

# The Effects of Dish Soap on Plant Development

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## Introduction:

Household dish soaps contain surfactants, which work by breaking down fats, oils, and waxes. Since dish soap breaks things down, it could be potentially hazardous to plants. If a cleaning product was to seep into the water supply that plants need, it could possibly negatively affect plant growth and development (Hall, 2014). Furthermore, the question at hand is: Does dish soap effect the growth of a plant? It is a necessity, for people as a whole, to understand the intricate interactions between resources that are intertwined with one another, such as water and agricultural crops (World Water Day 2014). A study was done to see the effects of generic dish soap and Seventh Generation dish soap (an eco-friendly dish soap) on *Triticum aestivum* (wheat) and *Helianthus annuus* (sunflower) plants. We hypothesized that the addition of dish soap to the plants' water supply will have a significantly negative impact on xylem count within the vascular bundles, stem and leaf length, and biomass; with the generic dish soap affecting the plant greater than the eco-friendly option. Monocots are composed of alternating nodes which contain internodes, that have scattered vasculature rather than a central cylinder, like dicots (Knoeller 2009). We predict that the sunflower (dicot) plants will have greater adverse effects than the wheat (monocot) plants, because of the previously stated difference between the two.

## Methods And Materials:

**Preparation:**  
Plant development experiment: Sunflower and wheat plants with three experimental groups for each: Sunflower and wheat plants were treated with eco-friendly dish soap, generic dish soap, or tap water (control). There were a total of 60 plants.

**Controls:**  
Amount of water, soil type, temperature, soap concentrations.

**Treatments:**  
Plant development experiment: Individual plants were separated into three treatment groups in separate trays. Once plants had sprouted about soil, they were given a 0.1% concentration of the appropriate dish soap once a week, for 3 weeks. Control group received no dish soap. All plants were watered twice a week with tap water.

**Measurements:**  
Every week we measured the height and leaf width. At the end of the experiment, we measured the biomass of the plant, and counted the xylem by taking a random sample of each species of plant and looking at them under the microscope.

## Acknowledgments:

Many thanks to Dr. Andrew Doust and his TA's: Ky Shen, William Hammond, and Dylan Franks, as well as to HHMI and Oklahoma State University's Department of Plant Biology.

