Evaluation of Level of Milk Potential on Nutrient Balance in 2- and 4-Year-Old May-Calving Range Cows Grazing Sandhills Upland Range

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Summary with Implications

A modeling study evaluated the effects of milk production level on nutrient balance in May-calving cows grazing Sandhills upland range during the breeding season. Forage quality of upland range peaks in June and steadily declines in July until November. With timing of forage quality decline and increasing nutrient demands due to lactation, cows were in a negative energy balance in late June and early July prior to deficiency of metabolizable protein. Supplementation to meet energy deficiencies in June and July and MP deficiencies in July with distiller grains that is high ruminally undegradable protein and high fiber energy may be needed in May-calving cowherds. Selection for milk over 23 lb at peak lactation creates deficiencies early post-calving and increases the need for additional supplementation to correct the nutrient deficiency. In an effort to match cow type to environment in the Sandhills and optimize performance, producers should consider selecting against high milk potential.

Introduction

Selection for growth-oriented traits including milk production has been a focus in the beef industry in effort to maximize output. As milk production potential increases in beef cows, cow maintenance requirements during gestation and lactation increase. For instance, energy requirements for cows with a high milk production required 11% more energy to support an increased level of milk production compared to low milk cows. Matching cow type or genetic potential to the production environment is and will be more important as cost of production increases. The continual increase in selection for milk production has resulted in range beef cows that are under greater nutritional stress in critical physiological periods, such as early lactation, that may ultimately reduce reproduction. Due to increased nutrient demand of lactation, cows often experience extended periods of negative energy balance after calving, which can have a negative impact on reproductive performance. This particularly is an issue when breeding on declining forage quality during mid- to late-summer. Inadequate nutrient intake to meet production energy requirements can result in reduced reproductive performance. Therefore, the objectives of this study were to demonstrate nutrient balance of lactation in May-calving cows grazing Sandhills upland range with 18, 23, and 28 lb of milk potential at peak lactation.

Procedure

Using the NRC model (NRC, 1996), net energy for maintenance, rumen degradable protein (RDP), metabolizable protein (MP) balances were predicted for 2- and 4-yr-old May-calving cows grazing Sandhills upland range from late-July and August during the breeding season. The amount of additional supplemental dried distiller grains were utilized in the model to meet maintenance requirements for energy and protein. Native range diets for this model were collected using esophageally-fistulated cows at the University of Nebraska's Gudmundsen Sandhills Laboratory (*1997 Nebraska Beef Cattle Report*, pp. 3–5) and previously used to model March- and May-calving herds (*2019 Nebraska Beef Cattle Report*, pp. 21–23). Cows were modeled to have 18, 23, or 28 lb of milk potential at peak lactation as a mature cow. The NRC model predicted 2-yr-old cows with 18, 23, or 28 lb of milk potential to be producing 26% less milk at peak lactation than they would as a mature cow.

Assumptions for the model were:

1. Cow body weight = 875 and 1175 lb for 2- and 4-yr-old cow; respectively
2. Average calving date = May 9th and May 22nd for 2- and 4-yr-old cow; respectively
3. Body condition score = 5.0
4. Peak milk production = 18, 23, or 28 lb
5. Estimates of dry matter intake were based on NRC model estimations
6. Breeding season started on July 26th for May-calving herd.

Results

Matching nutrient availability of range with nutrient requirements of the cow has been recommended to efficiently utilize forage quality. In doing so, changing calving date has been utilized to match nutrient requirement of genetic potential for milk production with the greatest nutrient value of the forage. However, as forage quality of upland native range peaks in June and steadily declines in July until November, forage quality and nutrient intake may impact reproductive performance in summer calving herds. For instance, previous research has illustrated that pregnancy rates in mature cows from March or May-calving herds are similar (*2001 Nebraska Beef Cattle Report*, pp 8–9); however, pregnancy rates in May-calving heifers are decreased compared to March-calving heifers (*2017 Nebraska Beef Cattle Report*, pp 8–10). This may be partially due to an imbalance of milk production and environmental condition. Moving cows from a spring-calving herd to a summer-calving herd matches calving date with increased quality forage to reduce feed costs compared to spring calving herds (*2001 Nebraska Beef Cattle Report*, pp. 8–9). However, due to the increase in nutrient requirement at peak lactation (approximately 60 days postpartum) with the concurrence of the start of breeding season, supplemental inputs during the breeding season may need to increase in May-calving herds, especially in young range cows, to optimize or maintain adequate pregnancy rates.

