



SULTANATE OF OMAN  
MINISTRY OF EDUCATION

## Summary:

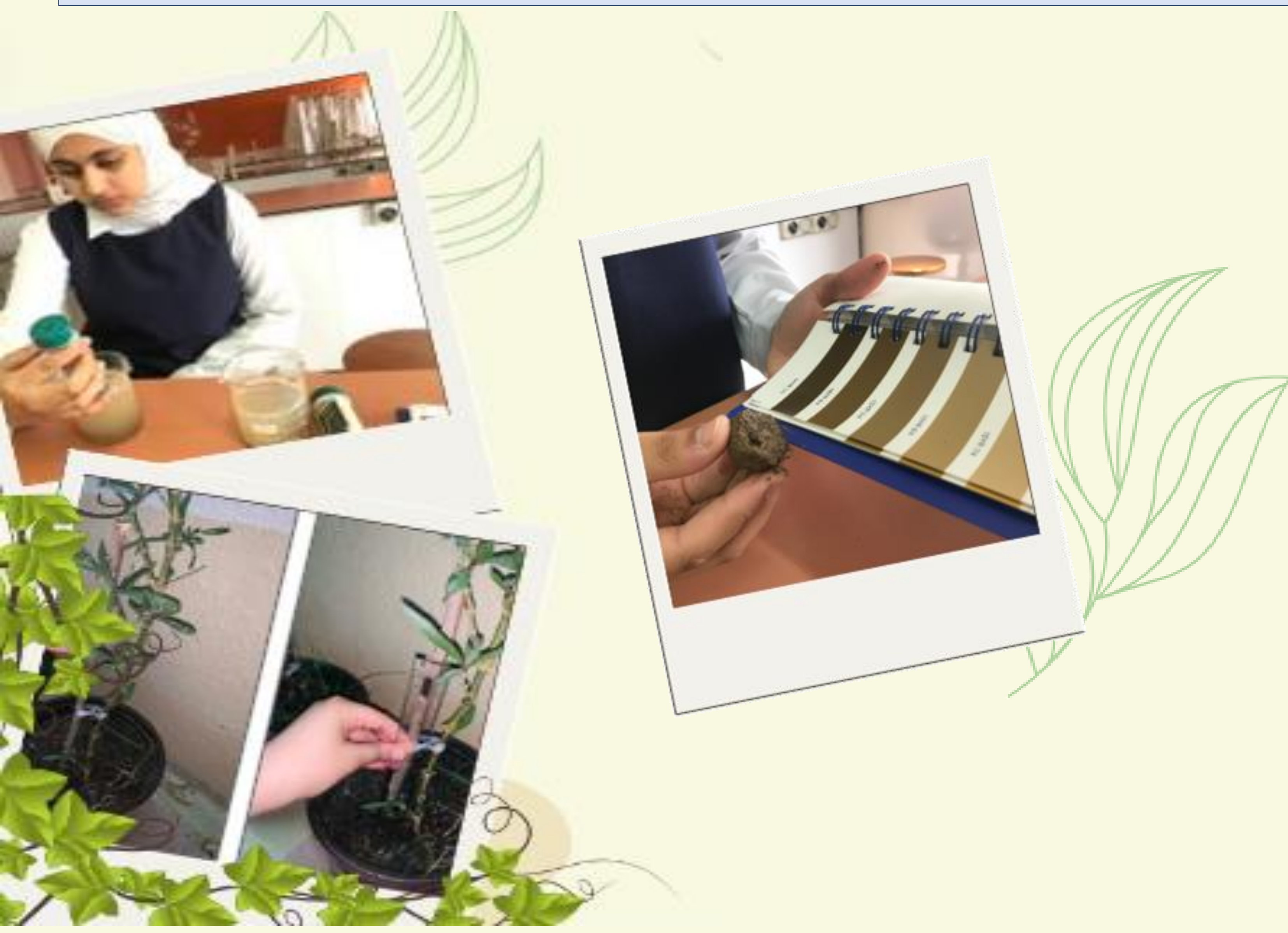
Food waste is a major component of landfills around the world, and a major global source of greenhouse gases. However, this waste can be converted into fertilizer used in agriculture, so this study was conducted with the aim of highlighting the effectiveness of fertilization with fruit waste in reducing carbon emissions from the soil. Fertilizer soaked in banana peels with yeast added to the Ruelia plant. Food waste is a major component of landfills around the world, and a major global source of greenhouse gases. However, this waste can be converted into fertilizer used in agriculture, so this study was conducted with the aim of highlighting the effectiveness of fertilization with fruit waste in reducing carbon emissions from the soil. Fertilizer soaked in banana peels with yeast added to the Ruelia plant. The research questions are: What is the effect of fertilization with fruit waste on soil properties? What is the effect of fertilizing with fruit waste (banana peels) on plant growth? How effective is fertilization with fruit waste in reducing carbon emissions from the soil? The water, soil and land cover protocol were applied. The results showed that adding the solution contributed to improving the pH and increasing the concentration of solutes and salinity. These are good results for the plant, as the leaves were more numerous and widespread than the control plant. The percentage of organic carbon in the experimental soil was (0.21%) compared to the control soil (0.18%), which indicates an improvement in the plant's ability to store carbon. Based on the results, we recommend spreading awareness among community members to benefit from fruit and vegetable peels by recycling them and using them for fertilization to improve soil quality, reduce gas emissions resulting from burning waste, and reduce dependence on chemical fertilizers in gardens and farms.

