CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
Garron W. Ireton

Project Number
S1914

Project Title
Can Mesquite Compete? A Study Regarding the Potential of Mesquite Beans as California's Newest Biofuel Stock

Abstract

Objectives/Goals
Hypothesis: Mesquite (Prosopis glandulsa) pods are more efficient bio-fuel stock than corn (Zea maize). When processed similarly mesquite will:
1) Produce more sugar dissolved in solution as measured by specific gravity (SG) than corn
2) When fermented, yeast will consume mesquite's greater amount of sugar to produce more ethanol (bio-fuel).
Formal Hypothesis (applicable to parts 1 and 2 above):
Null Hypothesis (Ho): $\mu m <= \mu c$ (where μ is the sample mean of mesquite/corn)
Alternate Hypothesis (H1): $\mu m > \mu c$

Methods/Materials
Methods and Materials: Ten fermentation trials were performed; 5 each with dry corn and dry mesquite bio-fuel stock. Equal volumes of dry milled corn and dry milled mesquite were combined with equal volumes of distilled water, boiled and treated with alpha and gluco-amylases. The purpose of these two enzymes, the first a heat resistant type and the second a non-heat resistant type, was to convert starch to sugar. The mixture was strained and the hulls were rinsed with equal volumes of distilled water to wash any remaining sugars into the catch basin. Each solution's specific gravity (SG) was measured once the solution cooled to approximately 35 oC (95 oF). The solutions were poured into the fermenters with one packet of brewer's yeast. After 96 hours the fermentation was complete. Each solution's SG was again measured. Ethanol content, based on the difference between the starting to the ending SG, was computed.

Results
Hypothesis 1: The sample mean for corn was 39.9 and for mesquite it was 40.4 thousandths of a unit of SG. The alternate hypothesis was accepted with a confidence level of 93%. In other words, mesquite produced more sugar in solution than corn with a 93% confidence level. See the Statistics portion of the presentation board for details.
Hypothesis 2: The sample mean for corn was 78.5 ml and for mesquite it was 79.5 ml of ethanol produced. The alternate hypothesis was accepted with a confidence level of 94%. In other words, mesquite produced more ethanol than corn with a 94% confidence level.

Conclusions/Discussion
Mesquite produced more sugar and ethanol than corn. Mesquite needs less fertilizer and water and is therefore a more efficient bio-fuel stock.

Summary Statement
Investigation of the superiority of mesquite beans to corn as a biofuel stock

Help Received
Mother purchased needed materials. Father taught statistics, helped with questions regarding mathmatical analysis and chart development