CALIFORNIA SCIENCE & ENGINEERING FAIR
2019 PROJECT SUMMARY

Name(s)

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Project Number

J1821

Project Title

Biotechnology and the Soybean Revolution: The Effects of GMO Soybean Meal on Plant Growth and Environmental Pollution

Abstract

Objectives

The purpose of my science fair project was to determine if the application of genetically modified soybean meal fertilizer would result in negative growth outcomes and environmental consequences. Nearly 94% of US soybean crops are modified to be resistant to glyphosate, the active ingredient in common herbicides. Research has linked the chemical to increased use of fertilizers due to poor soil health, resulting in contaminated food and water sources. My study compared plant growth outcomes in terms of weight, and negative environmental effects measured as residual nitrate and glyphosate concentration in runoff water.

Methods

Plastic planting troughs were altered with PVC pipe to collect runoff water, then 16 snow pea seeds were planted in each. I applied .8 oz. of glyphosate resistant (GMO) soybean fertilizer to one, .8 oz. of Non-GMO soybean meal to another, and left the third unfertilized to act as a control. After 72 days of cultivation, I collected water samples and extracted the plants and weighed them with and without the root base. Nitrate concentration was tested with an Ion Chromatograph, and glyphosate was tested using the Abraxis Glyphocheck kit.

Results

The average weight of plants fertilized with non-GMO soybean meal was greater than those fertilized with the GMO product and control plants. These also sprouted more quickly and appeared to grow more vigorously. Only 8 out of the 16 plants fertilized with GMO fertilizer sprouted, giving a poorer overall yield. The results from water samples resulted high concentrations of nitrates from both GMO and non-GMO soybean meal, compared to the control. Glyphosate levels were reported as "high" for all 3 samples, and controls with Nanopure and well water both resulted in "non-detectable."

Conclusions

My experiment proved my hypothesis in terms of plant growth. GMO fertilizer yielded a smaller number of plants and lower average weight. In regards to environmental pollution, the results were inconclusive. Both fertilizers were significantly higher than the control and the maximum contaminant level for nitrates, showing they both have the potential to be very polluting. The elevated glyphosate results revealed that the soil in all test troughs had been previously contaminated, obscuring the outcome. My project reveals the importance of limiting the use of herbicides and fertilizer to avoid accumulation of contaminants in soil and water.

Summary Statement

My analysis indicated the negative effects of (GMO) glyphosate resistant fertilizer on plant growth outcomes, however, environment pollution could not be determined.

Help Received

I was given assistance by my dad in altering the troughs with a drill. I was also guided by the laboratory supervisor in the use of the Acquion Ion Chromatograph.