



**CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY**

Name(s) Brennan T. Coulter	Project Number S0809
Project Title The Potential for Tree Based Oils As a Substitute for Diesel Fuel	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals This research investigates the potential for tree based oils as a substitute for diesel fuel. Firstly for an oil to be a viable substitute for diesel, it must provide comparative performance in terms of miles per gallon, demonstrate a positive net energy gain, reduce carbon emissions and have economics on a cost per mile basis equal to or better than diesel fuel. Secondly the oil must also be scalable in order to have an impact. Finally as oils from trees such tend to be much heavier oils their viscosity and ability to flow in the fuel system of a car, are major concerns so viscosity must be tested along with other basic physical properties that are of concern in a fuel; density, cloud point, and ability to blend with diesel.</p> <p>Results From the assessment of viscosity, cloud point, melting point, density, and blendability with diesel; palm, castor, and jojoba oils were eliminated as candidates leaving avocado, a blend of avocado and diesel, and a blend of coconut and diesel as possible fuels. The testing for performance showed a baseline performance of Diesel of 27.0 mpg, followed closely by Jojoba at 25.5 mpg, Castor at 24.7 mpg, and Avocado at 24.3 mpg(all within the expected ranges). The blended fuels (85% diesel) were also tested with results landing between diesel and the pure tree oil. The avocado oil emerged as having the best overall properties as a fuel with the best blending characteristics. The other tree oils were eliminated for a variety of reasons.</p> <p>Conclusions/Discussion Avocado oil is viable only if it can be sourced at a cost delivering a cost per miles equal to or better than diesel and can be scaled to produce 6 billion gallons. Based on an economic model for the production of avocados, a delivered cost of \$1.74/gal to Houston was estimated which is below the threshold \$1.82/gal to be equivalent to diesel. Tax credits of \$1.00/gal for the oil make the economics more favorable. To produce 6.0 billion gallons of avocado oil, it was determined that 14.2 million acres would need to be planted. A United Nations study shows that countries in Central America and the Caribbean have a total of 73.6 million acres of unplanted crop land that is viable for this purpose. Avocado oil has been found to meet all the criteria to qualify as a viable substitute for diesel fuel and may provide the US consumer a savings of \$0.05 per gallon; a first for an environmentally friendly bio-fuel.</p>	
Summary Statement The Potential for #Tree Based# Oils as a Substitute for Diesel Fuel	
Help Received English teacher helped critiqu report; Parent mentor helped with economics	