

Cultivation, Storage, and Fermentation of Sweet Sorghum Juice in Arid Regions

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Alternative fuel production is of increasing interest throughout the U.S. and the world as cost and demand increase while fossil fuel supplies decrease on a global scale. The state of Arizona presents a unique situation as we have an abundance of sunny days which provide an ideal environment for the growth of plants that could be utilized as feedstocks for production of fuels. The goal is to design a system to primarily produce ethanol from a biorenewable feedstock in a sustainable manner that requires low inputs of nutrients, energy, and water. We are investigating optimization of ethanol production from sweet sorghum. Sweet sorghum is chosen as a feedstock since it is salt tolerant and requires less seed, fertilizer, pesticide, irrigation water, and tillage than other crops currently used for ethanol production. Field studies have been completed using three different varieties of sweet sorghum – Cowley, M81E, and Topper. Density studies indicate that between 4 and 6 plants per meter is best to optimize the amount of total sugars per acre. The line M81E produces the most sugars of the three lines studied. It also does not lodge as readily or is more sturdy than the other lines thus it is easier to harvest. Initial bench scale fermentation studies performed in shake flask cultures with little control indicate that all of the sugars are fermented and the ethanol concentrations of 9% are feasible. Results indicate that the juice can be stored in the freezer for extended periods of time prior to fermentation. However, this is quite costly, thus other methods of preservation are required. Investigations demonstrate that the addition of HCl and Na₂S₂O₅ to fresh juice preserves the juice for sufficient time to allow for transportation of the juice from the field to a fermentation site. Current studies are focusing on optimizing the fermentation process and producing large quantities of juice that will be fermented and processed in a regional corn to ethanol facility run by Pinal Energy.