Grass to Gas: Phase III: Study of Calcium Hydroxide Pretreatment on Increasing Cellulosic Ethanol Yield and DDG Feed Value in Prairie Cordgrass and Switchgrass

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The purpose of my project is to compare the ethanol yield and feed value of distiller grains of switchgrass and prairie cordgrass pretreated with calcium hydroxide, compared to nontreated. I hypothesized that pretreatment will have a significant difference ($p<.05$) in the total ethanol yield with both grasses along with a significant difference in the protein levels of the distiller grains. My procedure involves harvesting grasses, pretreatment for 24 hours at 135 F, and then using alpha amylase and glucoamylase to produce ethanol samples after fermentation and distillation. Distilled samples were then professionally analyzed with HPLC and NIR for DDG's My data indicated that pretreatment of prairie cordgrass with calcium hydroxide caused a significant difference ($p=.0022$) in the total ethanol yield and protein levels, increasing ethanol by 80.7%. Switchgrass failed to produce a significant difference in the total ethanol yield along with the protein levels, only increasing ethanol yield by 4.7%. Prairie cordgrass has a higher lignin concentration, so when pretreated, lignin is degraded, causing the cellulose to be more exposed. With NIR analysis, pretreatment caused a significant difference (Prairie Cordgrass $p=.021$, Switchgrass $p=.035$) in the protein levels of the distiller grains. This project applies to lands currently in the Conservation Reserve Program (CRP). Both grasses grow well in these lands, which are unsuited for agricultural use. If these lands could be used for ethanol production from these grasses, ethanol can be produced, more than corn-based ethanol, without competing with the food supply, while also providing wildlife habitat and erosion control.

Awards Won: