SHEEP IQ

Increasing Your Lamb Crop Series

Optimal nutrition for the ewe

Introduction

Sheep are seasonal breeders that vary in their seasonality based on latitude and genetics. They achieve their highest reproductive rate during the mid portion of their optimal breeding season which is September to December in the northern hemisphere. Nutrition plays a critical role in the reproductive outcome and productivity of sheep with particular production windows of importance being the prebreeding period, late pregnancy and lactation. . These production windows require a greater plane of nutrition as demonstrated in Figure 1.

MEETING NUTRIENT REQUIREMENTS AND MONITORING NUTRITIONAL STATUS.

Meeting the nutrient requirements of sheep is accomplished in different ways depending on the production system and available resource base of the flock. In grazing systems, this requires managing pasture allowance and quality with grazing practices and pasture or range management. In feeding-based systems, this requires managing forage and concentrate resources with proper allowance to meet requirements.

Nutrient requirements also increase markedly in late pregnancy according to litter size and during lactation according to the number of lambs raised. Meeting the energy needs of prolific sheep is challenging in grazing programs due to the energy density limitations of pasture and range. In a feeding-based system, providing energy supplements is more feasible to precisely meet the higher requirements of prolific ewes. Therefore, the matching of genetics to a production system and resource base is an important consideration in sheep production.

Managing nutritional resources to meet the requirements of ewes according to their production level and state should include a means of monitoring their nutritional status to ensure success. This can be accomplished by body condition scoring which is a method of estimating body reserves. Body condition is measured on a scale of 1 (thin) to 5 (fat) and is performed by palpation of the spinous processes of the lumbar vertebrae. Optimal body condition target

Energy Requirement of Ewes Raising Twins in an Annual Production System

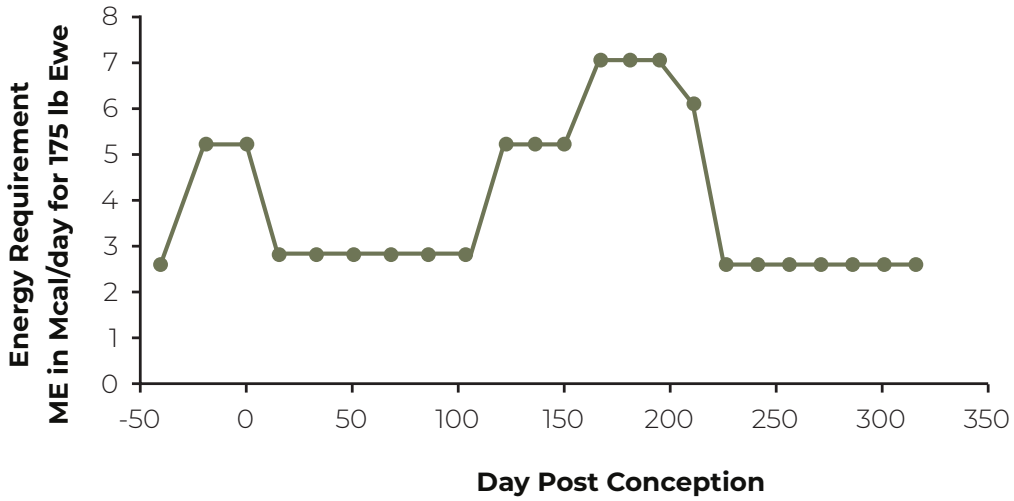

Figure 1. Energy requirements in metabolizable energy (ME) of ewes raising twins in an annual (12 month) production cycle (Adapted from NRC 1985, NRC 2007 and R. Ehrhardt, unpublished).

Body Condition Scores by Production Stage	
Maintenance	2.5-3.0
Breeding	2.75-3.5
Early pregnancy	2.75-3.5
Late pregnancy	3.00-3.50
Lactation	2.50-3.25

Figure 2. Recommended body condition score ranges for different stages of production of the ewe. Body condition is scored from a range of 1 (thin) to 5 (fat). In accelerated production systems, it may be beneficial to maintain body condition at the end of lactation slightly higher at 2.75-3.25.

ranges for each production state are indicated in Figure 2. Modifications of the nutritional management program may need to be made to meet these targets.

