Study of the effect of rice water compared to lentil water on plant growth and properties

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Sultanate of Oman – Buraimi Governorate

Summary:

This study aims to evaluate the effect of adding rice solution compared to lentil solution on the characteristics of fragile sandy soils and increase their ability to retain water and study its effect on the plant growth process. The research questions are What effect does rice water solution have on plant growth and soil properties? What is the effect of lentil water solution on plant growth and soil properties? The required amount of solution has been determinedRice, lentils and soil irrigation every 15 days by 50 ml and the application of the soil protocol to measure temperature, conductivity, salinity andpH and compare them with the controlling soil properties Measurements of salinity, conductivity and pH of irrigation water were also taken, and the ground cover protocol was applied to the third samples and measuring the length of the stem, the number of leaves and their color, and this is done every two weeks, and the results showed a slight decrease in salinity and it was by 1.05 in the experimental soil that was watered with a water solution Rice The rice water solution also increased the speed of plant growth and its properties compared to the control sample, but it did not outperform the lentil water solution sample because it improved soil fertility, which contributed to plant growth in the water solution sample

Lentils are more than rice water solution , while they did not grow much in controlled soils, and this proves effective in improving plant growth and increasing nutrients in the soil. Based on the results of the study, we recommend disseminating the results among farmers and educating them about the properties of the lentil water solution and how to benefit from it in their farms.

Key terms:

Natural manure: A group of nutrients that provide plants and soil with everything they need to complete their life cycle naturally, and it is called natural manure because it consists of natural organic materials, such as trees, household food, poultry and bird waste, and others.

Research Questions:

1- What is the effect of rice water solution on plant growth and soil properties?

2- What is the effect of lentil water solution on plant growth and soil properties?

Introduction:

Most people frequently use chemical fertilizers in agriculture in order to meet the market needs of plants, and these fertilizers contain many chemicals that harm the environment significantly, and the most important of these substances are potassium, nitrogen, magnesium, sulfur, and calcium (how do fertilizers affect the environment). The use of chemical fertilizers leads to water pollution, destruction of soil structure, climate change and other damage. There is a lot of dust that suffers from lack of nutrients and water and a high filtration rate, the most appropriate solution is the use of natural fertilizers that do not contain chemicals and in this research we will study the effect of fertilizing the plant with rice water solution compared to fertilizing it with lentil water solution and using them as alternatives to chemical fertilizers. Rice water solution is restored as a fertilizer for the plant, as it contains a large amount of starch, which makes the rice water soaked in turbid white color and plants can be watered periodically with this water to provide them with useful minerals instead of relying entirely on fertilizer and chemical supplements for plants and encourages the growth and reproduction of healthy bacteria that grow in the roots, nitrogen, and potassium, and for the lentil water solution, it is rich in diverse values and nutrients, it contains proteins and amino acids Lentils are also a rich source of carbohydrates, minerals and various vitamins such as: iron, calcium, phosphorus, and magnesium. Farmers have differed on whether lentil water or rice water solution is the best choice as a fertilizer for plants; the idea of this study came to compare the effect of adding rice water and lentil water solution on the soil and find which solution will affect plant growth.

Research Methods:

First: Research Plan:

1. Meeting with the team via Google Meet and choosing the search problem and distributing roles.

2. Locate the study

3. Collect samples of soil used for study

4. Prepare the solutions of rice water and lentil water by placing rice in a continent and lentils in another flask for at least 5 hours and then separating the lentils and rice from their water.

