Drought Mitigation for Grazing Operations: Matching the Animal to the Environment

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On the Ground

- With expected increases in drought frequency and severity, long-term drought management strategies that focus on cattle selection and natural resource management are essential.
- The livestock industry in general unintentionally tends to select for cattle that do not perform to their maximum potential in limited-resource environments. We discuss the implications of cattle selection based on characteristics such as genetic potential, cow size, and hide color.
- In a hypothetical model, we found that because forage requirements for smaller cows are lower than forage requirements for larger cows, using a herd of smaller cows produces a larger total calf crop if cow size and milk do not lead to greater calf production.
- Because grazed forage remains the least expensive source of nutrients to maintain the cow herd, matching cow size and milk production potential to forage resources to optimize forage utilization and reproductive efficiency should be considered a rangeland drought mitigation strategy.
- Contemporary strategies such as using EPDs and selection indexes to manage maternal traits such as mature weight and maintenance energy requirements can be integrated with conventional drought mitigation strategies that focus on resource quality management.

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The livestock industry has been all too familiar with drought because ranchers have always had to adapt to precipitation variability, especially on North American rangelands. Common drought management decisions have included reducing herd size and feeding harvested forage. Unfortunately, these methods have not alleviated the stress of long-term drought. According to climate forecasts, drought frequency and severity are expected to increase in coming years, posing greater challenges to livestock producers. As a result, livestock producers will have to rely on integrated and long-term management strategies. Matching animals to the environment is an effective drought management strategy. In reality though, the livestock industry has increasingly provided incentives for the selection of cattle that may not be the most suited to harsh rangeland environments. Therefore, it is important to weigh the pros and cons of animal traits, and understand how animals interact with the environment to develop integrated drought management plans.

Drought Trends and Effects on Cattle Enterprises

Climate forecasts out to 2060 suggest temperature and precipitation will change variably by region in the United States.[1] Some areas will become hotter and drier (southwestern states) and some areas will become hotter and wetter (northern mixed prairie), with a broad gradient of extremes between competing models.[1] Drought forecasts are predicting greater frequency and magnitude–forecasts that have direct implications for livestock production on rangelands.[2] First and foremost, drought reduces livestock production by reducing the amount of forage available. This reduction of forage can increase supplemental feeding costs or require herd reduction. Long-term drought patterns can cause an abnormally high volume of cattle sold at auction facilities and a subsequent short-term decrease in market animal value locally.[3] This can lead to a decrease in total cattle numbers and can cause higher market prices nationally. Consequently, these drought-driven market trends make it financially difficult to rebuild after herd

reduction because a greater number of replacements are required at a greater direct opportunity cost. Secondly, drought also reduces forage quality as much as 3% of crude protein for every one-inch reduction of monthly precipitation.[4] In Wyoming, this drought-induced forage quality reduction decreased daily gain from 0.03 to 0.07 lb for each inch reduction of precipitation.[5] Thus, even if an operation was stocked to absorb the reductions in forage quantity from drought, the negative effects from lower quality may still be detrimental. Managers must also consider that even if some areas are predicted to become warmer and wetter, drought frequency and magnitude may increase and heat stress may also escalate as a stress on animals.

Cattle Industry Trends and Effects on Animal Maintenance Costs and Production

Concurrently, yet independent of climatic trends, the beef industry has promoted genetic selection trends that influence animal-environment interactions. Selection for increased calf growth has been steady since the 1970s according to most breeds' genetic trend data.[6] Similarly, milk EPDs (expected progeny differences) in most breeds (including Hereford and Angus) has consistently increased since the 1990s while a few breeds' genetic trend is negative or static.[6] Breeds with a negative or static genetic trend including Gelbvieh and Simmental had a relatively high capacity for milk yield when they entered the US beef industry. As milk production and growth potential increases, nutrient intake requirements go up and weaning weights should also increase. However, if the genetic expression for milk and growth is limited by the environment as in rangeland environments, this benefit may not be realized. Currently, no evidence exists to indicate increases in weaning weights in commercial cow/calf operations in New Mexico, Texas, or Oklahoma according to Standardized Performance Analysis (SPA).[7] This all indicates that environmental constraints in forage capacity on rangelands (such as nutrients and quality) limit the realization of genetic potential for animal performance.

Another confounding issue to the cost of added weaning weight is the additional grazing and feed cost relative to the conversion of added milk to additional calf gain. Efficiency of conversion of added milk to additional calf gain is improved with lower-yielding cows but exacerbated with higher-yielding cows.[8] Furthermore, the positive relationship between increased genetic capacity for milk production and cow annual maintenance requirements has direct implications for feed costs and stocking rates.[9] This is especially problematic in rangeland production scenarios because efficiency of milk utilization declines as genetic potential for milk production increases in the limited nutritional environments.[8] Hence, the selection for excessive milk and growth could limit the expression of these traits by the forage system and not by the genetic capacity of the cattle.[10] Even if growth potential was maximized, the added output from added cow weight is not economical, even during periods of higher market values. For example, analysis of calf weaning weights against mature cow weights from six ranches in Oklahoma and Arkansas revealed a range of 6 to 17 lb of additional calf weaning weight for each additional 100 lb of cow weight. The benefits however, were offset by the added cost of the 100 lb of additional weight of $40 per year and a reduced calving rate of 7%.[11]

Contemporary Drought Mitigation Strategies Using Livestock Genetics

Given the recent trends in beef prices, selection for milk and growth, and drought forecasts, it is imperative that rangeland grazing enterprises minimize and control their cost of production without sacrificing reproductive efficiency. Managers should consider integrating contemporary livestock selection strategies to adapt and plan for the negative impacts of drought.

Ranchers can accomplish this by paying attention to cow size, striving to maintain moderate size cows with lower milk and moderate muscling, and neutralizing or reversing recent increasing trends in these features due to a strong selection of growth genetics and muscling.[12,13] Although frame size or mature height of popular cattle breeds has not increased since about 1987, phenotypic and genetic trends indicate that mature cow weight continues to escalate. This trend is largely due to the continued aggressive selection for rapid growth and increased muscling. These result in cattle with increased appetite, a greater proportion of their body weight in visceral organ mass, overall leaner body composition at a constant mature weight, and potentially lower overall fertility. To maintain constant or historical weaning rate, ranchers are forced to manage cows to heavier weights in order to reach the same body fat composition and therefore achieve similar reproductive performance.

Because grazed forage remains the least expensive source of nutrients to maintain the cow herd, matching cow size and milk production potential to forage resources to optimize forage utilization and reproductive efficiency should be considered a drought mitigation strategy. Given the dramatic acceleration in input costs seen in recent years and drought forecasts, downward pressure on milk yield would benefit many herds relative to their forage resources to reduce input requirements. Furthermore, larger heavier milking cows with greater maintenance requirements may have lower reproductive efficiency in constrained rangeland environments. Doye and Lalman[11] reported a reduction in cow longevity because a 1,400 lb cow would likely produce one less calf in her lifetime versus a 1,100 lb cow and have a lower calving rate.

To neutralize or reverse the trend towards larger heavier milking cows with overall greater-maintenance nutrient requirements, producers should pay attention not only to sire EPDs related to production traits such as calving, growth and muscling (i.e., birth weight, calving ease, weaning weight, milk yield, yearling weight, and muscling or yield grade EPDs), but should also pay attention to EPDs and selection indices related to maternal traits such as maternal milk, weight, height, and maintenance energy requirements.[14] These EPDs and selection indices are designed to assist in