Forage Sorghum Nutritive Value: A Review

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Introduction

Under the scope of higher water use efficiency, forage crops like forage sorghum [Sorghum bicolor (L.) Moench.] have been promoted as a substitute of corn (Zea mays L.) silage in dairy or beef cattle (Bos taurus L.) rations. Even though in regions like the Southern High Plains where the Ogallala Aquifer is declining (3) and research studies support that forage sorghum uses less water than corn in many situations (15,16,20), forage producers continue to grow corn instead of forage sorghum for silage. In addition, plant breeding programs have narrowed the gap in nutritive value between corn and forage sorghum, but preferences still remain for corn. The objective of this review is to discuss the substantial improvement of forage sorghum nutritive value in the last twenty years and analyze why forage producers are still unwilling to use forage sorghum instead of corn for silage.

Forage Sorghum Nutritive Value

Differences in nutritive value and digestibility among forage crops are determined by differences in plant tissue types. Plants with a C_3 photosynthetic pathway are generally more digestible and have greater nutritive value than plants with a C_4 photosynthetic pathway (29). Generally the main tissue types of C_3 and C_4 plants are the epidermis, mesophyll, and parenchyma, which in terms of digestibility are mesophyll > epidermis > parenchyma (29). The proportion of these three tissue types varies between C_3 and C_4 plants. The C_4 plants contain greater proportion of parenchyma tissue than C_3, in which mesophyll tissue is more abundant (29). Even though corn and forage sorghum have same photosynthetic pathway (C_4), the difference in tissue structure and distribution of leaves, stem, and ears/head is reflected in differences in nutritive value. Schmid et al. (28) conducted a study to compare the nutritive value of corn and forage sorghum for silage. Samples of eleven corn hybrids and 14 forage sorghum cultivars were separated into leaves, stem, and ears. On average the proportion of leaves and ears was greater and stem was lower in corn than forage sorghum (Table 1). A greater ADF concentration in non-bmr forage sorghum than corn may be associated with lower digestibility. Stems have a rigid structure and large proportions of the tissue are lignified and not available for digestion (1). In a different study Cummins (11) compared four forage sorghums at four maturity stages and separated leaf, stem, and head proportion and nutritive value of each component (Table 2). Similar to Schmid’s study, stem was in greater proportion at all maturity stages. Although Cummins did not compare nutritive value among plant components, greater digestibility of stem than leaf, and similar to head digestibility was observed in three of the four