

Environmental Factors Affecting Feedlot Cattle

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Introduction

Feedlot cattle live within an environment influenced by many factors including both physical and psychological aspects of the animal's surroundings. Stability of core body temperature is an essential factor in production efficiency (Stokka et al., 1996). Thermal environment has a strong influence on cattle. Air temperature is the primary effect, but is affected by wind speeds, precipitation, humidity, and radiation. Cattle compensate for ambient temperature variations by altering feed intake, metabolism, and heat dissipation, which in turn would alter the partition of dietary energy used for maintenance and growth. The net result of ambient temperature and environmental compensation would be an altered energetic efficiency (NRC, 1981).

Cold Stress Effects

A major problem depressing the performance of feedlot cattle in winter months is cold stress. Optimal cattle feeding performance generally occurs when the temperature is between 40° and 60° Fahrenheit (F; Mark and Schroeder, 1999). When temperatures are colder, the maintenance energy requirements increase to maintain core body temperature. In some feeding operations and systems, feed intake intakes may not increase enough to compensate for the increased energy requirements. Bedding, photoperiod, and precipitation will all affect feed intake during winter months. Lack of adequate bedding has been shown to decrease feed efficiency by 47% and decrease average daily gain by 25% (Stanton and Schutz, 1994). Research suggests that ad libitum feed intake would be expected to increase 1.5 to 2% in long-day months and decrease 1.5 to 2% in

short-day months based on deviations from the average ad libitum intake at 12 hours of daylight (NRC, 1996).

Heat Stress Effects

Heat stress occurs when the total heat load of feedlot cattle is greater than their ability to dissipate heat. Heat stress results from the combined effects of relative humidity and ambient temperature. Cattle are homeotherms, meaning that they have an external thermoneutral zone between 60° and 80° F (Stokka et al., 1996). Body heat gain results from three main sources: chemical (metabolism), mechanical (work or exercise), and thermal (environmental). Body heat dissipation is controlled through four mechanisms: conduction, convection, radiation, and evaporation. Cattle can also eliminate internal heat through elimination of feces and urine. During heat stress, evaporation is the most efficient means of heat loss (Stokka et al., 1996). The effects of heat stress included decreased feed intake, slower rate of feed passage, decreased blood flow to internal organs, increased water consumption. In temperatures between 75° and 95° F, cattle decrease feed intake by 3 to 10% (Peterson, 1983). In temperatures exceeding 90° F, feed intake can decrease by 10 to 35% (Peterson, 1983). Cattle may require 1.2 to 2 times more water during periods of high ambient temperature. Sprinklers and shade have been shown to decrease heat stress (Mitlohner et al., 2001).

Precipitation and Mud Effects

Accumulation of moisture, at certain times of the year, in feedlot pens is a problem that most feedlot producers face regardless of geographic location.



Muddy or poor pen conditions can have significant effects on feedlot performance. There are several possible theories explaining the reduced performance seen with muddy pens or cattle: 1) Cattle will generally spend more time standing when lying down in the mud is uncomfortable; 2) muddy cattle generally expend more heat because a muddy hide reduces the insulation value and increases evaporative losses; 3) feed intake is reduced because animals are uncomfortable moving around and may be reluctant to travel through mud to the feedbunk; 4) more energy must be expended to physically navigate through the muddy pen conditions (Riskowski and DeShazer, 1975). Excessive mud in feedlot pens has been shown to reduce average daily gain 25 to 37% and resulted in a 20 to 33% poor feed efficiency (Bond et al., 1970). It has been estimated that for every 3 to 4 inches of mud depth, feed efficiency will decrease 6 to 8% (Mader, 1999).

Wind Effects

Wind speeds affect cattle throughout the year. The effects of wind on performance of cattle are most evident in the winter time. Windchill is determined by wind speed and relative ambient temperature. Most of the effects of cold weather stress have already been discussed in this paper. Windchill simply lowers the temperature that cattle feel further than the ambient temperature. Windbreaks have been shown to effectively block wind that would, if unimpeded, further reduce feedlot performance during windy, cold weather (Drovers, 2000). In summer times, slight to moderate wind speed could actually improve feedlot performance by reducing heat stress; however, permanent windbreaks could effectively eliminate this benefit and actually increase heat stress on the cattle (Mader and Davis, 2002).

Summary

The performance, health, and well-being of feedlot cattle are strongly influenced by their environment. Environmental stress is a combination of ambient temperature translating to heat or cold stress, wind speed effects on relative temperature, and pen conditions. Bedding has been shown to help improve performance during periods of cold stress. Sprinklers and shade have been shown to help alleviate problems during periods of heat stress. Good pen design and an effective mud removal system could help improved pen conditions and, subsequent, performance. Windbreaks during the winter can significantly improve performance, but may actually be detrimental during summer months. Facilities and management strategies for feedlot cattle do not need to eliminate environmental stresses completely but rather minimize the severity of the environmental challenge and aid the animal in adapting to it.