Effects of Soil pH on Stomatal Density in Vigna unguiculata

Jabaley, Isaac (School: Benjamin Franklin High School)
Nguyen, Amy (School: Benjamin Franklin High School)

Pollutants have been shown to affect soil characteristics, particularly soil pH. Microplastics, an increasingly widespread pollutant, increase soil pH, according to literature. To understand potential effects of this pollution on horticulture, experiments were performed to investigate how an increase in soil pH affected plant development, particularly stomatal density due to its influence on plant health through impacts on respiration and photosynthetic rate. Our hypothesis stated that lower pH would result in higher stomatal density. The independent variables were containers with soil modified to pH 6, pH 7 (control), and pH 8. Three pea plants, Vigna unguiculata, were planted in each pot and watered until they formed a pea pod. After pea pod formation, stomata were visualized by removing the epidermal layer with clear nail polish and tape and studied under a microscope. One leaf from each cluster of three was randomly selected for imaging, and three random sites on the epidermis were photographed. Stomatal density was determined to be significantly higher in plants grown at pH 6 (Mean=198 pores/mm2, Standard Deviation=41.836, SEM=5.693) than those grown at pH 7 (Mean=163 pores/mm2, Standard Deviation=30.141, SEM=6.578) and pH 8.5 (Mean=158 pores/mm2, Standard Deviation=50.019, SEM=5.854) ($p<0.001$). No significant difference was found between stomatal density in plants grown at pH 7 and pH 8.5, supporting the hypothesis that pea plants fare better at lower pH and may be more susceptible to microplastic pollution.

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