CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

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Project Number

J1811

Project Title

Spinning Seeds: How Centrifugal Force Affects the Growth of Plant Roots

Abstract

Objectives/Goals

In this science fair project, I investigated how plants know how to send their roots down, and how to change the direction that their roots will grow. My research question was: "How does centrifugal force affect the direction of growth of a plant's roots?" After doing background research, I predicted that the angle of the plants' roots relative to vertical would increase when the centrifugal force increases, because the plant will feel an additional force besides gravity and the roots will then grow in a direction closer to horizontal. Quantitatively, I predicted that the angle will be determined by the sum of the two forces.

Methods/Materials

My experiment used a record player, petri dishes, soil, water, radish seeds, and wooden planks. Soil, water, and seeds were put in the petri dishes, and the seeds began to grow. The petri dishes were then put on the wooden planks on top of the record player at 0, 22, 44, and 74 cm from the center, and then spun to make the radish seeds feel centrifugal force. After 24 hours, the dishes were taken off and the angle of the plant roots (relative to vertical) was measured. This was repeated so there were 6 trials at each of the 4 distances from the center.

Results

I compared these angles to the predicted angle I calculated with the formula: a = arctan(Fc/Fg), where Fc is centrifugal force and Fg is gravitational force. Here are the results for the 4 distances (experimental data vs. prediction in degrees): 0 cm: 2 vs. 0; 22 cm: 7 vs. 16; 44 cm: 25 vs. 30; 74 cm: 40 vs. 44. The experimental data followed the predicted values pretty closely. Clearly, the farther away the seeds were placed from the center, the bigger the angle was, and since there is a strong correlation between the experimental and predicted, we can conclude the angle was determined by the sum of the two forces.

Conclusions/Discussion

The results match my hypothesis. Qualitatively, the root angles increase when the centrifugal force increases. Quantitatively, the angle is determined by the sum of the two forces. By adding another force beside gravity to the plant, I now know it is possible to make a plants' roots grow in the direction of the two forces combined. My results could have beneficial applications to space travel. By adding centrifugal force to a plant in space, we can give it a false sense of gravity, which can make the plant root grow straighter and in turn make the plant stronger.

Summary Statement

By adding centrifugal force to plants, I investigated how they would react when they were subjected to a force beside gravity.

Help Received

I would like to thank Ms. Bennett, my advisor, who taught me the basics of how to make a science fair project, a neighbor who gave me the record player, the Home Depot lady who gave me materials at a discounted price, and my mother and father who gave me advice and helped me assemble the backboard.