Factors Which Influence Forage Quality and Effectiveness in Dairy Rations

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INTRODUCTION

Forages have always provided the base upon which ruminant nutrition is built. Proper feeding of dairy cattle involves the use of high quality forage, and is a key to efficient production. With greater emphasis on milk yield, the dairy cow is increasingly challenged to consume sufficient nutrients to support milk yield while maintaining sufficient fiber intake to support good rumen health and digestion. Most ration formulation programs strive to satisfy net energy (**NE**) requirements of the cow. Often this is difficult without reducing forage (and fiber) to dangerously low levels in the diet.

At a Georgia dairy conference, the late Marshall McCullough referred to a colleague who, when invited to speak at a forage meeting, started with the comment "what in the world is there to say that is new about forages?" Indeed, in his paper McCullough cited an 1878 annual report at the Connecticut Agricultural Experiment Station referring to a book from Germany containing the results of some 1500 feeding trials, which clearly showed that maturing forages decline in crude protein **(CP)**, increase in crude fiber, and decrease in dry matter intake (**DMI**) and dry matter (**DM**) digestibility. So it seems that man has known the essence of forage production for well over 100 years. Yet the consistent production of forages of high quality often eludes us still.

Forage quality is determined by the user, the ruminant, and is a complex interrelationship of many factors which influence intake potential, nutrient content, digestion, gut fill, passage rate and partitioning of metabolized products within the animal. This is an area with a great volume of literature. This paper will discuss factors which influence forage quality that producers of forage, cattle or milk can use to improve animal performance.

DIFFERENCES DUE TO FORAGE SPECIES

It is often assumed that the correlation between digestion and intake of the forage, and the relationship of neutral detergent fiber (**NDF**) with intake is constant among forages, but those relationships are not regular. Large differences exist among classes of forages and if not considered in ration formulation, can lead to performance below expectations. Legumes such as alfalfa and cool season grasses differ not only in their fiber content, but also in the rate and extent of digestion (Van Soest, 1982). Relative to alfalfa, grasses have a greater lag to the start of digestion, a slower rate of digestion, but also have a greater extent of digestion. The greater extent of digestion of grasses offers the potential for greater energy availability, but slower digestive rates and greater ruminal retention times can result in lower intake, potentially offsetting gains from high digestibility.

Alfalfa has a high cell wall density because of the great extent of lignification, low fiber digestion relative to grasses, but a high total digestion (due in part to the high content of cell solubles). Thus, the digestible portion of alfalfa is rapidly digested and the remainder passes rapidly through the digestive tract. In comparison, grasses have a higher digestible fiber content, lower content of cell solubles and a less dense cell wall structure.

Digestibility (and its depression) is a function of the competition between digestion and passage rates. Digestibility depression is inversely related to lignification and to the rate of digestion (Van Soest, 1987). The more digestible and/or slower-digesting the cell wall, the greater potential for digestibility depression through the effects of intake level, physical form, passage, or concentrate addition. Thus as intake increases in multiples over maintenance, digestion of the more digestible fiber fractions (such as hemicellulose) becomes increasingly sensitive to passage effects and can pass from the rumen undigested. In a comparison of