5. Apply appropriate protocols (ground cover, water, soil).

Application mechanism	Protocol
Study of soil properties (conductivity, acidity, temperature).	**Soil Protocol**
Water the plant with the same amount of water with the division of samples into three sections: - Experimental sample (1) (fragile sandy soil with rice water fertilizer) - Experimental sample (2) (fragile sandy soil with lentil water fertilizer) - Control sample (fragile sandy soil without any additives) and plant growth observation and data recording	**Ground Cover Protocol**
Studying the characteristics of the water used in irrigation, which is a constant coefficient where measurements were taken (temperature, conductivity, salinity, acidity).	**Water Protocol**

Mechanism of application of protocols for data collection

6. Record plant growth data every two weeks for a month soon, and water it with equal amounts of water.

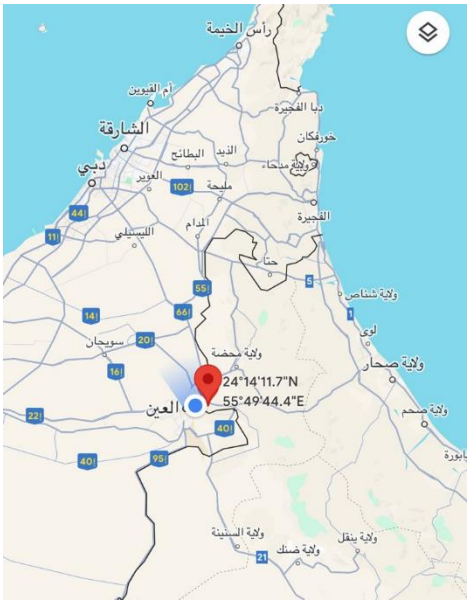
7. Compare results and write recommendations.

Research Plan Timeline:

Action Plan	Month
Formulate a research problem and identify tools	**December / 2023**
Data collection and analysis	**January / 2024**
Reaching conclusions and writing research	**February / 2024**
Submission of research	**March / 2024**

Second: Study Location:

(Sultanate of Oman, Buraimi Governorate, Al Gharifa area, longitude 55°49'44.4"E , latitude 24°14'11.7"N January and February, the weather is cold, water, soil and ground cover protocol has been applied).



Third: Data Collection and Analysis:

Lentil water was produced by adding lentils and water and measuring the pH, and determining the appropriate amount of lentils to add it in the soil, and rice water was produced by adding rice to the water and measuring pH, and the water protocol was applied to study the properties of the water used in irrigation.

To answer the first question, soil samples were collected and an experimental sample of soil was formed with rice water added to it, and then we followed up the experimental soil characteristics weekly in terms of (temperature, electrical conductivity, pH, salinity, color, humidity).

To answer the second question, soil samples were collected and an experimental sample of soil was formed with lentil water added to it, and then we followed up the experimental soil characteristics weekly in terms of (temperature, electrical conductivity, pH, salinity, color, humidity).






Results:

- Data properties of rice water and lentil water solutions used in the study:

Salinity	Electrical conductivity	pH	Solution
744	1508	5.74	**Fertilizer lentil water solution**
413	844	6.12	**Rice water solution fertilizer**

Table (1) Data Properties of Rice Water and Lentil Water Solutions

1- Water Protocol:

- Characteristics of water used in irrigation:

Salinity	Electrical conductivity	pH
202	408	7.44

Table (2) Data of the characteristics of the water used in irrigation

2- Soil Protocol:

Soil control properties (soil without adding rice water and lentil water solutions):

Soil moisture	Color	Electrical conductivity	PPM Salinity	pH	temperature	soil texture	Soil type
Humid	10yr2/2	1278	639	7.29	22.2	Fragile	Fragile sandy

Table (3) Soil Control Properties Data (without adding rice water and lentil water)

- Follow-up effect of adding lentil water and rice water solutions on soil properties (experimental):

Soil moisture	Color	pH	Salinity	Electrical conductivity	temperature	Soil type	Added solution
Humid	10yr2/2	7.5	pp 1.05	926	23.5	Fragile sandy	**Rice water**
Humid	10yr2/2	7.39	632	1260	23.1	Fragile sandy	**Lentil water**

Table (4) Soil Properties Data after Adding Lentil Water and Rice Water Solutions

