Name(s)
Vedha Santhosh

Project Number
S1123

Project Title
The Optimal Soil Stabilizing Biopolymer to Reduce Shear Induced Erosion and Improve Soil Productivity

Abstract

Objectives/Goals
The objective of my study was to determine the optimal soil stabilizing biopolymer to reduce shear induced erosion and improve soil productivity. I compared 3 vegetable based starches to test effectiveness of water retention, prevention of nutrient runoff, and promotion of plant growth.

Methods/Materials
Control: Untreated soil (not amended)
Independent Variables: Starch Based Soil Stabilizers
Dependent Variables: Resulting water retention, plant growth, nutrient runoff (N, P, K)
Phase I- 3 different types of soil stabilizing Super Absorbent Polymers(SAP)were produced using Corn, Tapioca, and Potato starch. Active ingredients used to increase cross linking and water retention were Carboxymethyl Cellulose and Aluminum Sulfate.
Phase II- The amended soil was tested for water retention and nutrient runoff. The water retention test measured how much water was retained by amended and stabilizer-free soil. Stabilizer free soil, retained the least water and started releasing water after only 20 mL. Tapioca Starch based SAP-amended soil was the most hydrophilic and retained most water since it started releasing water after 45mL. The nutrient runoff test measured retention of original Nitrogen, Phosphorus, and Potassium levels after using soil stabilizing SAPs.
Phase III- Pea plants were grown in amended soil and stabilizer-free soil. Optimal Starch Based SAP was determined by plant height and soil testing.Plants were watered 25mL every week after germination and observed.

Results
The results of my experiment confirmed my hypothesis; biodegradable SAPs were the best soil stabilizers. Plants grown in soil with Tapioca Starch based SAP grew tallest and healthiest (strong stalks, no breakages). Soil amended by Tapioca and Corn starch had increased water retention than potato starch. Plants grown with no stabilizers had lower height while the soil was dry and erosion-prone.

Conclusions/Discussion
Soil amended with Starch Based Super Absorbent Biopolymers especially tapioca starch is a renewable, sustainable, and biodegradable alternative to plants. Untreated soil is erosion prone, has low water retention, enables nutrient runoff, and inhibits growth.

Summary Statement
Soil amended with Starch Based Super Absorbent Biopolymers reduces shear induced erosion and improves soil productivity due to increased water retention and decreased nutrient runoff.

Help Received
This project was performed entirely at my home by myself. I researched on the internet about widely used methods of soil stabilization and alternate renewable resources.