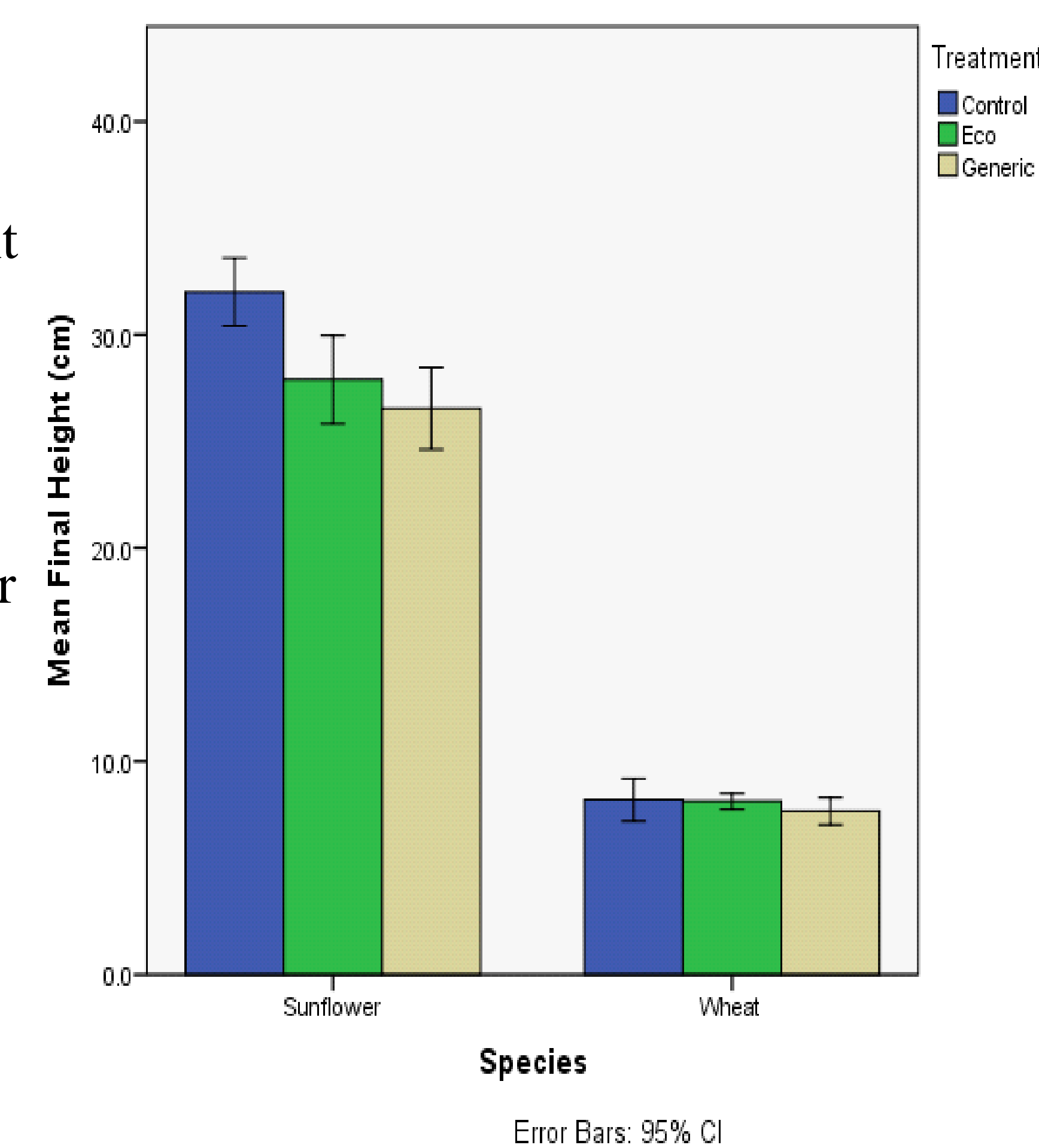
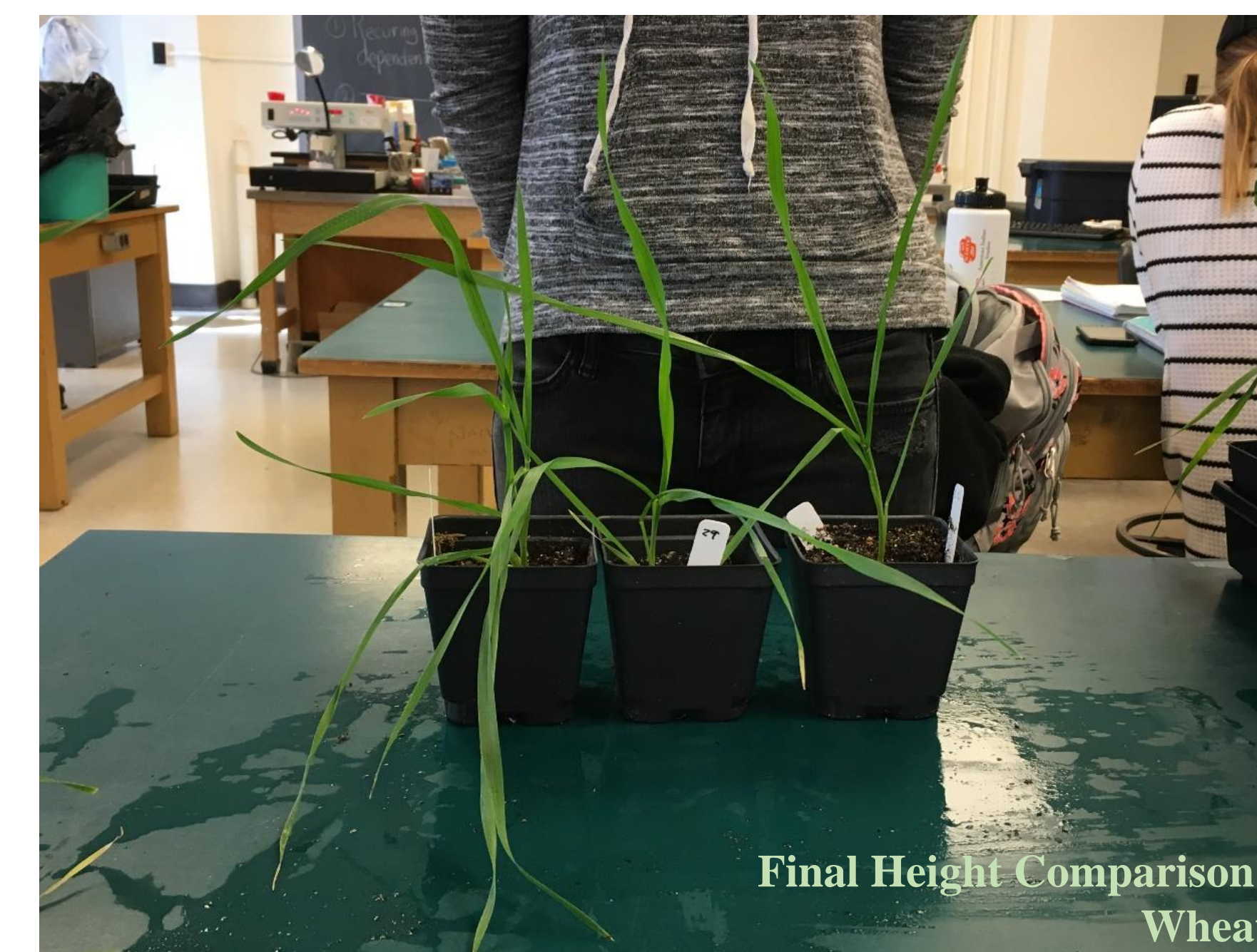
