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Al Kamil Secondary School (6-12)

Study the efficiency of foliar fertilization using yeast extract in growth of cowpea

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Content

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Abstract:

This research aims to study the effect of yeast extract on the growth rate of cowpea by answering these questions:

1- How yeast affect the growth rate of cowpea?
2- How yeast affect the size and number of cowpea's leaves?
3- what is yeast extract concentration suitable for cowpea?
4- Is yeast affect the PH of soil?

Research done in Al kamil school laboratory by preparing 4 different concentration of yeast extract (0%,2%,4%,6%) then sprayed 4 cowpea plants each by different concentration for one month. After that we Applied land cover protocol to measure plant length and numbers of leaves also we applied soil PH protocol. The result indicates that yeast extract increase the growth rate of cowpea. The tallest plant was the one which sprayed by 6% yeast extract with growth rate 8 cm compared with plant sprayed by 0% yeast extract which had growing rate 4.1 cm. Also, we noticed the higher the concentration used, the more plant grows. Moreover, the number of leaves and size become higher in plant sprayed with yeast extract than the plant do not sprayed with yeast. This shows that the yeast contain lots of nutrients which help to fast the growth rate of plant also plant has high ability to absorb the nutrients by stoma. Yeast as foliar fertilizer is support the soil fertilizer and both help growth the plant. Yeast extract has no effect on soil PH. We recommend farmers and anyone interest in agriculture and gardening to use yeast extract to increase growth rate, floral rate, leaves size and fruit size.

Key words:

Foliar fertilization: Is a technique of feeding plants by applying liquid fertilizer directly to their leaves.

Yeast: are eukaryotic single-celled microorganisms classified as members of the fungus kingdom.

Research questions:

1- How yeast affect the growth rate of cowpea?
2- How yeast affect the size and number of cowpea's leaves?
3- what is yeast extract concentration suitable for cowpea?
4- Is yeast affect the PH of soil?

Introduction:

The **cowpea** (*Vigna unguiculata*) is an annual herbaceous legume from the genus *Vigna*. Due to its tolerance for sandy soil and low rainfall it is an important crop in the semi-arid regions across Africa and other countries. It requires very few inputs, as the plant's root nodules are able to fix atmospheric nitrogen, making it a valuable crop for resource-poor farmers and well-suited to intercropping with other crops [(6)] .The use of yeast extract provides safe plant nutrition so that it is free of any harmful as well as inexpensive and produced in large quantities. It also contains nutrients such as organic iron, organic vitamins, proteins, antiseptics and zinc. The foliar fertilization provides plant needs by vegetative rather than by roots and this is more efficient since the absorption of elements by leaves occurs faster but it is a supplementary addition to soil fertilizer. During the first stages of growth the foliar fertilization is very rapid and show the response in 2-7 days . Leaves feeding increases the surface area of the leaves, which leads to increase the photosynthesis rate and size and quality of fruits [(2).]

In a study by an Egyptian scientist, his results showed that yeast strength orange trees and increase their branches and the total vegetative and flowers thus the abundance and quality of the final product and the size of the fruit, noting that yeast is a natural substance, safe, free of harmful chemicals, cheap and contains groups of vitamin B and carbon dioxide. Alcohol produced by the fermentation process increases the percentage of sugars in fruits produced by the use of yeast in the plant feed as the yeast contains growth hormone that activates the growth of plant cells thereby increasing the size of fruits.[(1)]

In this research we did experiment to study how bread yeast affect growth rate of cowpea and what are the suitable extract concentrations for the plant.

a. Material and methods:

1.**Schedule the research plan:**

work plan	Month
Choose the problem and ask questions	November
Collect adequate information	December
Data collection, analysis and discussion of results	January
Reach final conclusions and write research	February

Table (1): Research Plan Timeline

2. Distribution of work tasks to the research team:

Student	The work
Alshifa Alzzari	Identify the search problem and identify and process the required tools.
Alshifa, Aisha, Hajer	Visit farms and collect and analyze laboratory data.
Hajer Alhashmi	Enter data in the site.
Alshifa Alzzarei	Reach conclusions through aggregated data.
Alshifa, Aisha, Hajer	Write the final search.

