

# MU Biofuels Garden

A biofuel contains energy produced by relatively recent carbon photosynthesis. Commonly used fuel sources such as petroleum, coal, and natural gas resulted from photosynthesis, but that photosynthesis occurred millions of years ago. Plants produce biomass and that biomass can be used by humans for fuel. For most fuels, at least some conversion has taken place. Although plants exhibited in the MU Biofuels Garden have energy uses other than transportation, liquid fuels for transportation (blended into gasoline or diesel fuel) is the primary focus of the Garden.

Ethanol is a simple molecule with two carbon atoms. During combustion in an engine the bond between the two carbon atoms is broken and energy is released. Part of that energy is harnessed to move the vehicle and the rest dissipates as heat.

Ethanol is produced by yeasts during fermentation. Most yeast species require free sugars such as glucose to produce ethanol. Sucrose, starch, and cellulose are three common ethanol feedstocks made by plants. When fermentation is terminated, the liquid portion of the slurry is 8 to 12% ethanol. Water must be removed before ethanol can be used for fuel. Distillation and other means results in 200 proof (100% ethanol), which is denatured to make it undrinkable and therefore, not subject to beverage alcohol tax.

Common plants that produce starch feedstocks are corn and grain sorghum. Plants such as sugarcane and sugar beet store carbohydrate as sucrose. Examples of plants used for cellulosic feedstocks are miscanthus, eastern gamagrass, Indiangrass, big bluestem and switchgrass.

Biodiesel is produced from plant oils and animal fats. Plants that produce seeds with large embryos store large amounts of vegetable oil. Vegetable oils are liquid at room temperature and composed primarily of triglycerides. A triglyceride is three fatty acids attached to a glycerol molecule. The chains of carbon atoms in fatty acids release energy when combusted, so fatty acids can function like diesel oil after minimal processing.

Production of biodiesel starts with extraction and purification of vegetable oils in a process often identical to vegetable oil refining for human consumption. The oil is treated with an alcohol (e.g. methanol or ethanol) A methyl group (if methanol is used) or an ethyl group (if ethanol is used) is attached to each fatty acid to produce biodiesel. Biodiesel is often blended with petrodiesel.

Printed from <http://genezoo.missouri.edu/>.



Bradford Research Center

573-884-7945

I-70 to Highway 63  
South on 63 for 1 mile to the  
"Broadway & WW" overpass exit  
Turn left (east) on Broadway/WW  
for 6.5 miles  
Turn right on Rangeline Road  
(watch for the sign) for 2 miles.  
Headquarters are on the right.



## MU Biofuels Garden, 2018

	Eastern gamagrass	Miscanthus	Camelina
Forage sorghum	Indiangrass	Peanut	Canola
Sweet sorghum	Big bluestem	Grain sorghum	Sunflower
Sugar beet	Switchgrass	Corn	Soybean

	Plants that produce starch feedstocks for ethanol
	Plants that produce sugar feedstocks for ethanol
	Plants that produce cellulose feedstocks for ethanol
	Plants that produce feedstocks for biodiesel