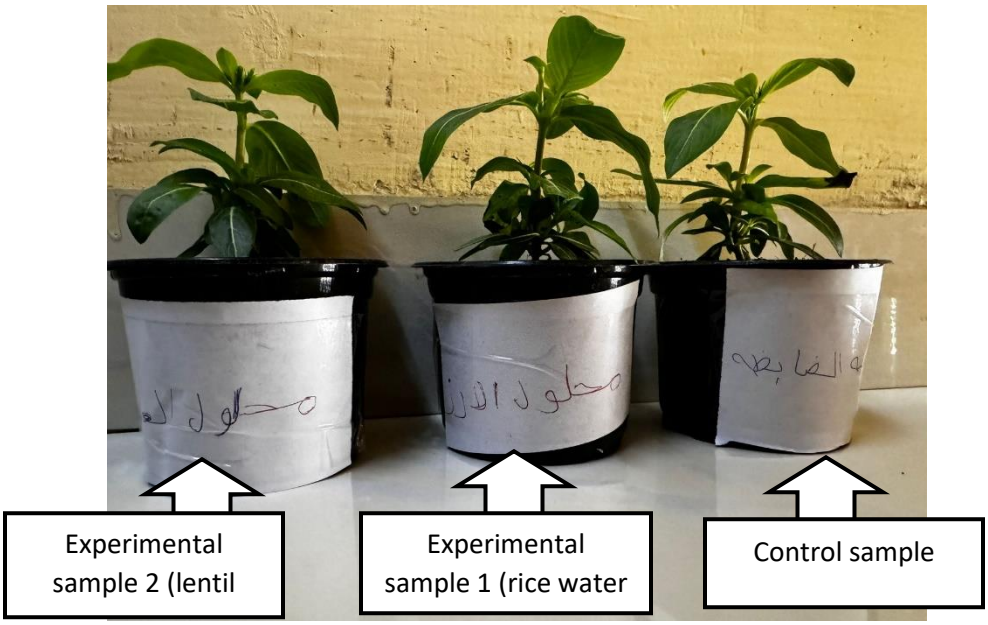


Photo (1) Comparison of the effect of rice water and lentil water solutions in plant growth and better health

Second: Land Cover Protocol

- Comparison of plant growth rates in experimental soils (1) and (2) and control soils:

Table (5) Following the Stages of Plant Growth in the Experimental Breeding and Control Soil

Experimental Soil (2) (Fragile sandy soil fertilized with lentil water solution)			Experimental Soil (1) (Fragile sandy soil fertilized with rice water solution)			Control soil (fragile sandy soil without additives)			Date
Number of papers	Leaf color	Leg length	Number of papers	Leaf color	Leg length	Number of papers	Leaf color	Leg length	
28	Light Green	8 cm	26	Light Green	8 cm	33	Light Green	8 cm	**29\1\2024 before) (fertilization**
30	Dark Green	10 cm	29	Light Green	8.8 cm	34	Light Green	9.5 cm	**7\2\2024**
33	Dark Green	11.4	31	Dark Green	11 cm	36	Light Green	10 cm	**14\2\2024**
36	Dark Green	13	34	Dark Green	12.8	38	Dark Green	10.5 cm	**28\2\2024**

