



**CALIFORNIA SCIENCE & ENGINEERING FAIR
2019 PROJECT SUMMARY**

Name(s) Jiyoun Roh	Project Number S1899
Project Title Preventing Eutrophication with an Organic Fertilizer Made of Dark Chocolate, Coffee Grounds, and Banana Peels	
Abstract Objectives Problem: Chemical fertilizers cause problems with water quality when they run off into water sources, which often lead to eutrophication, otherwise known as accelerated water enrichment. A rapid, massive growth of algal blooms can occur, which diminishes water quality and harmfully affects the aquatic community by decreasing the photosynthetic rate of plants (by lowering the oxygen content of water) and increasing water toxicity. This experiment focused on the initial hindrance of eutrophication, beginning with the usage of organic fertilizers--which have similar benefits as chemical fertilizers but are less harmful to the environment. Banana peels, coffee grounds, and dark chocolate contained the active ingredients potassium, nitrogen, and phosphorous. Questions: Can these items work as efficient organic fertilizers? And what is the most effective use of them--as powder, solid, or liquid? Hypothesis: If a liquefied mixture of banana peels, coffee grounds, and dark chocolate is used as an organic fertilizer for the <i>Lepidium sativum</i> (garden cress), then the photosynthetic rate of the plant will increase at a faster rate, as compared to the control, powder form, and the whole form. Methods Used banana peels, coffee grounds, and dark chocolate. Used a dehydrator to dry out these foods, then crush them (by blending), liquefy them (by blending with water), or cut them up into chunks to make the respective fertilizers. Fertilized the soil of pots with these fertilizers, sowed garden cress seeds into the soil, and then let grow under a grow light. Results Each trial showed that the plants that grew with the help of the liquid fertilizer consistently germinated more rapidly and grew significantly faster and higher than the other plants (maximum height difference between the liquid and control at the end of 21 days was 2.6 cm). Conclusions Hypothesis that liquid fertilizer would work best was proved correct. This experiment can be a foundation for other scientists to build upon to eventually prevent eutrophication.	
Summary Statement I tested three different forms of fertilizer--solid, liquid, and powder--on plants in order to determine which fertilizer worked best and in the long term, work in preventing eutrophication.	
Help Received I designed and performed the project by myself, with input from my research mentors Ms. Tuason, Ms. Coba, and Ms. Arunachalam.	