CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Grace Xu

Project Number
34879

Project Title
Where's My Water? The Effect of Contaminants and Organic Compounds in Various Soil Textures on Soil Water Retention

Abstract

Objectives/Goals
The purpose of this project was to investigate how the presence of solutes, CO_2, and acidity in water, as well as organic compounds in soils, may interact with soil textures to affect water retention characteristics. Water retention includes two aspects, water saturation, and the soil water potential, which affects the wilting point and amount of effort plants must use to withdraw water. As water becomes more and more scarce, it is not only the amount of water held in soil that is important, but also its accessibility. Therefore, if we understand what can negatively affect usability, we can better manage those factors to reduce the demands of limited water resources.

Methods/Materials
The objective of this project was achieved by applying controlled drying cycles to soil samples saturated with different types of water, and then obtaining their drying curves (moisture content vs. elapsed drying time). Faster drying speed is a reflection of higher water potential and vice versa. Although typical water retention curves are obtained by applying vacuums, drying curves reflect the same water retention characteristics.

Results
This experiment confirms almost all hypotheses. Finer soils do indeed hold more water and have slower drying speeds due to lower water potentials. It was also found that a small amount of humus increased water saturation greatly. The presence of CO_2 in water did reduce drying speeds, and thus water potentials, slightly. As expected, the presence of even a small concentration of salt significantly water potentials, and thus drying speed. Vinegar did cause faster drying speeds due to the faster evaporation rate of acetic acid, but the increase was surprisingly significant compared to what was predicted.

Conclusions/Discussion
The findings suggest that a small amount of humus makes a noticeably positive difference in water retention, and is especially helpful in the case of coarser soils, which do not retain water well due to their lower water saturation and higher water potentials. Experiment results also showed that it is very important to prevent accumulation of solutes in soil and water, especially in finer soils where contaminants tend to build up faster and are difficult to leach out. This sustained buildup further reduces water potentials, making water much less accessible by plants. Thus, even a small amount of solutes can have a very significant effect.

Summary Statement
This project studies how various forms of soil water pollutants can decrease soil water potential and thus decrease the amount of water available to plants.

Help Received
Father helped carry out experiment trials and use computer programs to graph and chart data.