Simulating plant growth under accelerated gravity, resulting from a greater gravitational force than that on The Earth.

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Abstract

The project purpose to study germination rate of green been planting in an accelerated rate due to higher gravitational force than The Earth. Using a gravity simulator that has been invented for experiment. When inclined rotation in an experimental cultivation set, 100 green bean seeds were planted. The rotation was continued consecutively for a period of 2 days and planting an additional 100 green bean seeds normal The Earth gravity conditions. Comparing the germination rate results of green beans by controlled in the same environment .

The results show that plants grown in the simulator exhibit a growth rate of 83% and an average weight of 0.371 grams, whereas plants grown under normal conditions show a growth rate of 97% with an average weight of 0.445 grams.

Introduction

According to population data from 2002-2017, the human population increased by 16.94 percent, raising concerns about the future. It is implied that there are limited resources on The Earth. These resources may not be sufficient to meet the growing needs of the human population. Humans may need to move to another planet that may have a different gravitational acceleration than The Earth.

Plants are important to human life because they contain essential nutrients. In addition, other environmental factors It is also important for human survival. The researcher therefore intends to experiment with growing plants to study the growth and changes of plants under conditions of higher gravitational acceleration compared to The Earth.

Method

1) Calculate the acceleration due to gravity using the formula $RCF = 1.12 \times r \times (RPM \div 1000)^2$
   RCF (g force) = relative centrifugal force
   RPM (r/m) = revolutions per minute
2) Create a simulation of a greater gravitational force than that on The Earth, start by installing the MY-1025Z2 250W Gear Box 12V DC Brush Motor. Then, attach a lever with a length of 34 centimeters to the motor's rotation point
3) Create a planting set by cutting the plastwood board trays to fit the experimental dish. Drill holes to create 100 slots per tray and cover the experimental dish with the lid to control moisture.4. Planting crops with a control set and an experimental set within the simulation apparatus, controlling variables that have the greatest impact on plant growth to optimize their development.

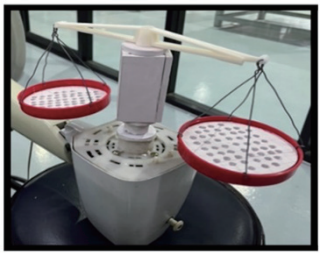

Fig 1 The Gravity Simulator

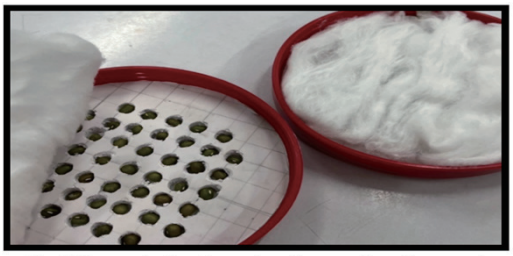

Fig 2 Show planting trays, tray liners with cotton wool. Top with a plastic sheet with holes drilled for placing the green beans.

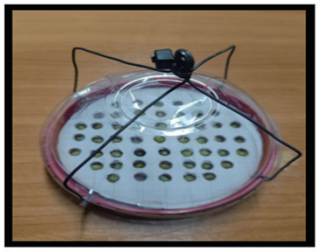

Fig 3 Show a planting tray covered with clear plastic. to control environmental factors.

Result

	Number of plant is growing (Percentage)	Average Mass (Grams)
acceleration due to gravity greater than The Earth's	83	0.371
acceleration due to gravity of The Earth	97	0.445

Table 1 shows a comparison of the germination rate and the average mass value of green beans grown in different gravity conditions.

Form the Table 1, Green beans grown in a acceleration due to gravity greater than The Earth's have a growth count of 83 plants, an average plant mass of 0.371 grams. Green beans grown in a normal gravitational environment have a growth count of 97 plants, an average plant mass of 0.445 grams

Conclusions and Discussion

From the experiment, it was found that green bean plants grown in a simulated gravitational acceleration environment due to increased gravitational force had a mass that was less than the average, specifically 0.074 grams per plant. This result was obtained over a period of 3 days of experimentation. The observed outcome indicated that the green bean plants exhibited growth only in the initial stage of seed germination, resulting in the experiment showing the development of root sprouts in the green bean plants.

Growing beans in an environment with a higher gravitational acceleration than The Earth's has shown results with a lower average mass compared to growing beans under normal conditions on The Earth. This is due to the higher gravitational acceleration, which enhances the growth of bean plant stems compared to normal conditions on The Earth. Conversely, bean plants grown in an environment with higher-than-normal gravitational acceleration tend to have longer roots. This phenomenon is known as positive gravitropism, causing the roots to grow in the direction of increased gravitational force.

Reference

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2) Merck. G Force Calculator RCF to RPM. Retrieved April 30, 2023, from https://www.sigmaaldrich.com/TH/en/support/calculators-and-apps/g-force-calculator