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J.L. Morrill

DAIRY CALF AND HEIFER RESEARCH AT KSU

J.L. Morrill[1]

Summary

At Kansas State University, we are conducting research concerning nutrition and feeding management of calves, heifers, and dairy steers with emphasis in the following areas: 1) development of feeds and management practices to stimulate rumen development and allow earlier weaning, concomitant with satisfactory growth; 2) vitamin supplementation to improve performance of growing dairy animals, with emphasis on increasing efficiency of the immune system; 3) determination of nutrients needed by growing heifers to achieve desired rates of growth required to reach adequate size at freshening at 22 to 24 mo of age, without getting too fat; 4) study of feeding programs designed to produce lean, tender, flavorful meat from surplus dairy bulls, with emphasis on methods to monitor body composition in the live animal; and 5) investigation of protein sources for milk replacers.

Introduction

The success of the programs to raise young dairy animals impacts on the overall efficiency and profit of the dairy in several ways. To reach their inherited ability to produce milk, heifer calves need to remain healthy. Fairly rapid growth is necessary if the heifer is to be bred early enough to freshen near two years of age and be of the desirable size. Low mortality and involuntary culling of growing heifers allows more choice when deciding which heifers to keep for herd replacements. Also, the increased awareness of the desirability of surplus bulls from the large breeds for meat production has made those animals more valuable for sale or for feeding on the dairy farm. The overall goals of our research with young dairy animals have been to discover ways to improve health and performance of growing calves, heifers, and surplus bulls, with emphasis on earlier development of the rumen, improvement of the function of the immune system, refinement of the requirements for nutrients needed for optimum growth of dairy heifers, and development of improved programs for feeding and management of surplus bulls intended for meat production.

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Feeding and Management of the Early-Weaned Calf

The ability of the calf to consume and utilize dry feed, which is less expensive than milk or milk replacer, is completely dependent on the proper functioning of the rumen; however, the rumen is not functional at birth and its development is dependent on several factors. A major effort of our calf research has been directed toward a better understanding of what affects consumption of dry feed by young calves and the various factors responsible for development of the size, absorptive ability, and microbial population of the rumen. By improved control of these factors, we hope to be able to wean calves earlier and, thus, reduce labor, feed cost, and incidence of disease and prevent a depression in growth that often occurs when calves are weaned. Currently, we are investigating the requirement of the pre-weaned and early-weaned calf for fibrous feeds, and rumen escape protein and are trying to determine ways to increase energy concentration of calf starters without depressing intake. One approach we have found very useful is the use of properly processed whole soybeans. We are continuing to investigate processing conditions required for economical, optimum, heat treatment of beans. Other approaches have been to investigate the use of ionophores and products to stimulate the development of beneficial microorganisms in the rumen.

Vitamin Supplementation

During the past decade, we have conducted several studies to determine the vitamin E requirement of young dairy animals. We have shown that the calf requires more vitamin E than had been suggested and that vitamin E, when added to what had been considered to be an adequate diet, was effective in improving the efficiency of the immune system. More recently, we have compared the efficiency of various forms of vitamin E.

In many cases, a deficiency or excess of one nutrient will affect the utilization of another nutrient. Currently, we are investigating the effect of excess vitamin A on the requirements for vitamin E and the relationship between vitamin E, vitamin C, and carotene. Carotene is the precursor of vitamin A and some research in recent years suggests that the cow has a need for carotene, apart from its vitamin A requirement. The very young calf, unlike the cow, does not have the ability to make vitamin C itself, and we are trying to determine when and how much supplementary vitamin C might be useful. By better understanding the needs of the calf and heifer for nutrients, we hope to improve health and reduce dependence on antibiotics and other types of medicines, the use of which is becoming more restricted.

Heifer Growth Requirements

Several studies have shown that lifetime efficiency of heifers is greater if they freshen first at 23-24 mo of age. Fairly rapid growth is required if heifers start coming into heat to be bred early enough and are at the right size when freshening at that age. Too rapid growth, especially before the heifer reaches puberty, will adversely affect development of the mammary system and future production. Based on the hypothesis that in some cases when heifers were reported to have become too fat, the problem was feeding excess energy or some other nutrients instead of a balanced diet, we initiated a project to evaluate NRC requirements for growing heifers. This is a long-term project, but as reported last year (Report of Progress 580, pp 22-25), heifers fed 115% of NRC requirement tended

to grow more rapidly without excessive fattening, came into heat and freshened earlier, and produced as much, if not more, milk than heifers fed 100% of NRC requirements. We are now investigating the effect of changing from 100% of NRC requirements to 115% or from 115% to 100% at 12 mo of age. Results from this experiment are not yet available.

Dairy Beef

Dramatic changes are occurring in the United States concerning the type of beef desired, with more emphasis on lean meat and more concern about cholesterol and other dietary factors. An increased awareness of the desirability of the Holstein steer for producing meat that is lean, tender, and flavorful is reflected by the large numbers of Holstein steers in Kansas feedlots. Many of these come from as far away as California to be fed out here because of the availability of grain and protein supplement. Recently, we began a research project to compare various methods that might be used to estimate body composition in live Holstein steers with actual measurements determined after slaughter. Measurements are made when the animals are 3, 6, 9, or 12 mo of age and some of the animals are slaughtered at those ages to obtain carcass information. Availability of a rapid, harmless, economical method to determine body composition in the live animal will allow us to monitor growth as affected by time and by various diets and, thereby, more efficiently develop feeding and management programs for production of a specific type of product.

Milk Replacer Protein Supplements

Justification for use of milk replacers for calves is based on the possible economic advantage of using all milk produced for human food or converting surplus milk in one season or geographical area to manufactured products that can be stored for use at another time or in another area when milk is scarce. Of the major components in milk, the fat can be replaced by non-milk sources without too much difficulty, and the carbohydrate (lactose) is available in large amounts as a byproduct (dry whey) of the cheese industry. The protein is the most difficult component to replace, because limitations on use of protein by the young calf require a very digestible protein, with the correct amino acid balance and free of antinutritional factors. We have conducted research to evaluate commercial sources of milk replacer protein of plant and animal origin and are beginning a project on use of a wheat protein product for milk replacers.