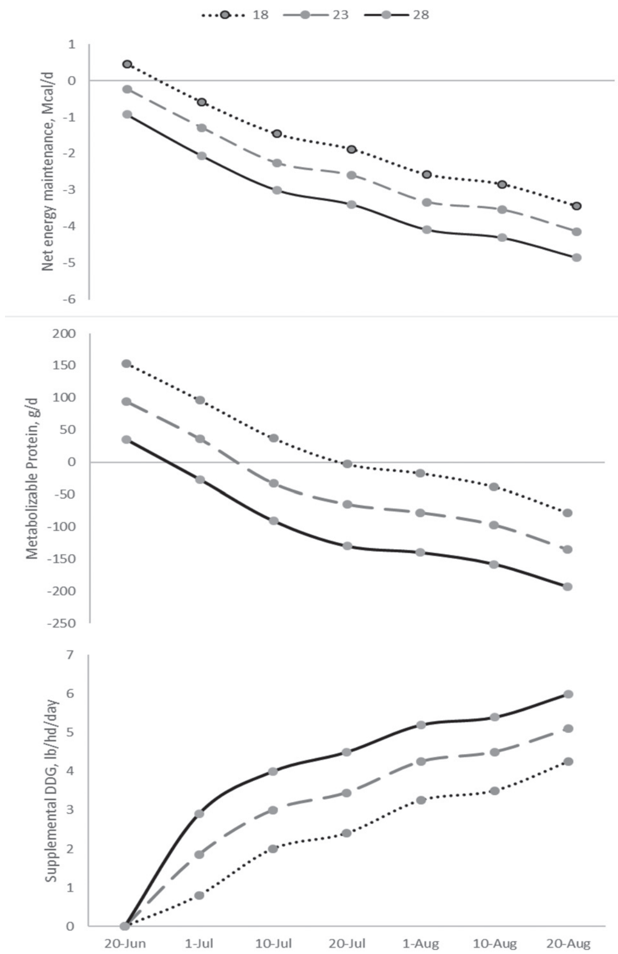

Figure 1. Evaluation of NEm balance (top graph), metabolizable protein balance (middle graph), and supplemental DDG needed to meet maintenance requirements (bottom graph) for May-calving 2-yr-old cow with milk production ranging from 18, 23, and 28 lb of milk at peak lactation while grazing Sandhills upland range.

