STRATEGIES FOR IMPROVING EFFICIENCY OF BEEF CATTLE IN TALL FESCUE PASTURE SYSTEMS

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ABSTRACT
A beef (*Bos taurus* L.) cattle producer must allocate land and forage resources to meet nutrient needs of the entire herd. Using 20 yr of calving and grazing data, templates of herd composition, associated Total Digestible Nutrients (TDN) requirements over the whole year, and forage TDN production were developed for a typical herd and land area. The monthly energy needed by the entire herd was relatively constant. Forage productivity varied monthly, indicating the need to plan for efficiently using surplus TDN from some seasons to meet needs at other times. This approach could be expanded to include more definitive nutrient requirements than TDN and additional pasture forages.

KEYWORDS
Forage distribution, NRC, herd requirements, Tall fescue, TDN requirements

INTRODUCTION
One of the most important decisions a beef cattle producer makes is allocating land resources for the herd (cows/calves, replacement heifers, bulls). This decision is affected by the production goals of the enterprise and the available resources. Forage resource allocation must consider the nutrient needs of the entire herd and the growth patterns of adapted forages. Normally, nutrient requirements are expressed on an individual animal basis and recognize that the production demand varies throughout the life cycle of the animal. However, the successful manager must develop a plan that meets the cumulative requirements of all animals that collectively comprise the herd. Pasture systems include several species that respond differently to the climatic and edaphic conditions of the regions where they are grown, and to defoliation. Strategies for improving the efficiency of beef production must be developed to match the productivity of forages with the nutritional demands of the entire herd.

MATERIALS AND METHODS
Calving records from about 120 cows/yr in university research herds over a 20-yr period were used to generate the time sequence of calving for a typical spring-calving (January-February-March) beef herd with a 90-d breeding season. From this data set, a frequency distribution was generated which described the herd composition over a production year, taking different stages of pregnancy/lactation in consideration.

Nutritional demands for TDN were then developed according to the requirements described in NRC-84 (National Research Council, 1984). Yearly nutrient needs of mature beef cows were divided into 4 periods of about 3 mo each: heavy lactation, breeding, middle third of pregnancy, and last third of pregnancy. In contrast to the usual method, which assumes that a properly-fed cow supplies the nutrients to the calf, nutrient requirements of nursing calves were divided into 3 periods: the first 3 mo (most nutrients supplied by milk); the next 3 mo (two-thirds of nutrients supplied by milk); the 3 mo prior to weaning (one-third of nutrients supplied by milk). Nutrient requirements for replacement heifers included growth (weaning to breeding), pregnancy (especially the last third), and lactation until she is pregnant again. The herd sire(s) were maintained for the entire year.

The energy requirements for beef cattle are presented in the traditional TDN system rather than in the net energy system (NE) which, although it may be more logical for ease of comprehension of the fate of nutrients, currently is not supported sufficiently by data. Animal requirements for protein, minerals and vitamins are not presented here although this type of information could be generated for beef herds if more complete data were available.

The predominant forage system in our region consists of tall fescue (*Festuca arundinacea* Schreb.) pastures which, when well managed, contain about 30% clovers (*Trifolium* spp.). The TDN estimates for fescue-clover production over time were derived originally from Blaser *et al*. (1986) and modified based on forage and animal productivity from 20 yr of Tennessee-wide grazing research data.
Results and Discussion

The cumulative TDN needed each month for a representative beef herd composed of 21 500-kg mature cows (90% average conception rate) and calves, 4 replacement heifers, 6 post-weaning heifers, and one herd sire, is presented in Figure 1. Calving season for the herd begins on January 1, with weaning in mid-October. When the entire herd is considered, the most striking feature in the figure is the relatively constant quantity of energy needed each month. The monthly TDN production from a properly-managed 24-ha tall fescue-clover pasture is presented also in the figure. Unlike the relatively constant nutrient requirements by the herd, forage productivity varies monthly, exceeding needs in spring with deficits of varying magnitude at other times; it is assumed that the animals in the herd consume the forage produced.

Changing the start of calving season from winter to other times of the year shifts the time when some classes of livestock need the energy, but the total monthly herd energy needs remain relatively constant (data not shown). Management practices for meeting animal needs when TDN production is insufficient at some times include use of hay from excess spring growth and deferred grazing of fall growth in winter. Hay properly harvested, stored and fed is essential to successful management of forage resources for efficient beef production. Other forages can be used also to mitigate deficit periods. Summer forage deficits can be alleviated with annual lespedeza or annual warm-season grasses. Annual ryegrass or small grains may be used in winter to reduce dependence on stored feed. Systems with multiple forages require more management than simpler systems but matching herd needs within restricted land resources increase efficiency. Inability to match forage systems and animal requirements leads to the necessity of supplementation from purchased hay, or with grains or commercial supplements.

The approach used here could be expanded in the future by utilizing the information in the recently published NRC-96 (National Research Council, 1996) to include metabolizable energy and protein as well as TDN. This new edition, although based on more data than previous ones, illustrates the need for additional research to quantify the contributions of many pasture forages to meet the nutrient needs of beef cattle.

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Figure 1

Comparison of monthly TDN productivity of 24 ha of tall fescue-clover pastures with the nutrient needs of a representative 21-cow beef herd in Tennessee