Sustainable Agriculture Enabled by Biodegradable Hydrogels for Improved Water and Nutrient Management

Isakson, Aubrey (School: Kidder County Tappen)

My question for this project was if biodegradable hydrogels a viable option for water conservation and fertilization in agriculture? Which hydrogel formula is the most efficient tool for soil nutrient content, water conservation, and plant growth? My hypothesis was that the Agar Agar, Citric Acid, and Hydroxyethyl Cellulose Hydrogels with Fertilizer added would have the most positive impact. Together, the Agar and HEC will create a structured hydrogel with high absorption rates. The fertilizer will increase the nitrogen, phosphorus, and potassium in the soil, therefore increasing plant growth. My materials were a kitchen scale, Agar powder (60 grams), Hydroxyethyl cellulose (HEC) powder (60 grams), Citric acid (30 grams), water, a pot to boil water, a bowl, a fork, a spoon, 30 small plastic containers, paper towels, potting soil - enough to fill up to 35 pots, small pots (35), 30 Manjula Pothos Cuttings, and a Soil Testing Kit. Test 25g of each type of hydrogel standing alone and in soil, with and without plant cuttings. Record water retention and absorption as well as soil nutrient levels, before and after hydrogel use. The results of the standalone hydrogels showed that HEC had the highest water retention and absorption rates, with Agar Agar gels having the lowest, losing mass. In soil, the Agar Agar and HEC combination with Fertilizer had a combination of high water intake and slow water release. The fertilizer was released in a controlled manner from the combination gels, while the HEC released it too quickly, yellowing the plants.

Awards Won:

Chemistry and the Law: Fourth Award of $1,000