



To investigate which citrus fruit peel enables a plant to grow best

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Hypothesis

Orange peels as fertilisers enable a plant to grow the best.

Abstract

Our project aims to investigate which citrus fruit peel would help regular household plants grow the best. This usage of fruit peels also helps to reduce food waste.

In this experiment, five similar pots of Bryophyllum plants were fertilised separately with four different citrus fruit peels, keeping the last pot as a control. The pots were then observed for four weeks. The results showed that lemon peels worked the best as a simple and easy fertiliser.

Introduction

Our project seeks to find out how different citrus fruit peels can improve plant growth. We chose fruit peels as a fertilizer because one of the main problems today is food waste and by using fruit peels, the amount of food waste can be decreased. Fruit peels are a contributing factor to food waste. Studies have shown that a mandarin generate 84% of flesh and 16% of peels which are thrown away.

Theoretical background

Basic fertilisers should include phosphorus and potassium. Citrus peels are an excellent source of phosphorus and potassium which are both beneficial to the plant. Phosphorus helps the plant in photosynthesis, respiration, energy storage and transfer, cell division, cell enlargement and several other processes. Phosphorus is essential to plants; without sufficient phosphorus, plants may potentially end up having weak stems and its older leaves may turn into dark bluish-green.

Potassium helps to regulate the opening and closing of the stomata which controls the intake of the amount of carbon dioxide by the plant. Lack of potassium in plants can cause the leaves of the plant to start browning and the tips of leaves to curl. The lack of potassium can also affect the growth of the plant. Too much potassium can result in nitrogen deficiency which may cause the foliage on older growth leaves on the lower parts of the stem to turn yellow and the veins of the leaves will start to have a red tint. Newer leaves will be smaller. Nitrate is absorbed from water through the plant's roots. It is needed for the plant to make proteins for a healthier growth. Without nitrates, the amount of chlorophyll in the leaves decreases, causing the leaves to turn a pale green or yellow. the plant's ability to photosynthesis with thus reduce.

Table 1. Amount of phosphorus and potassium in various fruit

Type of fruit	Phosphorus / mg/100g	Potassium / mg/100g
Kumquat	3.6	186
Orange	14.0	181
Lemon	16.0	138
Grapefruit	8.0	135



Fig 1. Fruit peels (top); Pots of bryophyllum labeled with the various fruits and initial number of leaves (bottom)

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grow best

Materials

- Fruit peels used:
 - Orange peel
 - Grapefruit peel
 - Lemon peel
 - Kumquat peel



(2 grams of fruits were used to fertilise weekly on the same day in all pots.)

- 5 pots of identical bryophyllum plants
- Distilled Water (50 ml)
- Same brand of soil for all five pots of plants

Procedure

- Measure the length of leaf 1 and leaf 2. Count the number of leaves for each plant. Record the measurements.
- Tear citrus fruit peels into small pieces.
- Put the respective citrus fruit peel into each pot, except for the control pot. Place all pots together in a sunny area
- Water the plants daily with 50 ml of distilled water.
- Fertilize the plants with the respective fruit peels after checking the growth of the individual plants by measuring the length of its leaves and the number of leaves every week
- Record the results observed.
- Repeat steps 1 - 6 over four weeks.

Results and Discussion

Table 2. Number of leaves of plants with various fruit peels as fertilisers

Pots	Week 0	Week 4	Growth of plant
	no. of leaves	no. of leaves	Difference in no. of leaves
Control	9	9	0
Kumquat	9	11	+2
Orange	8	9	+1
Lemon	6	9	+3
Grapefruit	10	12	+2

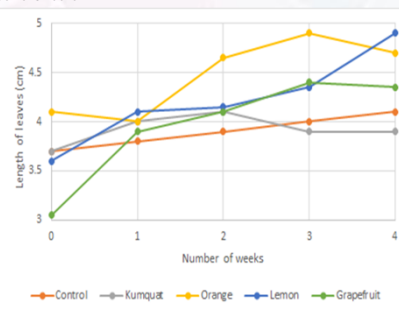


Fig 2. Average length of leaves over 4 weeks

From **Fig 2**, the average length of leaves increased over the span of four weeks. We found out that the pot of plants that was fertilized by the lemon peels grew the best in terms of the number of leaves and the length of the leaves were also the longest.

With reference to **Table 1**, lemon peels have 16 mg of phosphorus per 100 g of fruit, which is the highest amount. This is beneficial to the plants as it helps the plant in photosynthesis, respiration, energy storage and transfer, cell division, cell enlargement and several other processes.

Furthermore, lemon peels have 138 mg of potassium per 100 g of fruit. Even though the lemon peels did not have the highest amount of potassium, it is actually beneficial to the plant as too much potassium may cause nitrogen deficiency. We had observed the foliage of the older leaves at the bottom of the two plants containing orange and kumquat peels turned yellow. This was due to both orange and kumquat have a high amount of potassium. Thus, high potassium amount is, in fact, damaging to the plant and impedes growth and photosynthesis in the plant.

Conclusion

In conclusion, out of the fruit peels used, lemon peels are considered as the best fertiliser. This is different from what we had predicted initially, which was that orange peels would cause a plant to grow the best because it had a large amount of both potassium and phosphorus and that would probably be the most beneficial to the plant. However, after further research, we found out that having too much potassium could be harmful to the plant and hence, lemon is the ideal fruit peel to use for plant growth.

References

- Essential Role of Phosphorus in Plants (n.d.) Retrieved 30 April 2019 from <https://www.cropnutrition.com/efu-phosphorus>
- How Does Your Garden Grow? (n.d.) Retrieved 30 April 2019 from <http://www.environhpa.org/pdfs/How%20Does%20Your%20Garden%20Grow.pdf>
- Potassium in plants (n.d.) Retrieved 7 May 2019 from <https://www.smart-fertilizer.com/articles/potassium-in-plants>
- Potassium deficiency (n.d.) Retrieved 30 April 2019 from [https://en.m.wikipedia.org/wiki/Potassium_deficiency_\(plants\)](https://en.m.wikipedia.org/wiki/Potassium_deficiency_(plants))
- Joseph Nicholson. What happens when plants get too much potassium (n.d.) Retrieved 30 April 2019 from <https://www.hunker.com/13403809/what-happens-when-plants-get-too-much-potassium>
- Fruit and Vegetable Waste: Bioactive Compounds, Their Extraction, and Possible Utilization (23 March 2018) retrieved 23 July 2019 from <https://online.library.wiley.com/doi/full/10.1111/1541-4337.12330>