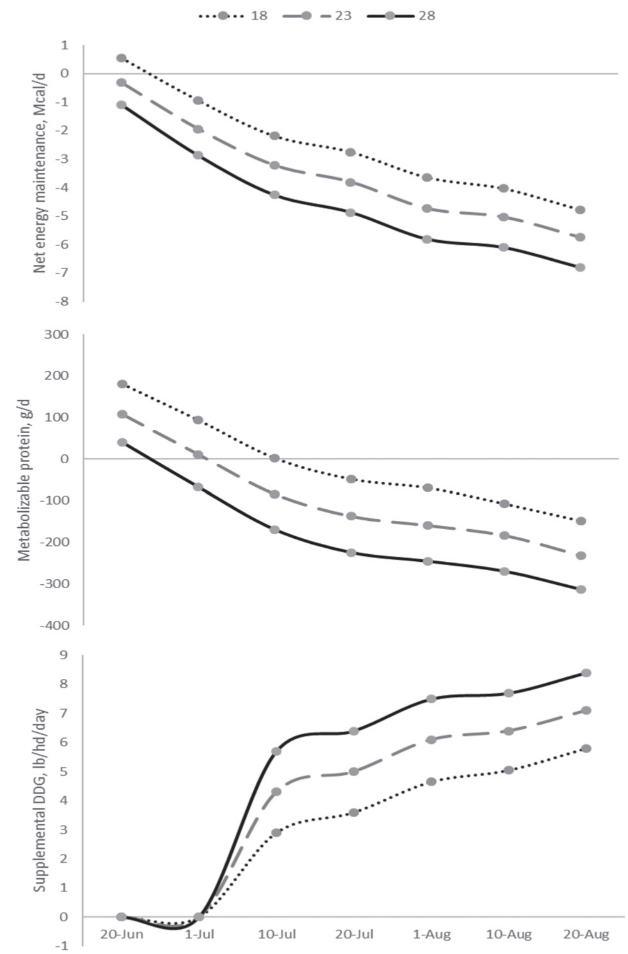

Figure 2. Evaluation of NEm balance (top graph), metabolizable protein balance (middle graph), and supplemental DDG needed to meet maintenance requirements (bottom graph) for May-calving 4-yr-old cow with milk production ranging from 18, 23, and 28 lb of milk at peak lactation while grazing Sandhills upland range.

In both age groups, NEm balance was in a deficit in late June ~ 30 d before the start of breeding and continued to be deficient through the breeding season. Even with low milk potential at 18 lb at peak, energy balance was deficient starting in first of July with increasing energy deficit as milk production increases. Without supplemental feeds, coming into the breeding season in a negative energy balance creates a scenario that cows have to have the ability to mobilize and utilize stored body fat and lean tissue. In contrast, MP balance was above requirements until early to mid-July depending on milking level. With increasing milk level from 18 to 28 lb, MP deficiency occurred early in July. The energy and MP deficiencies put more stress on younger, lactating cows, which will have a larger impact on reproductive performance. Young beef cows are calving for the first or second time, supporting calf growth, and require additional nutrients for growth to reach their mature BW. These factors contribute to increased nutrient demand, resulting in young beef cows having extended days to resumption of estrus after calving and lower pregnancy rates compared to mature cows. A driving factor of rebreed performance in young range cows is timing of resumption of estrus. Previous milk production and resumption of estrus have shown that postpartum interval increases 1.5 to 2.5 d/lb of milk produced in 2- and 3-yr-old range cows. Selecting beef cows with moderate milk potential may reduce the need for supplemental energy and protein and increase reproductive performance and longevity in the cowherd.

Similar to previous studies (*2019 Nebraska Beef Cattle Report*, pp. 21–23), RDP balance (graphs not shown) was in excess and was predicted to be from 71 to 167 g/d above requirements during the period of the study. In July when MP deficiency occurs, supplements high in RDP will likely not correct the MP and energy deficiencies and may be a less effective strategy to improve cow performance. Supplementation with a high RUP supplement with increased fiber energy content such as distillers grains may still be needed in young cows to meet the deficiency in MP and energy. The bottom graph in Figure 1 and 2 illustrate the predicted amount of DDG needed to meet nutrient requirements in 2- and 4-yr-old cows. In 2-yr-old cows, this model predicts that DDG supplementation for energy and MP would need to start July 1 with amounts needed increasing as the breeding season progresses. In addition, as milk production level increases, supplementation needs would increase ~2 fold from an 18 to 28 lb peak milk potential cow. For 4-yr-old range cows, supplementation would start during the first week of July and increase in amounts needed through the breeding season. The 4-yr-old cows required more supplemental DDG to meet requirements due to their increased actual milk production. However, previous research has illustrated that pregnancy rates in mature cows from March or June-calving herd are similar (*2001 Nebraska Beef Cattle Report*, pp 8–9). This similar reproductive response in mature cows compared to the decline in young cows is partially due to increased nutrient requirements for young cows for growth. If pregnancy rates in mature cows are lower, cows may respond positively to distiller grain supplementation.

Conclusion

In forage-based beef systems, balancing the environment (forage quality and quantity) and cow requirements is the foundation for production efficiency. The need for livestock producers to match cow size and milk production potential to forage resources in order to optimize forage utilization and reproductive efficiency is critical. In May-calving herds, lactating cows were deficient in MP and NEm during the breeding season. With RDP requirements in surplus during the breeding season and as milk potential increases, there is a greater demand to supply supplementation that would meet the energy and MP deficit. To increase reproductive performance in a July breeding season with May calving, young range cows, supplementation may need to start approximately 4 weeks before the start of breeding.

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