## Introduction:

Wasted food - if it were a country - would be the third largest source of greenhouse gas emissions in the world, and reducing food waste can help reduce these emissions, and a study conducted by the journal Nature in 2023 found that converting food waste into fertilizer has a lower environmental impact, which leads to reduce emissions by 38-84% compared to landfills.

Farmers are increasingly using sustainable agricultural methods to enhance productivity and reduce greenhouse gas emissions at the same time. News has been spreading for some time about the benefits of using ground coffee for plants and eggshells, and recently the use of banana water for fertilization has increased. It is rich in potassium, calcium, phosphorus, and magnesium, and this combination can stimulate plant growth (Awad, 2023). According to FAO 2014, about 118 million tons of bananas are produced annually globally, and therefore the waste from this production will be enormous and it is best to exploit them to fertilize the soil and improve plant growth. Studies (Naseer, 2021) (Al-Dulaimi and Rashid, 2020) have shown that making banana fertilizer with boiled peels may be a more effective way to increase potassium levels. A study (Omar, 2003) proved the effectiveness of yeast extract in increasing the growth rate of tomato plants because the extract increases the rates of assimilation of carbohydrates and amino acids, which leads to improved vegetative growth.

Due to the lack of previous studies on the role of fruit waste in reducing carbon emission, the idea of this study came to evaluate the effectiveness of fertilization with fruit waste in increasing carbon storage in the soil, thus increasing plant growth, and reducing excessive consumption of chemical fertilizers to reduce the emission of greenhouse gases.



# Studying the effectiveness of fertilization with fruit waste (banana peels) in reducing carbon emissions

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## Research questions:

- 1- What is the effect of fertilization with fruit waste (banana peels) on soil properties?
- 2- What is the effect of fertilizing with fruit waste on plant growth?
- 3- How effective is fertilization with fruit waste in reducing carbon emissions from the soil?

## Results:

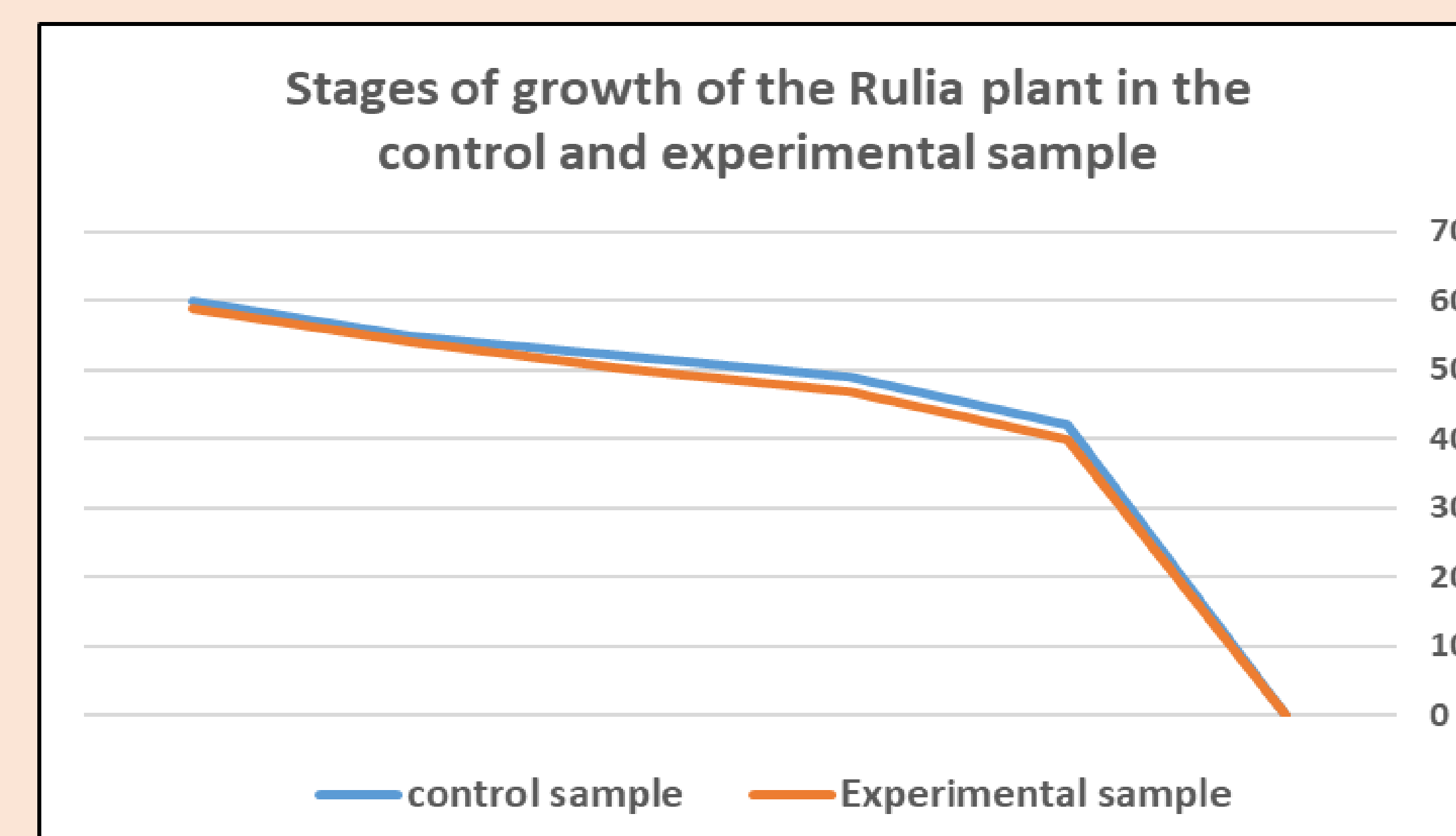
### - Soil characteristics data (control) before adding banana peel fertilizer and yeast.

