Next-generation sweet sorghums for the production of fuels and chemicals in the Southeastern United States

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Sweet sorghum is a tall (4-6 m) grass that grows well in hot and water-limited environments and that accumulates large amounts of soluble sugars in its stem juice. Given the large amount of bagasse (crushed stems) that remains after the extraction of the juice, sweet sorghum is an ideal crop to transition from first-generation sugar-based biofuels and chemicals to second-generation biomass-based fuels and chemicals. We have developed new sweet sorghum cultivars that perform better in Florida and neighboring states than currently available germplasm, and have generated short-statured sweet lines that can be evaluated for their potential as parents for hybrid sweet sorghums. Improvements in yield rely in part on germplasm that is resistant to anthracnose, the most prevalent fungal disease in the region that can reduce crop yields by 70%. With the use of a mapping population and genotyping-by-sequencing, we have identified a locus that confers anthracnose resistance, so that this useful trait can be introduced more efficiently in new cultivars. We are also developing novel, high-value nanomaterials from the lignin-rich waste stream of the biorefinery, with the goal of offsetting some of the operating costs of the biorefinery. We have shown that some of these nanomaterials show promise in biomedical applications, specifically as delivery vehicles for DNA and therapeutic agents into human cells. Commercial-scale application of these combined approaches is expected to lead to regional production of fuels and chemicals in an environmentally and economically sustainable manner. Supported by Southeastern SunGrant Center and USDA-NIFA Award No. 2010-38502-21854 and USDA-BRDI grant no. 2011-10006-30358.