PRE-BREEDING NUTRITION OR FLUSHING

The process of providing improved energy nutrition prior to the breeding season is commonly referred to as flushing. This is a critical nutritional management window as flushing can improve ovulation rate 25%. Both prior and current nutritional status influence flushing responses. Ewes in better body condition (>3.5) show less response to improved nutrition. Improving the nutrition status of ewes about one half a condition score (5-10 lb. of body weight) is a good target and can be attained by providing ewes with 2 times their maintenance energy intake for a 2-3 week period just prior to ram introduction. This can be accomplished by supplemental feeding of energy concentrates and/or provision of a greater allowance of and possibly quality of forage in grazing or feeding programs. A flushing program can be scaled back at the time of ram introduction. During the breeding and early pregnancy period, feeding for slight weight gain is recommended to minimize embryonic loss. A flushing program needs to be matching with careful nutritional management throughout the production cycle to ensure that this boost in production is maintained and optimized.

NUTRITION DURING PREGNANCY

The nutrient requirements of pregnancy become measurable after mid pregnancy and increase rapidly in the last trimester. As the last trimester begins, the size of the placenta begins to exert its influence on fetal growth by limiting nutrient supply. To minimize this constraint, the plane of nutrition of the ewe must increase to meet fetal and placental demands. In ewe bearing twins, the energy requirements must expand 2-fold during late pregnancy over that required to maintain body weight. The challenge in meeting this requirement in prolific ewes is that voluntary feed intake is constrained (rarely exceeds 3% of body weight) which means the nutrient density of the diet must increase. This increase in density in some instances can be met with high quality stored forage or pasture, However, in prolific ewes rearing 3 or more lambs, the diet must be supplemented with concentrates (primarily energy) to meet the requirements of the last trimester.

If the ewe is moderately underfed during the last trimester, she can mobilize her own reserves to maintain fetal growth. This loss of body reserves however may impact her performance in early lactation as well as lower her immunity to infectious diseases like mastitis. If maternal undernutrition in late pregnancy is more severe, fetal growth will be compromised, leading to greater lamb mortality. In addition, underfed ewes have lower colostrum production, less beneficial maternal bonding behavior and other negative health consequences. The incidence of metabolic disease including ketosis and milk fever will also be much greater in underfed ewes.

Ewes fed to requirements will have larger lambs with lower mortality, greater colostrum and ensuing milk production and will a greater degree of beneficial bonding behaviors at birth. Late pregnancy nutrition is a critical investment to ensure flock health and productivity.

Grouping ewes according to litter size during late pregnancy allows more precise matching of feed resources to flock requirements. This can be accomplished by performing trans-abdominal scanning of ewes with real time ultrasound during the day 40-60 window of pregnancy to determine litter size. Additional grouping strategies for late pregnancy feeding that can be added include grouping according to body condition (high and/or low) and parity (number of births the ewe has had). First parity ewes, especially those bred under 12 months of age, will have greater requirements than mature ewes rearing the same number of lambs as they are still growing. First parity ewes are also smaller and less capable of competing at the feed bunk as found in feeding-based operations. Therefore, grouping them separately in situations when they are competing with older ewes for feed will help ensure that they meet their nutrient requirements during this critical time.

NUTRITION DURING LACTATION

The nutrient requirements of the ewe increase during lactation. Fortunately, this can be met partly by increased feed intake as the ewe will increase her voluntary food intake by at least 25% after she gives birth. The requirements for protein expand greater than energy during lactation, however, requiring an increase in the protein concentration of the diet to meet the requirements for milk synthesis. Therefore, the feed resources for the ewe flock need to be allocated to reserve higher protein sources for lactation. In grazing programs, the goal is to manage pastures or range to maximize intake of herbage rich in both energy and protein. In feeding-based systems, these needs can be met precisely by feeding and formulating rations according to lactation requirements.

As with pregnancy, the requirements of lactation vary according to the number of lambs. During lactation nutrient requirements are based on the number of lambs reared. Therefore, it is beneficial to group ewes according to the number of lambs they are rearing during lactation to allow for more precise feeding. This is generally more feasible than grouping according to litter size during late pregnancy as this can be done easily at birth in some production systems.

