Bioenergy crop research has received considerable attention in the last decade. Since the passage of the Energy Independence and Security Act (EISA) of 2007, research has intensified even more. To satisfy the EISA mandate, a multitude of so-called “energy crops” are proposed, including short-rotation woody, perennial herbaceous, and annual herbaceous crops.

Sweet sorghum, an annual crop, has a storied history in American agriculture as source of sugar, with cultivation dating back to the early 1800s. While it is still grown for syrup production, the sugary sap can also be fermented for ethanol production. For either use, the stalks must be crushed as in sugarcane processing. The crushed stems, known as bagasse, are often discarded as there are few known uses for the material.

To further the potential of sweet sorghum for energy production, University of Missouri researchers James Houx, Craig Roberts, and Felix Fritschi were interested in determining the potential of sweet sorghum bagasse as a livestock feed. Farmers in other countries, such as India and Brazil, have dual uses for bagasse, including heat production and livestock feed. However, the use of sweet sorghum bagasse in this manner is underexplored elsewhere. Thus, investigating alternate uses of sweet sorghum became the basis for two research publications.

The initial research focused on the analysis of sweet sorghum bagasse by near-infrared (NIR) spectroscopy to increase analysis throughput and reduce costs associated with determining plant biochemical properties (Roberts et al., 2011). The researchers grew 12 sweet sorghum genotypes in diverse environments and analyzed more than 650 bagasse samples that were either pretreated with anhydrous ammonia or left untreated. They found that NIR spectroscopy accurately determined gross-calorific value and common forage quality traits, thereby reducing the expense and analysis time of traditional chemical methods.

With this procedure, they set out to determine if sweet sorghum bagasse could also be used as an alternative livestock feed. Their study, published in the July–August 2013 issue of Crop Science, focused on growing 12 sweet sorghum cultivars in flooded, lowland, and upland environments with minimal inputs of nitrogen fertilizer (50 lb ac⁻¹) and harvesting the plants with maximum fermentable sugar concentrations and biomass yields. However, as plant development progresses, cell walls typically become lignified, resulting in high fiber concentrations, lower digestibility, and reduced amount of feed that livestock can consume. With this in mind, the researchers were further interested in determining whether pretreatment with anhydrous ammonia would improve the nutritive value of bagasse; ammonia is known to loosen chemical bonds and improve the digestibility of cell walls.

The researchers were surprised to discover that the nutritive value of the sweet sorghum bagasse was greater than expected, regardless of pretreatment with ammonia. Without pretreatment, in-vitro true digestibility (IVTD) values ranged from 640–770 g kg⁻¹ across environments and cultivars, and it was greater when the plants were subjected to flooded conditions (754 g kg⁻¹) than when grown in upland (699 g kg⁻¹) and lowland (739 g kg⁻¹) environments. Ammonia did not improve IVTD of flooded plants, but it did improve that of upland and lowland plants by an average of 26 g kg⁻¹. Cultivars responded differently to both environment and ammonia treatment, as the IVTD of some cultivars were greater from some environments and were improved by pretreatment in some environments but not in others. Crude protein (CP) of untreated sweet sorghum bagasse was low. It averaged 26 g kg⁻¹ and did not differ between environments. However, as with most low-quality forages, the ammoniation treatment improved bagasse CP of every sweet sorghum cultivar from each environment by an average of 117 g kg⁻¹.

This study suggests that sweet sorghum bagasse has attributes that merit further evaluation as a livestock feed, including feeding trials to determine animal intake and performance. The study also suggests that sweet sorghum can be used for more than just energy production, which adds value and flexibility for producers. This is an important consideration for farmers that contemplate production of bioenergy crops and cropping systems—particularly concerning the volatility of government policy and the scarcity of current bioenergy crop end uses.


References