Colorado Science and Engineering Fair

2024 Individual Project Abstract Form

Please print 2 copies of the completed form. Sign both copies, keep 1 for your notebook and submit 1 copy to your Regional Fair Director with your other paperwork.

Title of Project: Paper for the Planet Development of a novel paper inoculated with wildflower seed and carbon-sequestering fungi

Finalist's Name: Naomi Kruse

School and City: Schullandheim, Colorado Springs

Sponsor's Name: Tami Kruse

Category: Earth & Enviornmental Sciences (EAEV)

Division: Senior (9th - 12th grades)

Abstract (250 words or less):

Naomi Kruse
Paper for the Planet: Development of a novel paper inoculated with wildflower seed and carbon-sequestering fungi

Background
With worldwide attention to decreasing carbon dioxide (CO2) emissions, we need to look at natural carbon capture and storage methods to stop CO2 from escaping into the atmosphere. In nature, plants store carbon as cellulose in leaves and tree trunks but this does not account for all atmospheric carbon captured. Recent satellite imagery has calculated that 36% of world carbon emissions are captured by plants and are stored by underground fungal networks of mycelium. I determined to discover whether seed and mycelium could be germinated together on a cellulose-based paper as a way to administer it in the wild.

Method
I created pasteurized and unpasteurized slurries of cellulose plus Pleurotus ostreatus spawn or Agaricus bisporus fungi at high or low levels of inoculant at three agitation levels (45, 70, and 240 rpm). Wildflower seeds were added at 1g/L. The pulp was pressed, molded, and dried into paper. Small amounts of sucrose and coffee were added to cellulose in some samples as known champions of mycelial growth.

Propagation
Paper was re-wet and placed in a growth chamber at a constant temperature of 20°C and neutral pH under conditions related to humidity, aeration, light level, and added food. Samples were evaluated every other day for two weeks. Seed germination counts and mycelium measurements were taken and evaluated.

Results
Pasteurized cellulose plus Pleurotus spawn hand stirred at 70rpm produced the most ideal pulp. Low levels of Pleurotus spawn in light with adequate aeration proved to benefit higher levels of seed germination. Higher levels of spawn inoculant left in darkness with less aeration led to 90% greater mycelial growth. 45% humidity benefitted both plant and spore. Neither coffee nor sugar significantly impacted growth. The methodology for using Agaricus fungi as an inoculant is still being fine-tuned.

Conclusion
The "planting" of the paper as a natural method of carbon capture in the wild was found to be positive as spores and seeds naturally germinated into a low-nutrient soil, where conditions are less managed but more selective to growth than within a lab setting.

I hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I also attest that the above properly reflects my own work.

Finalist's Signature: Naomi Kruse Date: 03/04/2024

In addition, all students must complete the ISEF Student Checklist (1A), Research Plan, Approval Form (1B), and Checklist for Adult Sponsor (1), and any other ISEF forms required for this type of project. See the International Rules and Guidelines for form requirements. Return COPIES o all of these forms to your Regional Fair Director with you Finalist Verification/Permission Form. A signed copy of this form must be included in your notebook.