# CALIFORNIA STATE SCIENCE FAIR
## 2011 PROJECT SUMMARY

**Name(s)**
Arianna M. Wood

**Project Number**
**J1938**

**Project Title**
# Improving the Food Supply and Environment Worldwide: Using Adjuvants to Augment Organic and Conventional Herbicides

**Abstract**

**Objectives/Goals**
My objective was to determine if weed killing could be improved by adding the adjuvant, ammonium sulfate, to an organic weed-killer, D-Limonene, and to glyphosate, the most commonly used weed-killer worldwide. Controlling weeds is important as they compete for nutrients and sunlight in the same soil.

**Methods/Materials**
Herbicide and adjuvant levels were varied to create different spray solutions. Using two pump-and-spray backpacks, I sprayed each of the resulting eleven solutions on separate six-foot by ten-foot plots of weed-covered land, with six-foot by ten-foot buffers in-between to minimize drift between each of the eleven conditions. A Calgamite Indicator analyzed the hard water elements of the local water used in the solution, in order to determine ammonium sulfate levels. Weed death in all conditions was measured weekly over a span of four weeks, and percentages of weed death were compared.

**Results**
Weed death did not occur during the first week, but began during the second week in all conditions with a 50% of the calculated ammonium sulfate dose and above. Weed death spiked during the third week, in conditions with 50% ammonium sulfate and above, and then leveled off in the fourth week. Both glyphosate and the organic D-limonene were twice as effective at killing weeds when combined with a 50% or greater dose of ammonium sulfate, compared to the herbicides without the adjuvant. Using half the manufacturer's recommended dose of glyphosate was very effective when combined with the adjuvant, and more effective than glyphosate alone.

**Conclusions/Discussion**
In conclusion, the organic herbicide did exceedingly well if paired with at least half the recommended dose of ammonium sulfate, showing the effectiveness of organic herbicides can be improved with a surfactant. The finding that a large amount of weeds was killed by 50% glyphosate, if combined with 50% ammonium sulfate and above, demonstrates that a farmer can use half the glyphosate normally used. Reducing glyphosate use by half in the farming community is a great cost savings and helps the environment. It also gives farmers the chance to kill weeds more often and across a larger area, leading to healthier crops and better food production worldwide. The results also suggest that with glyphosate, the adjuvant's effect may be as a surfactant, a protein-synthesis inhibitor, or both.

**Summary Statement**
My project is about how using adjuvants to enhance the effectiveness of herbicides to kill weeds is a great way to help the food supply and environment worldwide.

**Help Received**
My dad mixed the herbicide solution, and supervised me while I sprayed, because he has a private applicator certificate; a Camrosa Water District specialist analyzed the water sample I submitted.