U.S. DEPARTMENT OF ENERGY
AlgaePrize
NextGen Algal Innovators

Team Name:

Algators

Team School/Organization:

Livingston High School, Livingston, NJ

Abstract:

Human activity continues to push our Earth beyond naturalistic limits. To keep up with growing food demands—a byproduct of a booming population—society has turned to synthetic compounds and fertilizers to increase crop yield. However, these synthetics have long-term, adversarial effects on our soil, air, and water, as well as on our health. Synthetic fertilizers release excess nutrients at rapid rates which the plants cannot absorb quick enough. During periods of ample rainfall, the excess nutrients in the soil run off into bodies of water, stimulating algal growth. These algal blooms prevent sunlight from penetrating the water, reducing photosynthesis and lowering dissolved oxygen levels. When the algae dies, decomposers further deplete the low oxygen levels to break down the algae. This forms hypoxic water conditions and aquatic dead zones in which no organisms can inhabit.

Luckily, microalgae are promising biocatalysts for enhancing the production of food in a sustainable manner. Algal biofertilizer has been shown to increase soil fertility, crop biomass, and crop macronutrient content; this means that more food can be grown to support humanity (Suleiman et al). Not only that, but algal fertilizers result in a more maximized absorption of nutrients in plants, given such nutrients are released to the plant at a slower rate in comparison to mainstream, synthetic fertilizers with a similar NPK ratio. Thus, there is a less excessive amount of unabsorbed nutrients constituting the runoff which will ultimately accumulate in nearby bodies of water. The accumulation of said nutrients in water bodies may lead to eutrophication. We are investigating the potential for algae to provide an organic substitution for synthetic fertilizer compounds that are currently being used on our Lancer Farm as a promising solution to combat the adverse impact of chemical fertilizers on water bodies, climate change, and provide food resources for our growing community.

In our study, we seek to synthesize our Livingston High School Biotechnology Pathway through our agricultural initiative: Lancer Farm. Our Biotechnology class utilizes the farm in order to learn about agricultural processes, techniques, and agricultural engineering possibilities. The experimental nature of our Lancer Farm challenges us to try novel farming techniques. In this study, we will investigate algal biomass as an alternative for fertilizer for our plants.

Using multiple different strains, we are looking to identify a potential substitute for traditional nutrients in inorganic fertilizers, preventing runoff that damages the environment. The use of algal biofertilizers would also allow for less material to be utilized by the soil due to progressive and slow release of algal products. Overall, this will reduce our carbon footprint due to both the absence of manure and inorganic fertilizer and the reduction in travel time required to purchase commercial fertilizer.