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Advances in developing sorghum hybrids for use as a feedstock for bioenergy production in Brazil

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Bioenergy sorghum is divided into four categories based on the transformation vehicle and photoperiod sensitivity. Sweet sorghum is the traditional feedstock with high juice extraction rich in sucrose for direct fermentation with G1 technology. Sorghum for ethanol production can be photoinsensitive or photosensitive. Sweet sorghum cytoplasmic male sterile lines (A-lines) have been developed for use in confecting both photo-insensitive and photosensitive sweet sorghum hybrids. In tropical conditions, there is a window of opportunity during short days where photo-insensitive female lines flower simultaneously with photosensitive R-lines enabling the production of photosensitive hybrids. These hybrids produce 120 – 150 t ha⁻¹ fresh biomass during the long days of summer making sweet sorghum very competitive with sugarcane. Biomass sorghum is a photosensitive hybrid with dry stems that can be processed using G2 technology to transform cellulose and hemicellulose into sugars or burned to generate electricity (co-generation). Embrapa has developed biomass hybrids with reduced lignin for G2 technology and hybrids with increased lignin with greater calorific value for burning. Random mating sweet sorghum B and R populations using ms3 have been developed, principally to increase sucrose and high purity using recurrent selection. The harvest of sorghum for ethanol production, unlike grains where the product can be stored, is a 24/7 operation where the feedstock must be delivered to the processing mill continuously for several days or weeks. We developed a “Period of Industrialization – PIU” protocol for selecting sweet sorghum cultivars with high sucrose extraction for a minimum of 30 days, facilitating “Industrial Planning”. Sucrose content is highly correlated with longer periods of PIU. The major research challenge in biomass sorghum for co-generation is reducing the water content of fresh biomass. Genes for both biotic and abiotic stress tolerance are introgressed into breeding lines and hybrids using both molecular and traditional breeding methods.