behavioral indicators of stress.

The observable signs of stress overlap classical signs of disease and may include: (1) depressed appetite, (2) abnormal posture, (3) dull or depressed attitude, (4) restlessness and excitability, (5) lack of grooming, (6) self isolation from the herd, and (7) elevated respiration rate.

Once a stressor is identified, its rapid elimination will assist in minimizing the stress response. Proper management of the livestock including housing, waste management, sanitation, preventive health programs, and nutrition are essential in minimizing stress. The proper handling of cattle, prevention of accidents, and suitable facility design that incorporates the animal's well-being have continual effects on the behavior and physiology of both the young calf and older mature cow.

The onset and spread of disease are influenced by multiple stressors. Disease susceptibility of cattle depends on many factors including the immune response, pathogen challenge, and the effectiveness of disease prevention programs. Ear tagging, dehorning, castration, and transportation may be necessary procedures for cow-calf operations, however, they produce short or long term stress effects.

Management techniques should be planned to minimize the total additive effect of all stressors on the animals. An example may include the additive effects of individual stressors during processing at weaning such as separation, feed and/or water restriction, handling restraints, vaccination, and long hauling by truck.

Lack of cleanliness and high stocking density may occur during the calving season or in feeding and holding corrals. This may increase the pathogen challenge to cattle at times when other stressors may additionally be impairing the animal's ability to respond. Improved hygiene and handling can reduce the pathogen challenge.

One stressor that is easily eliminated is the improper handling of cattle by operators, which can cause both behavioral and physiological stress effects. This may be critical at certain times of the season such as calving and weaning. The newborn calf is dependent on passive transfer of immunity by the ingestion of colostrum. Good colostrum management and keeping pathogen counts minimized should be major goals for stress-wise producers.

Providing shade and/or sprinkler systems that are directed over the affected cattle can greatly reduce the effects of heat stress during periods of high environmental temperatures.

Cattle should be provided with enough feed space to allow all animals access, especially the smaller or less aggressive ones. Water should be fresh, clean, and easily accessible.

Slippery surfaces should be avoided to prevent injury, especially when moving or loading cattle. Cattle should have access to nearly level ground for comfortable resting positions.

Providing adequate nutrition, controlling the effects of parasites, and properly immunizing cattle to control or prevent known infectious diseases are important components in effectively managing stressors associated with disease. Herd history, performance, and age of cattle will assist in planning an effective preventive health program.

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