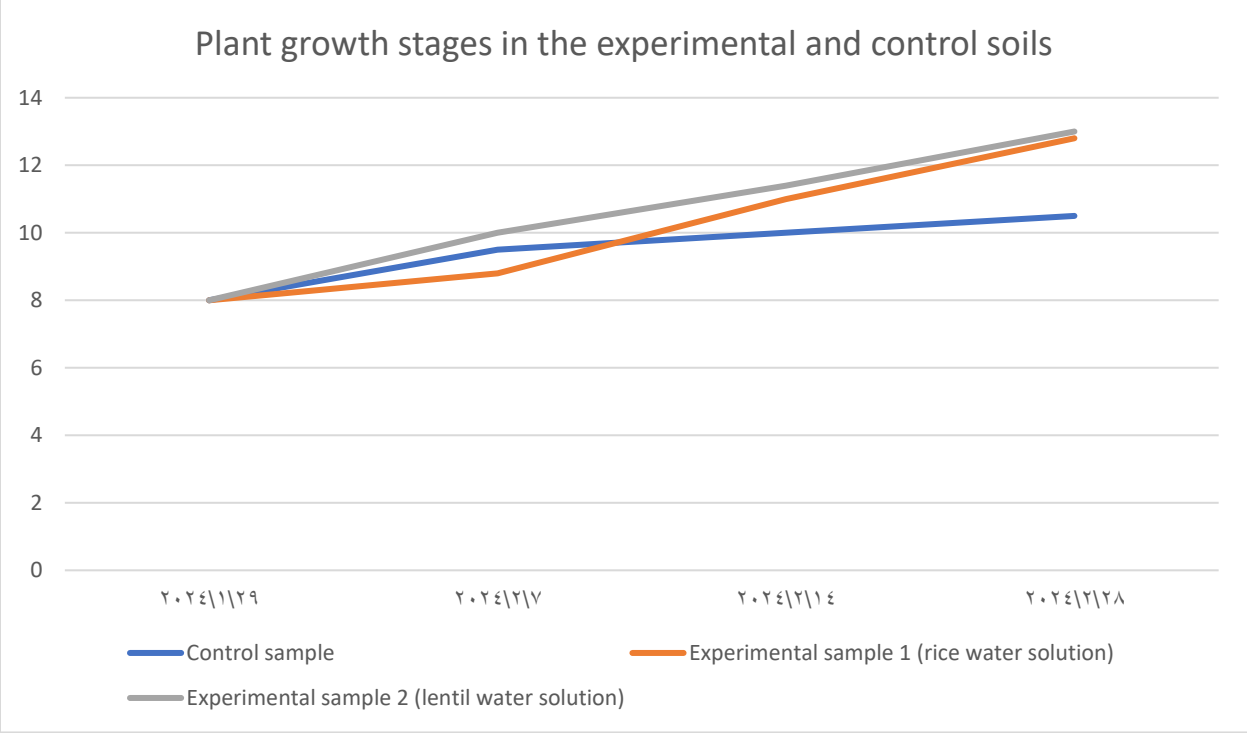
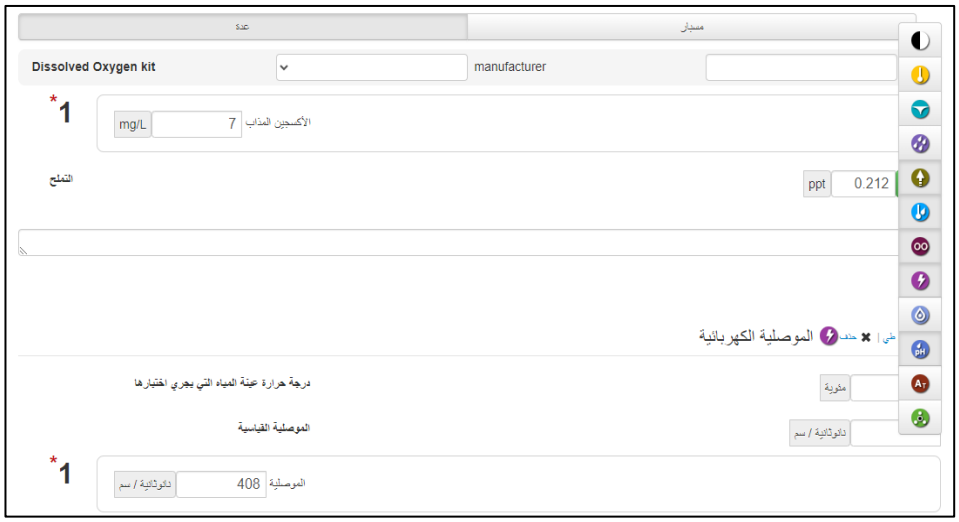
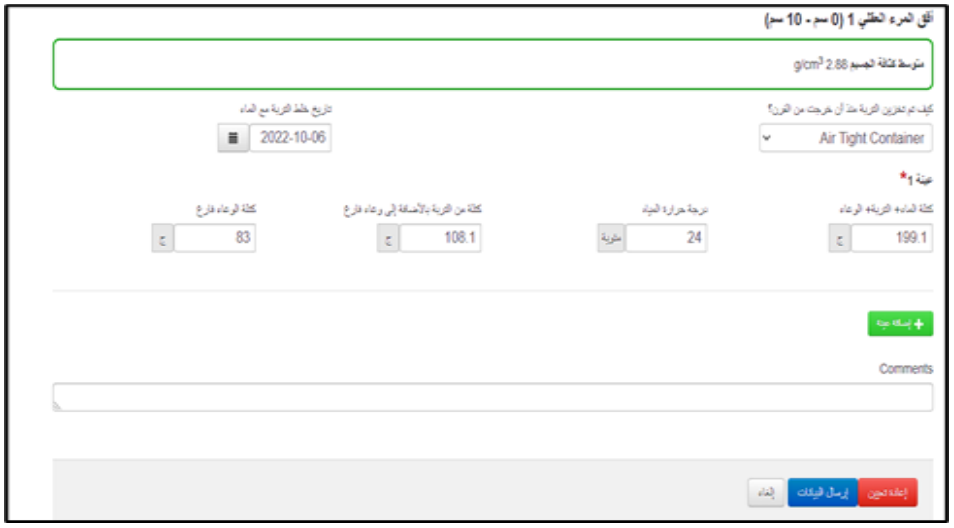