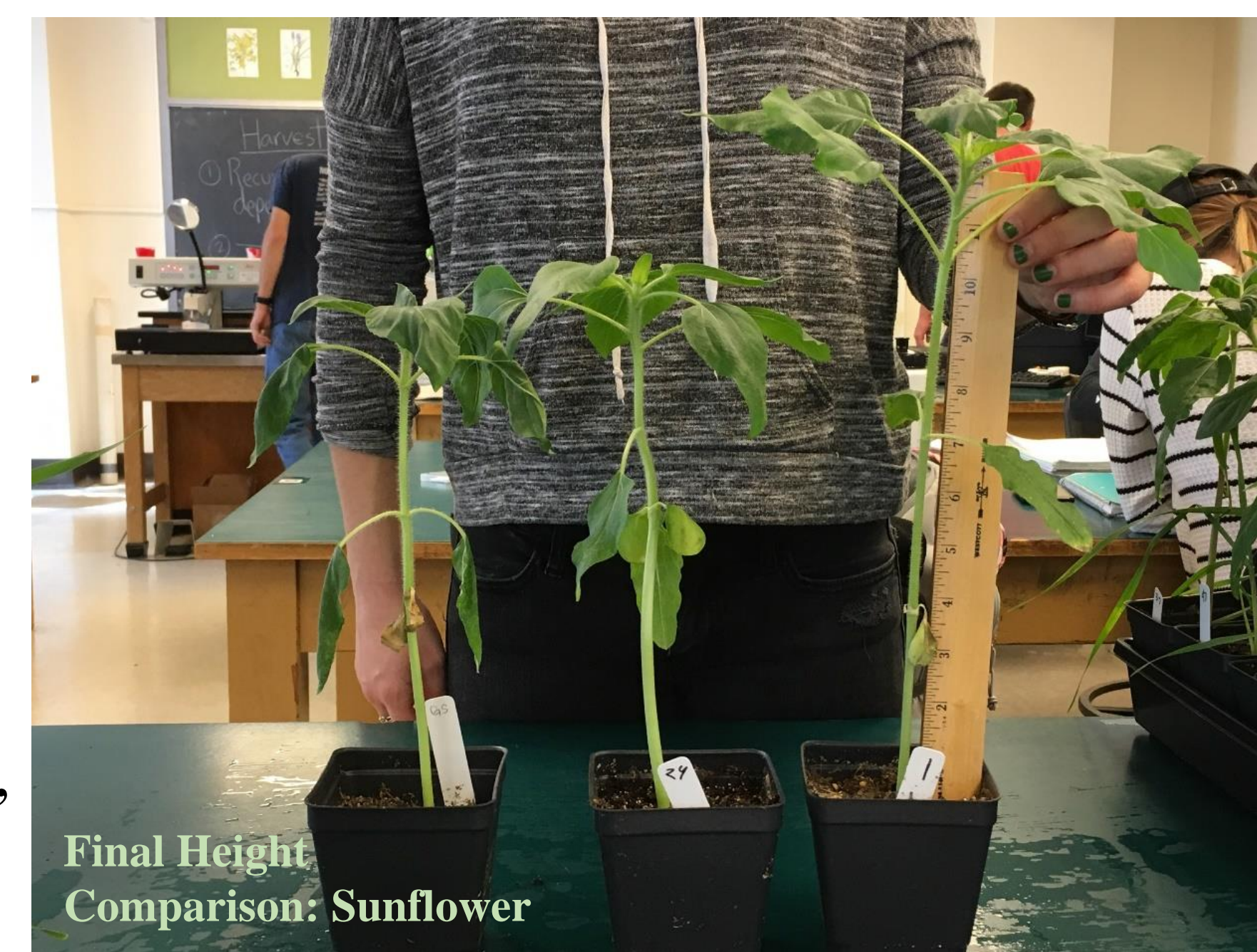


