

The effect of Propel Water on the growth of bean plants

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Abstract

With the ever-rising population, which requires more resources to support the population's health, there is a need for more supply of plants to support everyone around the world faster. The purpose of this experiment is to find out if Propel water would help bean plants grow taller compared to normal tap water. The water was chosen because it doesn't contain too many corrosives and could boost the plant's growth. There were 2 IV levels in this experiment: normal tap water and flavored bottled water. Each IV Group had ten plants that were tested. The constants for this project are the amount of soil, 1 $\frac{3}{4}$ cups of soil for each plant; the amount of water, $\frac{3}{4}$ cup of each type of water for each plant; and the location of the plants, which was a residential home in Louisville, Kentucky near a window sill. This whole experiment took four weeks, and the dependent variable was the height of the plants after four weeks. The data gave a mean for each of the IV levels and it was seen that the Water had double the mean for height than the mean height for the plants' water with Propel showing to be significant. Looking through the data it can be seen that the hypothesis for this project is that Propel water will lead to a result in greater height for the plant which was ultimately rejected. The corrosives inside the water reduces the functionality of the plant resulting in decreased growth.

Keywords: Propel Water

Introduction

Water is one of the most vital ingredients for growing almost every plant in the world. “For land plants, including crop species, freshwater is a basic requirement for life. Water is a common trigger for seed germination. Its uptake from the soil facilitates inorganic mineral nutrition, and its flux through vascular tissues of the plant circulates minerals and organic nutrients throughout the plant” (Blatt et al., 2014). This study has shown that freshwater is needed for the growth of these plants and in the next century, the demand for water usage--in general--will grow to create a strain on the amount of fresh water that will be available in the future affecting the sustainability of life. For plants, water comprises up to 95% of a plant’s tissue and is required for a seed to sprout. As the plant grows, water carries nutrients throughout the plant. Water is responsible for several important functions within plant tissues. (Richmond, 2021) During the entire process of the growth of the plant, water is a basic necessity for a plant to thrive in any environment it is in. For example, Photosynthesis is the conversion of light energy absorbed by chloroplasts into energy required for plants to survive. Chlorophyll pigments in chloroplasts use water and carbon dioxide from the air to produce carbohydrates to hold the energy. (Let's Talk Science & 21, 2019). Additionally, water helps move nutrients around the plant to where it needs to be and helps the structure of the cells by putting constant pressure on the turgor to keep plants strong. (Richmond, 2021) With the ever-rising population which is in need of more resources to support the population’s health, we need more supply of plants to faster support everyone around the world. Especially now, the process of urbanization has led to fewer people working in the agricultural field leading to fewer resources being supplied for consumers. This is why more solutions need to be created to be able to speed up the process of growing more plants along with making the process more efficient. Therefore, it was asked does

Propel Water increase the height of plant better than normal water. Propel Water was specially chosen due to the fact that it isn't purely a different liquid with many changes like soda because that has basically no chemicals and a lot of carbonation. On the other hand, Propel Water is a form of tap water that has some additive vitamins and other chemicals which can decrease negative reactions between the water and the chemicals compared to other commercially sold drinks and prove to be better than normal water. Propel water has many different nutrients: Purified Water, Sucrose Syrup, Citric Acid, Natural Flavors, Sodium Citrate, Potassium Citrate, Sucralose, Vitamin C (Ascorbic Acid), Vitamin E Acetate, Niacinamide (Vitamin B3), Calcium Disodium EDTA (Protects Freshness), Calcium Pantothenate (Vitamin B5), Pyridoxine Hydrochloride (Vitamin B6), Acesulfame Potassium, Vitamin B12 (SportMedBC,2021). In Propel water there is vitamin C which is researched to be able to boost the process of photosynthesis and the neutral value of the fruit that is being grown (Hooser, 2020). "Potassium citrate (KC) increase leaf area, improves leaf mineral content, enhancing yield and improved fruit quality as well as physical and chemical properties"(2015). This study showed that sucralose significantly increased green leaf area, and the study showed that the photosynthetic capacity documented that *L. minor*-a mixotrophic plant-can use sucralose as a sugar substitute to increase its green leaf area and photosynthetic capacity which can help the plant growth overall (DM;). These are only some of the ingredients that can assist the growth of plants. On the other hand, certain types of ingredients are contained in Propel water that can actually stunt the growth of the plant. Citric acid is a primary example of this because the acid has a ph level of 4 which can make it corrosive enough to burn through the seeds causing the seed to stop germinating. The acid can also burn through the plant's roots causing the absorption of nutrients to halt (SHIELDS). Sucrose syrup also has a negative effect because for a plant that hasn't died or is

growing healthy it doesn't need extra sugars added because it already creates enough nutrients for itself during the photosynthesis process. Therefore, the sucrose syrup could potentially cause the plants to die off and wilt. That is why the hypothesis for this project is that Propel water will lead to a result in greater height for the plant since it has many additive benefits.