Color	Conductivity	Salinity	PH	Carbonate	Roots	Rocks	Fabric	Consistency
10YR3/4	597.6	450.6	7.5	Little	Little	Little	Sandy Loam	Fragile

### - Follow-up data on experimental soil properties after fertilization with banana peel waste and yeast

Soil moisture	Color	PH	Salinity	Conductivity	Temperature	Date
Moist	10YR 4\4	7.15	608	1192	30.9 ° C	8/9/2023
Moist	10YR 3\4	7.28	536	1115	29.1 ° C	23/9/2023
Moist	10YR 4\4	7.26	530	992	28.6 ° C	23/20/2023
Moist	10YR 4\4	7.10	708	1407	28.3 ° C	27/10/2023
Moist	10YR 3\4	7.11	688	1052	28.1 ° C	12/11/2023
Moist	10YR 3\4	7.10	516	940	28.6 ° C	26/11/2023

### - Results of the growth of the Ruelia plant for three months



## Conclusion:

We conclude from this study:

- 1- Fruit waste, as an organic fertilizer, is important in increasing the concentration of nutrients and organic materials in the soil.
- 2- A solution of banana peels and yeast provides a rich source of nutrients that improve plant growth, as banana peels contain a high percentage of phosphorus and potassium, and yeast contains a high percentage of nitrogen, which are considered essential nutrients for plant growth and development.
- 3- Using organic fertilizer in agriculture helps sequester carbon in the soil and can replace chemical fertilizers that release high levels of greenhouse gases.
- 4- Fertilization with fruit waste contributes to improving the plant's ability to reduce CO<sub>2</sub> emissions

## References

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## Research methods:

1. Choose the research problem.
2. Determine the study site.
3. Collect soil samples from the study site and plant the Ruelia plant.
3. Prepare the mixture by adding banana peels to a liter of water, leaving it for between 24 and 48 hours, then filtering it, adding a spoonful (5 grams) of yeast, and storing it at room temperature.
4. Contact Dr. Jamal Al-Sabahi, head of the central laboratory, and Dr. Hamad Al Busaidi at the College of Agricultural and Marine Sciences at Sultan Qaboos University to analyze the chemical elements in the solution and in the study, soil samples and to measure the percentage of organic carbon.
5. Apply appropriate protocols (water, soil, and land cover).
6. Record the growth data of the Ruelia plant every two weeks for three months and water it with equal amounts of water.
7. Conduct an experiment to detect CO<sub>2</sub> emission using the Bromothymol detector in the school laboratory.
8. Contact agricultural engineer Nasser Al-Wahaibi, senior plant nutrition researcher - General Directorate of Agricultural and Animal Research in Barka to analyze the results.
9. Compare results and write recommendations.
10. Enter data into the program's website ([www.globe.gov](http://www.globe.gov)).

## Discussion of the results:

The results of the study showed:

1. Fertilization with waste banana peels and yeast led to improved soil properties, as the PH value decreased and ranged between (7.10-7.28). The salinity value increased, ranging from (516-708ppm) in the experimental sample due to the increased soil content of dissolved nutrients, and its ability to retain moisture increased, unlike the control sample that was exposed to drought as a result of the rapid descent of water to the bottom.
2. Increase the height of the plant, the number of leaves, the greenness of its color, and the appearance of some flowers in the experimental sample plant. This is because the yeast present in the fertilizer increases the indicators of vegetative growth. Banana peels also contain magnesium and sulfur, which are elements that help in making chlorophyll, which is what gives plants the green color and contains Phosphorus, which improves fruiting and flowering.
3. The percentage of organic carbon increased in the experimental soil (0.21%) while in the control soil (0.18%).
4. The results of the experiment to detect CO<sub>2</sub> gas emission using the Bromothymol detector indicated that the color of the detector changed to yellow in the control plant leaf sample, which means that the percentage of CO<sub>2</sub> is high. However, in the experimental sample, the color of the detector was green, which means that the amount of CO<sub>2</sub> emission is ideal.

