SUGAR/ENERGY CANES AS FEEDSTOCKS FOR THE BIOFUELS INDUSTRY

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It is widely acknowledged that technologies for the conversion of the ligno-cellulosic component of the plant will have to be developed if the United States is to replace some of its needs for transportation fuel with renewable sources of biofuels. Sugar cane is cultured as a perennial row crop in the southern areas of Florida, Louisiana, and Texas. Since 1795, it has been grown, harvested, and processed for commercial sugar recovery in Louisiana, which lies farther from the equator than almost any area where this tropical crop is grown. Sugar cane is a very efficient C_4 grass in converting sunlight and other inputs into biomass—biomass that includes a high percentage of sugar that can be easily converted to ethanol as demonstrated by the successes in Brazil. Three sugar cane varieties (L 79-1002, HoCP 91-552, and Ho 00-961), dropped from the sugar cane varietal development program because of excessive fiber levels, were released in 2007 as "bench-marking energy cane varieties" to meet the possible needs of biorefineries, where the production of ethanol from all of the aboveground components of the crop is the desired objective. The three varieties produced soluble sugar yields of 10.5 to 14.8 t/ha and dry fiber (bagasse) yields of 13.0 to 20.8 t/ha with an estimated total ethanol yield of 11,400 to 13,400 L/ha when averaged over four yearly fall harvests of the same planting. New varieties of dedicated energy canes with higher levels of cold tolerance and higher fiber yields are being developed by introgressing genes from sugar cane's wild relative, *Saccharum spontaneum*, and from its near relatives *Miscanthus* and *Erianthus* in an attempt to move the geographic range of adaption further northward. Some of these early-generation hybrids are being tested in Alabama, Arkansas, California, Mississippi, and Oklahoma, as well as more northern areas of the traditional cane-growing states. Other types of sugar-containing grasses are also being evaluated as complementary crops to lengthen the season for feedstock deliveries and reduce storage costs at the biorefinery. Among these are four sweet sorghum varieties (Dale, M 81-E, Theis, and Topper) and two essentially nonflowering sorghum × sudangrass forage hybrids (MMR 333/27 and MMR 333/47). When these sorghums were planted in the early spring and harvested in the mid to late summer prior to sugar cane harvest (approximately 140 days after planting), soluble sugar and dry biomass yields of 8.1 and 15.7 Mg/ha were obtained with estimated total (sugar plus fiber) ethanol yields averaging 11,300 and 11,200 L/ha for the sweet and forage sorghums, respectively. Of the total ethanol produced, 50 percent of the sweet sorghum's ethanol yield was derived from sugar while for the forage sorghums only 34 percent was produced from sugar.

KEY WORDS: sugarcane, sweet sorghum, sorghum × sudangrass forage hybrids, *Miscanthus, Erianthus*, ethanol production

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