Figure 1: Bar graph showing the effect of different soap treatments on the height of sunflower and wheat plants.

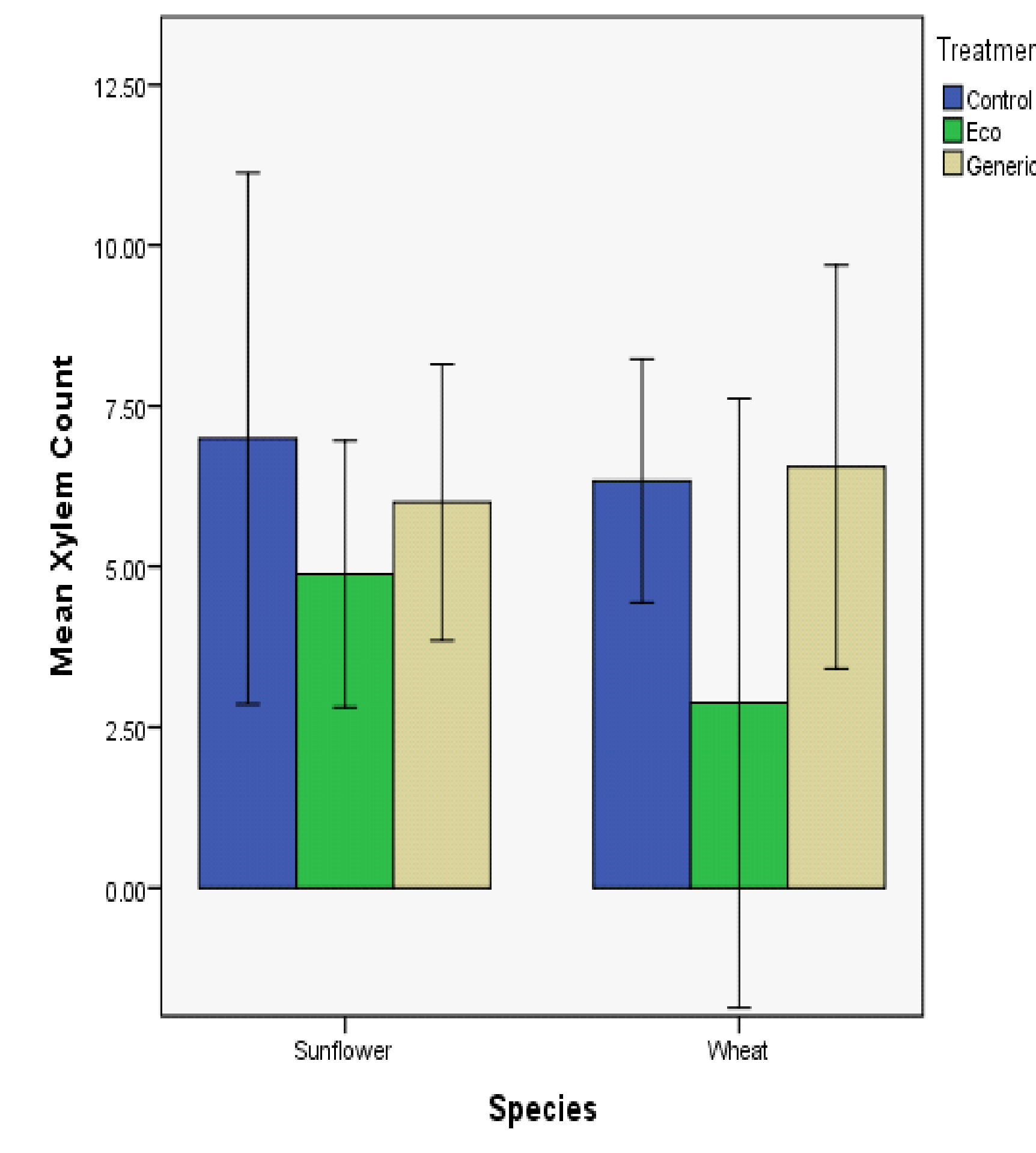
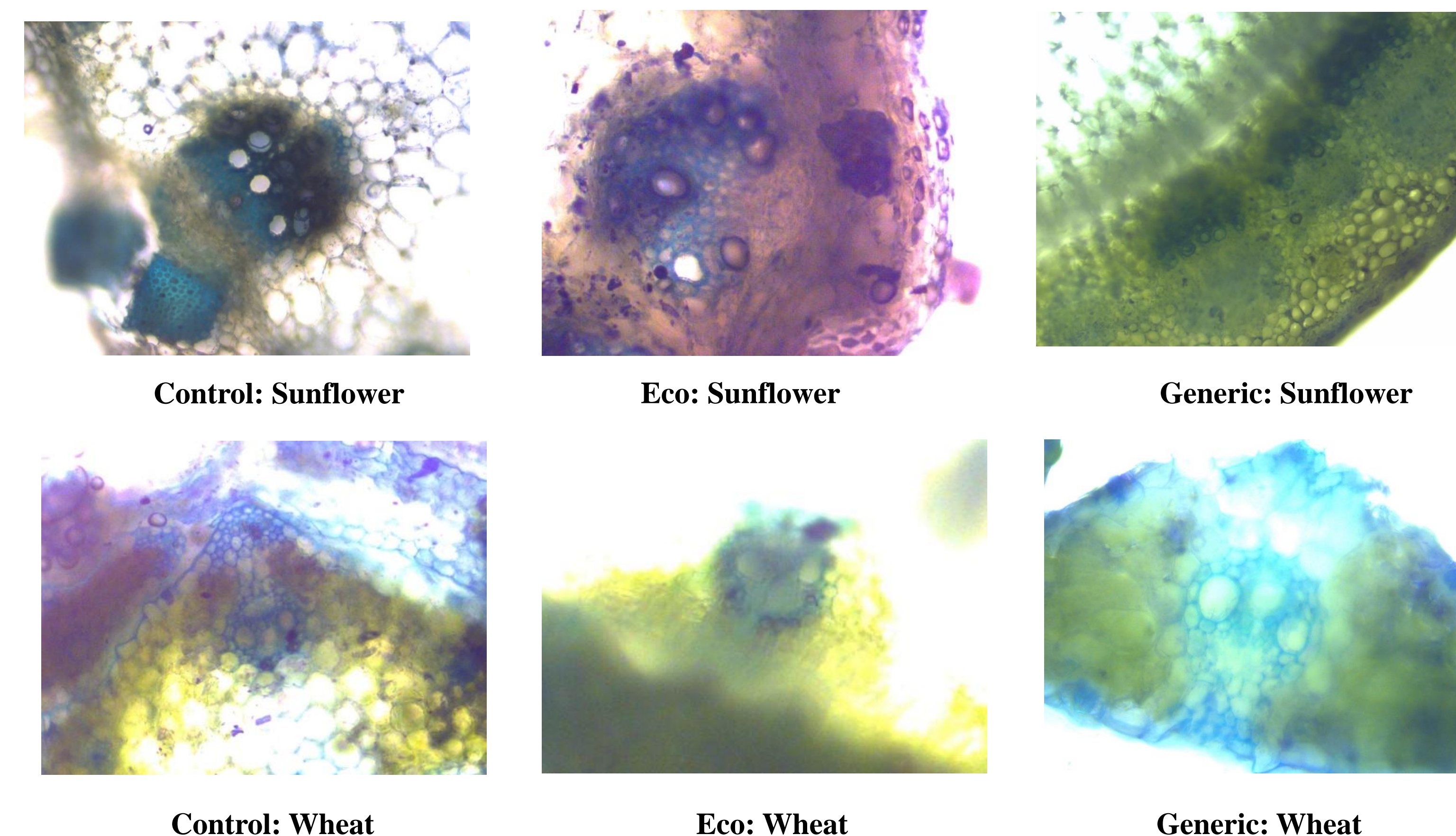


