



**CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY**

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Project Title Using Adjuvants to Amplify the Effect of Organic Herbicides to Kill Undesired Plants	
Objectives/Goals The objective of the experiment was to solve the issue of invasive species which compete for nutrients with desirable plants. As a solution, adjuvants can be added to herbicides to amplify their effects. We wanted to determine which adjuvant, Ammonium Sulfate, Ammonium Nitrate, or Urea + Ammonium Nitrate would enhance Avenger Organic Herbicide the most.	
Abstract Methods/Materials To test our question, we treated three Mentha plants with separate solutions of adjuvant and herbicide in three replicates. The control group was given only the herbicide. We decided to use chlorophyll as a measure of plant health. To attain a quantitative value, we designed a spectrophotometer that registered the intensity of light passing through liquid plant material on a photoresistor. We conducted this test at the beginning, midpoint, and end of the project. Finally, we connected a multimeter to record the final end point as resistance. A dying plant would have a lesser amount of chlorophyll. The lighter the pigment of green, the more light passing through the plant material was recorded on the photoresistor, which was displayed as less resistance on the multimeter.	
Results Throughout our experiment, the plants treated with Ammonium Sulfate had the greatest decrease from the initial to the final measurement in resistance, having an average of 425 ohms. The Urea + Ammonium Nitrate plants had the next greatest decrease in resistance, with an average of 264 ohms. The Ammonium Nitrate treated plants came in third for the greatest decrease, with an average of 229 ohms.	
Conclusions/Discussion The Ammonium Sulfate treated plants had the greatest average decrease in resistance because they had the highest Hydrophilic-Lipophilic Balance (HLB). The adjuvants used in the project are surfactants, which break the surface tension between the herbicide and plant leaf, allowing the herbicide to disperse throughout the plant. The HLB indicates the strength of the hydrophilic and hydrophobic tails of the surfactant and shows which ones are most compatible with certain herbicides. Ammonium Sulfate was the most successful, as the organic water-soluble herbicide required a surfactant with a higher HLB.	
Summary Statement By measuring the chlorophyll content in Mentha leaves, we concluded that Ammonium Sulfate is the most effective adjuvant at increasing the penetration of an organic herbicide into the undesirable plant.	
Help Received Our mentor, Mrs. Kumar, helped us understand the mechanics of building a spectrophotometer, and guided us on how to quantify the data we received from it.	