Methodology

The experiment was done on the first floor in a room next to a window with lighting during the day. First, each cup was punched with a hole at the bottom and filled with a 1 3/4 cup of soil in it. After that was done 10 cups were put into 1 aluminum tray to be watered by tap water and 10 cups in another tray to be watered by Propel Water. In each cup, there were two seeds to be grown, so in total there were 20 seeds grown for testing both waters. The seeds were added to the cup by placing the seeds 1 inch deep by slowly pushing the seed into the soil with my finger for each cup. The trays were placed right next to each other besides a windowsill so both trays got the same amount of sunlight. Every 2 days the plants would get watered by adding 40 ml of tap water and Propel water. However, instead of adding it directly into the cups themselves, it would be poured into the trays so the plants can absorb how much water it needs. The plants will be measured for height after 4 weeks of planting the seeds. The ruler was placed so it just met the top of the soil and the measurement is recorded in excel.

Data and Results

Fig 1

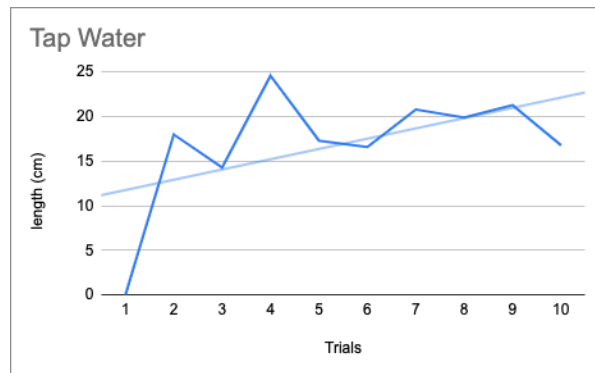
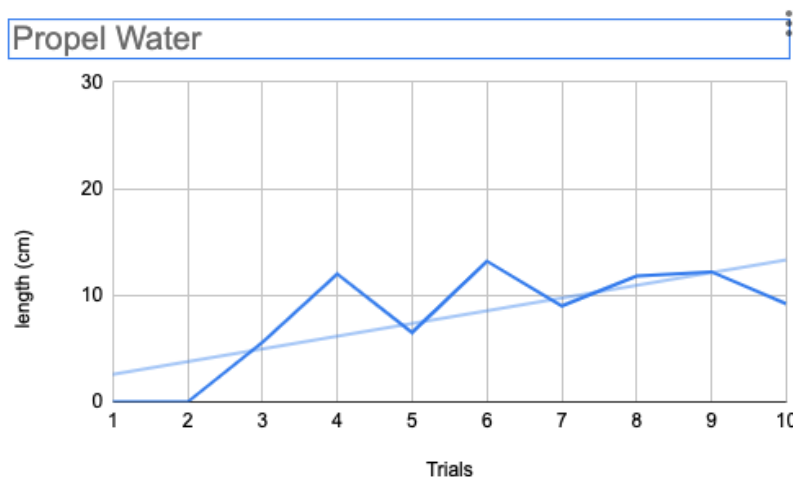


Fig 1 shows the length of the plants when they are watered with normal tap water. The hypothesis for this project is that Propel water will lead to a result in greater height for the plant since it has many additive benefits. The independent variables are the 2 liquids that are being used to grow the plants. The dependent variable is the height of the plants after every week for the duration of a whole month. In the table and graph above it can be seen that most of the plant heights are within the same 10 cm range. There was one point that was at 0 which was an outlier but there was one height that grew a little bit more than the other plants.