Figure 2: Bar graph showing the effect of different soap treatments on the xylem count of sunflower and wheat plants.



## Results:

Analysis of the data revealed that there was no significant difference in the biomass and leaf length of the sunflower and wheat plants between each of the three experimental groups. There was a significant difference ( $p = 1.744E-07$ ) in the sunflower plant height, as shown in Figure 1. The results also show that the xylem count contained a significant difference ( $p = 0.005837$ ), as shown in Figure 2.

## Discussion:

In this experiment, our hypothesis was not fully supported. Only one of the variables, the sunflower plant height, was calculated to have a p-value less than 0.05. The sunflower control group was significantly taller than either sunflower group treated with dish soap. The wheat plants were not effected in any clearly significant way from the addition of dish soap. Also, the eco-friendly brand Seventh Generation did not appear to be any less harmful to the plant than the generic dish soap.

Concerning the results of the xylem count, perhaps a clearer answer could be determined if the sample size was larger. The small sample size could have produced the potentially misleading p-value that was obtained through ANOVA analysis. Figure 2 shows that all of the error bars fall within the same interval; however, there is a noticeable difference in the wheat xylem count between the control group and the eco-friendly group. Determining whether or not this result is truly statistically significant would be an area that would interest us for further research. Also, it would be interesting to develop a method to statistically determine the differing effect dish soap has on the dicot and monocot internal structure. Another area of further research would be to determine the germination success for each treatment group, at different soap concentrations.

Our results were not consistent with an experiment testing the addition of surfactants to aquatic plants: their results yielded significant decrease in plant growth (Pandey, 2010). Our experiment relates to the rising concern of climate change: future water shortages and runoff issues could lead to a decreased quality of the available water (EPA, 2013). Greywater, which is water polluted by soap products used in kitchen sinks and washing machines, may also increasingly be utilized to water household vegetation (Jefferson, 2000). Perhaps experiments analyzing the effect of household pollutants on plant growth will become more prevalent as the climate continues to change.

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