Figure (1) Stages of plant growth in experimental and control soils

The data has been entered in the program website (www.globe.gov) where the study site was added and enter data collected in research:





Discussion of the results:

We note through the measurements and readings taken during the application of the water protocol that the results of measuring the pH were suitable according to the Omani standards for water quality, where they amounted to (7.44) as in Table (2).

The results also indicated that the solutions of lentil water and rice water used are located in the acid range, where the pH value of the lentil water solution was (5.74) and the rice water solution (6.12) as in Table (1), as well as we note in Table (4) that the pH value of the experimental soil (1) that was fertilized with rice water solution amounted to (7.5) and as for the pH value of the experimental soil (2) that was fertilized with lentil water solution, it reached (7.39) so it is neutral soil.

As an answer to the first question, the results showed that the application of rice water solution led to increased plant growth more and in better health, as in Table (5), as the sample that was fertilized with rice water solution every 15 days, the amount of 50 ml, was better than the control sample in terms of length, number of leaves and color, as shown in Table (5), but it could not outperform the sample that was fertilized with lentil water solution every 15 days by 50 ml, as in Figure (1). And Table (5), and many studies such as (AGROLAND The Agricultural Sciences Journal (e-Journal) and others have found that rice water solution is an effective fertilizer for plant growth and increase its length and number of leaves, and we emphasize the need to apply the appropriate amount of it in the soil to prevent damage.

However, the results indicated that there are clear and beneficial effects of rice water solution when added to the experimental soil, such as the effect on the speed of plant growth and its characteristics, as in picture (1) and table (5), rice water contains many nutrientsnecessary for plant growth, and studies have found that rice water used for the plant led to an increase in the growth of many varieties .Because it contains a lot of nutrients, nutrients and vitamins that are necessary for plant health, as it contains starch that plays an important role in plant nutrition and others. In general, the nutritional composition of rice water was found to be equivalent to the standard inorganic fertilizer composition. This makes it a high-quality organic fertilizer that you can prepare at home (Olle Gardens, Rice Water for Plants, 2022)

As for the growth of the plant in the experimental sample (2) that was fertilized using a solution of lentil water and the results obtained and as an answer to the second question, clear effects were observed on the speed of

plant growth in better health than the experimental sample (1) that was fertilized using rice water solution. On the sample (2) we noticed an increase in length and an increase in the number of leaves as shown by the results in Table (5). It is the most developed sample compared to the control sample experimental sample (1) as its color indicates that its growth was good while the color of the control soil did not change significantly throughout the study period as in Picture (1) and Table (5), and this supports the idea of the ability of lentil water solution to improve soil properties and increase fertility, and enhance crop productivity, and this is evidenced by the increase in plant length and the number of leaves and change its color as in Table (5) . Many studies have found that lentil water is an effective fertilizer for plant growth and studies that prove this are the study of the scientist (Yantai Gan), a research scientist specializing in alternative crops and diversification and his study was conducted in Canada (Agriculture and Agri-Food Canada's Research Centre in Swift Current, Sask, 2007 - 2011) and his study showed that lentil water can enhance nutrients for the soil.