Peak milk yield occurs around 30 days of lactation and then declines at a greater rate after 60 days of lactation. The nutrient requirement of ewes declines accordingly. However, in accelerated production systems where the birth interval is shorter, so is the period before the next mating. For example, in an eight-month birth interval accelerated system, ewes are bred about 3 weeks following weaning. In systems such as these, it may not be beneficial to feed less during late lactation as that may diminish body condition and impact ovulation rate in the next production cycle.

ADDITIONAL DIETARY SUPPLEMENTATION CONSIDERATIONS.

In addition to the importance of meeting energy and protein requirements during key stages of production, there are also important micronutrient needs to consider and to supplement when feed resources are not adequate to meet their requirements. The critical micro minerals to provide will depend on the soils of the region which in turn determine the concentration of these micro minerals in grain and forages from that region. Therefore, supplementation needs for micro minerals are region dependent so producers should contact local expertise (cooperative extension and/or nutritional consultants) for supplementation strategies.

Fat soluble vitamin content declines rapidly after harvest in stored forages. Therefore, ewes fed stored forage may require supplementation of both vitamin A and E particularly during late pregnancy. The vitamin E requirement of sheep has been reexamined over the past 30 years and revised to recommend a much higher level of vitamin E than in the past (NRC 2007). Enhancing vitamin E supplementation to ewes during late pregnancy provides additional protection as an antioxidant against white muscle disease and may also increase birth weight and lamb vigor. All stored feeds (grain or forage) are too low to meet this requirement necessitating the need for vitamin E supplementation.

Figure 3. Prolific ewes such as these are limited in fed intake during late pregnancy, so it is important to increase the nutrient density of the diet to meet nutritional requirements (Photo R.Ehrhardt).

Summary

Optimizing the nutritional management of the ewe over her production cycle will improve reproductive outcomes and productivity of the flock. Periods of special importance are the prebreeding period, late pregnancy and lactation. In feeding-based systems the nutrition requirements of these periods can be met precisely with proper feeding levels and formulation of diets. In grazing-based systems, the nutritional requirements are met by careful grazing and range/pasture management. Micronutrient supplementation is also needed especially during late pregnancy with specific mineral needs based on regional soil mineral content.

SELECTED REFERENCES

Bell. A.W. (1995). Regulation of organic nutrient metabolism during transition from late pregnancy to early lactation. Journal of Animal Science 73: 2804-2819.

Bell, A.W. and R.A. Ehrhardt. 2002. Regulation of placental nutrient transport and implications for fetal growth. Nutrition Research Reviews 15: 211-230.

Coop. I.E. (1966). Effect of flushing on reproductive performance of ewes. The Journal of Agricultural Science 67:305-323.

Dixon, A. B., Knights, M., Winkler, J. L., Marsh, D. J., Pate, J. L., Wilson, M. E., ... Inskeep, E. K. (2007). Patterns of late embryonic and fetal mortality and association with several factors in sheep. Journal of Animal Science, 85(5), 1274–1284.

Kenyon, P.R., S,K.Maloney and D. Blache. 2013. Review of sheep body condition score in relation to production characteristics. New Zealand Journal of Agricultural Research 57: 38-64.

Nottle. M.B., D.O, Kleemann, T.I. Grosser and R.F. Seamark. (1987). Evaluation of a nutritional strategy to increase ovulation rate in Merino ewes mated in late spring-early summer. Animal Reproductive Science 47:255-261.

NRC. 2007 Nutrient requirements of small ruminants. National Academies Press, Washington.

NRC. 1985. Nutrient requirements of sheep. Sixth Revised Edition, National Academies Press, Washington.

Parr, R. A. (1992). Nutrition-progesterone interactions during early pregnancy in sheep. Reproduction, Fertility and Development, 4(3), 297–300.

Russell, A.J.F., J.M. Doney and R.G. Gunn. (1969). Subjective assessment of body fat in sheep. Journal of Agricultural Science, Cambridge 72: 451-454.

Sakul H, Boylan WJ. (1992). Lactation curves for several US sheep breeds. Animal Science. 54(2):229-233.

Scaramuzzi, Rex J., Campbell, B. K., Downing, J. A., Kendall, N. R., Khalid, M., Muñoz-Gutiérrez, M., & Somchit, A. (2006). A review of the effects of supplementary nutrition in the ewe on the concentrations of reproductive and metabolic hormones and the mechanisms that regulate folliculogenesis and ovulation rate. Reproduction Nutrition Development, 46(4), 339–354.