



**CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY**

Name(s) Zachary W. Been	Project Number 38072
Project Title Importance of Processing Lawn Clippings to Release Sugars to Produce Ethanol to Reduce the Use of Fossil Fuels	
Abstract Objectives/Goals The objective of this project was to investigate if processed grass clippings could more efficiently generate biofuel, specifically ethanol. Methods/Materials I processed the grass clippings in three different ways to help break down the cellulose to sugar and then put yeast with the clippings to turn the sugar to ethanol. The processes that I used were microwaving, boiling, and blending the grass clippings. The grass clippings were then placed in water bottles with water and yeast. The goal was to create ethanol and carbon dioxide. The carbon dioxide was measured with a balloon that captured it. The balloon circumference was measured to determine the amount of carbon dioxide produced. This should relate directly to the ethanol produced, as carbon dioxide is a by-product of ethanol production. Results The control group of grass clippings showed the most consistent carbon dioxide yield. I did find that one hundred percent of the trials yielded some carbon dioxide and over seventy five percent of the trials yielded enough carbon dioxide to make the balloon stand upright on the bottle. Conclusions/Discussion Based on my results, I believe that I should continue to research the best method to produce ethanol with grass clippings. I found that grass clippings could produce ethanol efficiently without being processed. In future research, I would fine-tune my experiment procedures; room temperature, water temperature, length of trial, amounts of grass. I believe that this topic should continue to be researched because if we can create fuels using grass clippings, we can lessen our dependence on fossil fuels, and we won't have to use valuable food crops and prime agricultural land to create biofuels, when we have an endless supply of grass clippings from our existing lawns.	
Summary Statement I found that processing lawn clippings did not increase the efficiency of producing ethanol.	
Help Received My parents helped me complete the computer research and conduct my experiment. Mrs. Robinson, my fifth grade teacher, was my project advisor. Mr. Whitmore, a science teacher at Norris Middle School, was my Designated Support Provider and reviewed my project for safety.	