

MANAGING HIGH BIOMASS SORGHUM FOR OPTIMUM ETHANOL YIELD IN MISSOURI

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Short Abstract

High Biomass Sorghum (HBS) has potential for production as a biofuel feedstock in Missouri, but little is known of the crop's yield and appropriate nitrogen (N) management for optimizing ethanol yields, especially in a low-input cropping system on marginal lands. This dissertation is a collection of four studies examining the potential for HBS to be adopted as a biofuel feedstock for ethanol production in the Midwestern U.S. The first study tested the effects of five N fertilizer rates (0, 56, 112, 168, 224 kg N ha⁻¹) on the production of two HBS hybrids (ES 5200 and ES 5201) over two years in central Missouri and determined yield of HBS was greatest at 56 kg N ha⁻¹ and above, but NRE and NUE decreased at higher N rates. The second study determined the corresponding HBS leaf and stem concentration and contents of 11 macro- and micronutrients from the first study above, where response to N fertilizer rate was controlled by differences between years in rainfall which increased concentrations, and demonstrated the strong link between nutrient uptake and plant growth. The third and fourth study included comparing the long-term yields (2010-2014) of HBS to maize and sweet sorghum at two marginal sites in Missouri and the effects on soil carbon. Theoretical ethanol yields of sweet sorghum and HBS were similar and greater than maize at both locations. Soil organic carbon concentrations decreased within all crop plots over the first two years at both sites, but after five years the SOC concentrations returned to levels similar to initial 2010 levels, suggesting beneficial effects from the biofuel feedstocks, namely HBS. High biomass sorghum is a high-yielding biomass feedstock that shows promise for production in Missouri.