CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
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Project Number
S1104

Project Title
Amending Desert Soil to Reverse Desertification

Abstract

Objectives/Goals
This engineering project reverses desertification by constructing a lattice composed of biochar, basalt rock dust, and coconut coir. By reducing wind erosion, maintaining soil temperature, reducing water loss, and improving soil nutrition, this product allows crops to establish themselves in an arid area in a cost-effective and sustainable way.

Methods/Materials
The testing procedures included three experimental trials with and without the lattice. The experiments tested four specific characteristics. Wind erosion was tested by measuring the volume of sand blown downwind using a hairdryer. Moisture retention was tested by exposing sand to a heat lamp and measuring water infiltration, permeability, and evaporation. Soil temperature was tested by exposing sand to a heat lamp and measuring the soil temperatures. Soil nutrition measured the N,P, and K content by using the Rapitest soil kit after infusing degraded soil with the lattice and compared against the control. Plant growth was measured using a tape measure after growing a variety of plants in desert conditions for three weeks with and without the lattice.

Results
The product met the following objectives: the effect of wind erosion was reduced by 91%; water loss was reduced by 50%; topsoil temperature was maintained between 25C and 26.7C; NPK content of the soil increased to surplus; plant growth was maximized, and the per-unit cost of production was about $0.50.

Conclusions/Discussion
The product met the design goals. While the causes of desertification have been well researched, there is no single cost-effective and practical solution. This lattice cohesively combines three different components which reverse the effects of desertification. Coconut coir acts as a wind barrier, provides a moderating influence on temperatures, sponges nine times its own dry weight in water, is pH neutral, and acts as a transport medium. Biochar retains moisture and essential N, P, and K nutrients when pyrolyzed. Basalt rock dust provides essential minerals that are native to igneous rock. By mass-producing this lattice, the current per-unit cost of $0.50 will be dramatically reduced. This single, biodegradable, and easily transportable lattice, protects and revitalizes the soil and retains moisture while enabling farmers to cost-effectively grow sustenance and commercial crops, thus reversing desertification.

Summary Statement
I created a biodegradable and cost-effective lattice that reverses desertification by protecting against wind erosion, maximizing water retention, and increasing soil nutrition, enabling plants to grow.

Help Received
None. I designed, built, and performed the experiments myself.