Conclusion:

The results of this study clearly showed that the application of lentil water solution and rice water solution on fragile sandy soils contributes to improving their physical and chemical properties, as it helps accelerate plant growth and in good health, as well as the time period between irrigations can be prolonged, provide part of the irrigation water and reduce expenses, as they are a strong soil improver and make the soil more fertile as well as fixing and storing nutrients in the roots of the plant because they are better than other materials that are added to the soil to improve Its fertility, which consequently leads to increased plant growth, which will reduce excessive dependence on chemical fertilizers and traditional fertilizers, so fertilizing the soil with solutions of lentil water and rice water is a promising approach to continuously improve its health and promote crop growth.

The strengths of the research were to know which of the two solutions would affect plant growth more and healthier than the other solution and to obtain important and influential results and the availability of valuable information to farmers. The results showed that fertilizing the plant with lentil solution affected more on the characteristics of the plant and its growth speed compared to rice solution.

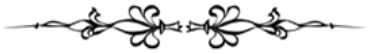
One of the challenges that we faced during the study is the acidity of the solution of lentil water and rice water, so we had to be careful when applying it in neutral soils and we were able to overcome this by fertilizing the soil in the appropriate amount without damaging the soil and for the success of the application of lentil water and rice water solutions on the soil, we suggest focusing on the following principles: appropriate application rate, and measuring the pH of the soil before application.

Therefore, we believe that the research can be applied again to clay soils, which usually retain water, to test the hypothesis that solutions of lentil water and rice water contribute to accelerating plant growth faster and healthier, especially lentil water solution.

Thanks and appreciation:

We extend our thanks and appreciation to the supervisor of the globe program at the school, Ms. Naima Al-Ghaithia, for motivating her to conduct research and her continuous follow-up to us, and we thank Professors Assila Al-Saadia and Shamsa Al-Ghaithia, science laboratory technician at the school, for their cooperation in providing the necessary tools.

Badges:



Be cooperative.

The Globe team students cooperated in discovering the problem, distributing tasks and roles to collect data, arriving at results, finding appropriate solutions, recording the research, and creating statistics and mathematical charts accompanying the research.

Be a data scientist.

The team's students demonstrated data analysis skills through their ability to retrieve and process data using computer programs and compare it with data from other studies. Our school team's students were able to analyze the data and discover the effect of organic fertilizers on plant growth.

Make an impact

The report shows that the students have reached important and influential results in society through their discovery of the importance of organic fertilization and relying on it instead of chemical fertilizers. The results were positive on plant growth and we did not notice any harm to plant health, whether in terms of leaf color or plant length. Accordingly, we encourage It should be relied upon, especially in home gardens, to reduce the harmful effects of chemical fertilization on the environment and climate change.

References

Gardener -1on :benefits of rice water on plants , https://2u.pw/Bu29Qn4

-2agroland the agricultural sciences journal (e-journal) , The Effect of Application of Rice Dishwater and Manure as Organic Fertilizer : https://n9.cl/gf40h

-**3**advancing open science (mdpi) : Chemical and Microbial Characterization of Washed Rice Water Waste to Assess Its Potential as Plant Fertilizer and for Increasing Soil Health **:** https://n9.cl/uxci4

-4Olle gardens , rice water for plants on garden or garden beds – a great way to improve plant health : https://n9.cl/3sj5k

-5top crop manager , Beneficial impacts of lentils for more climate resilient soils , https://n9.cl/j7ukm