Table 1: Length (cm) of Plants Grown Using Propel Water vs Tap Water										
	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Trial 6	Trial 7	Trial 8	Trial 9	Trial 10
Propel Water	0	0	5.6	12	6.5	13.2	9	11.8	12.2	9.2
Tap Water	0	18	14.3	24.6	17.3	16.6	20.8	19.9	21.3	16.8

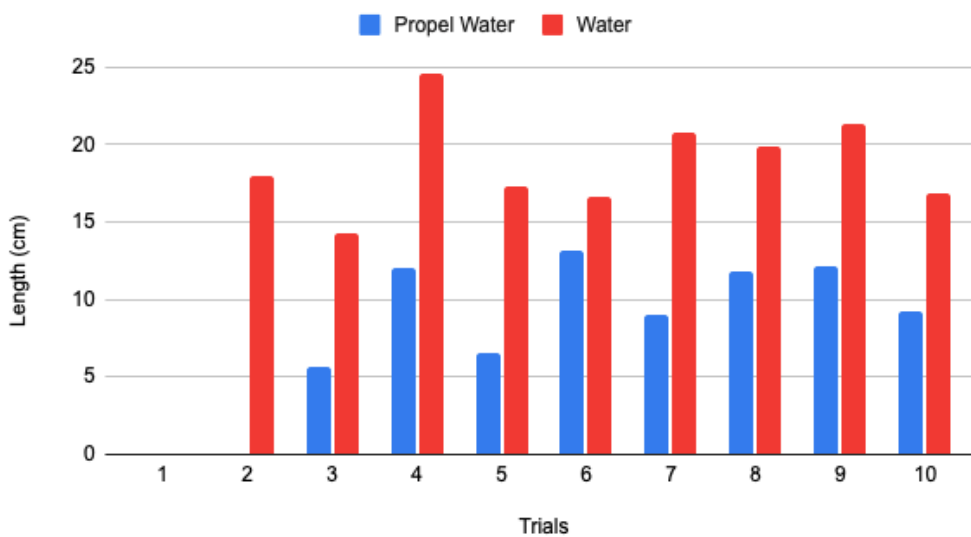
Fig 2



In figure 2 and Table 1 you can see the results from watering the plants with the Propel Water instead. It can be seen that the lowest dip of height was zero for two plants ,and the highest height of a plant was 13.2 cm which is significantly lower than the plants from the normal tap water plants.

Fig 3

Propel Water vs Tap Water



Level of IV	Propel Water	Tap water	
Variance	23.727	44.074	
Mean	7.95	16.96	
Standard Devia	4.87	6.64	
SD 1	3.08-12.82	10.32-23.6	
SD 2	-1.79-17.69	3.68-30.24	
SD 3	-6.66-22.56	-2.96-36.88	
Number of trials	10	10	
Results of test	t=-3.4602 p=.0014		
Significance	Significant		

When you analyze the data on Table 3 the means are significantly different from each other with a difference of 9.01 cm. The table shows that the plants grown with tap water grew

significantly larger than the plants watered with propel water: Propel Water mean was 7.95 cm and the tap water mean was 16.96 cm. The null hypothesis is that Propel Water and Tap Water will result in the same plant height. Table 3 shows the conditions and results of the T-test, and the comparison between the data from the tap water ($M=16.96$, $SD=6.64$) and the Propel Water ($M=7.95$, $SD=4.87$). In these results it can be seen that the Propel Water is significant. The SD for tap water was bigger so it had data points that were farther away from the mean. The SD for Propel water was closer to the mean which means it had data points that were closer to the mean.

Conclusion

The purpose of this experiment is to find out if Propel Water would help bean plants grow taller compared to ordinary tap water. There are two IV levels that were used to water the plants with; tap water and Propel Water. That is why the hypothesis for this project is that Propel water will lead to a result in greater height for the plant since it has many additive benefits. After completing the experiment, it could be concluded that the hypothesis was rejected, and the plant grown with tap water had taller heights. The mean for the plants grown with water (16.96 cm) was more than double for the mean of the plants grown with Propel Water (7.95 cm), showing a huge difference in growth, seeing that it was more than double. When you compare both of the IV levels, the $t=-3.4062$ and $p=.0014$ mean they are significant. During the experiment, there was a possibility of some errors that occurred that caused the growth to not be as consistent as wanted. During the analysis, an outlier that came across was that 2 of the cups in each of the trays didn't grow, but those data points were the most significant changes. Another point to look at is that since the plants watered with the Propel Water still grew, it shows that the chemicals in the water didn't completely kill the plant, which means that there could still be ingredients in the

water which could result in better growth. It can be supported that because Propel Water was made for human consumption and had many corrosive agents like sodium, citric acid, etc, they can block sugars from being absorbed, or the germination of the seed can be destroyed, ultimately disrupting the growth of the plants. In the future, a change that could be done is to add more IV levels to see if other drinks could produce different results compared to normal water. Additionally, the tap water could be compared to an enhanced formula by injecting different types of nutrients that are beneficial to the plants, so everything in that mix would be nutrients that would only benefit the plants being grown. Lastly, another modification that could have taken place was to add more trials to create more consistent and accurate data.

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