Table (2): Distribute works to the research team

3. Collect information from relevant sources such as the use of the Internet and the notes of the GLOBE program.

4- Communicate with dr.Sardar Farooq at Sultan Qaboos university from biology department to give us more information about yeast and how can help plant to grow rapidly and increase the productivity and flowering. He said "Yeast can produce a variety of biologically active compounds such as Phytohormones (Auxins & Cytokinins), vitamins, amino acids, enzymes etc which have active stimulating effect on the plant growth and development and help to increase their productivity. Yeast can break down sugar in plant cells and produce heat. Yeast also break down dead plant tissue and encourage root growth. Yeast extract has effect in promoting growth of plant and elongation of root. Yeast extract improves the taste of an edible plant and increases amino acid content when sprayed onto the surfaces of leaves in a plant".

5. Selection of work sites to apply the study and gather information.

The work	Location
1- Growing cowpea seeds in 4 pots. 2- Preparation of the yeast extract with four concentrates. 3- Conduct the experiment.	School - Laboratory

Table (3):Search plan work sites

6. Determine the appropriate protocols applied for data collection.

Appropriate protocol	**The work**
Land Cover Protocol	Measure the length of the plant, the number of leaves, the thickness of the leaf and the size of the leaves.
Soil Protocol	Examination of soil acidity before and after experiment.

Table (4): The protocols used in the search .

7. Identify the appropriate devices and tools to implement steps:

4Pots with the same type of soil and fertilizer, cups, empty spray cans, ruler, tester, distilled water, pH meter, locator, yeast, sugar.

7. Start the study application:

Research question	Protocol	Application mechanism
1.How yeast affect the growth rate of cowpea? 2.How yeast affect the size and number of cowpea's leaves? 3.what is yeast extract concentration suitable for cowpea?	Land Cover Protocol	Bring a quantity of cowpea seeds and put them in water for a full day and then the seeds are grown. Chose four seeds suitable for agriculture and put them in 4 pots then watering them until the seeds grow. Three seeds are selected from which the yeast extract is processed with four different concentrations (the first concentration is 2 grams of yeast with a spoon of sugar and one liter of water, the second concentration of 4 grams of yeast with one spoon of sugar and one liter of water, the third concentration of 6 grams of yeast With one spoon of sugar and one liter of water). All the ingredients are then mixed together and left for two hours. Each extract is placed in a spray box and then each one of the yeast extract concentration is sprayed into the developing leaves every 10 days.
4.Is yeast affect the soil PH?	Soil Protocol	Sampling soil before and after experiment, and recording acidity of the soil using pH meter

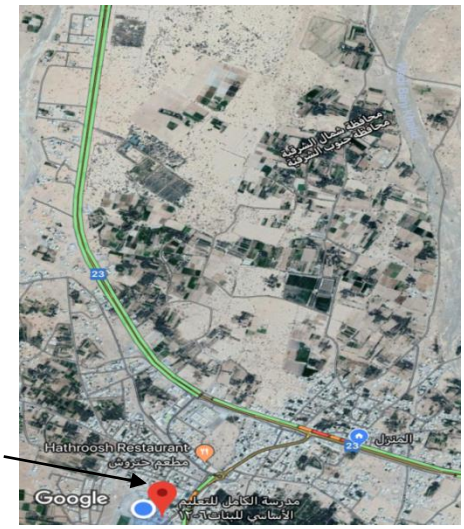
8. Data collection, organization and representation in tables.

9. Enter data in the www.GLOBE.gov website .

10. Reach conclusions and recommendations.

b. Site location:

Research done in Wilayat AL Kamil & Al Wafi – Al Kamil – Al Sharqia south – Al Kamil secondary school – Soil and land cover protocols is used.



picture of research site

c. Data collection and analysis:

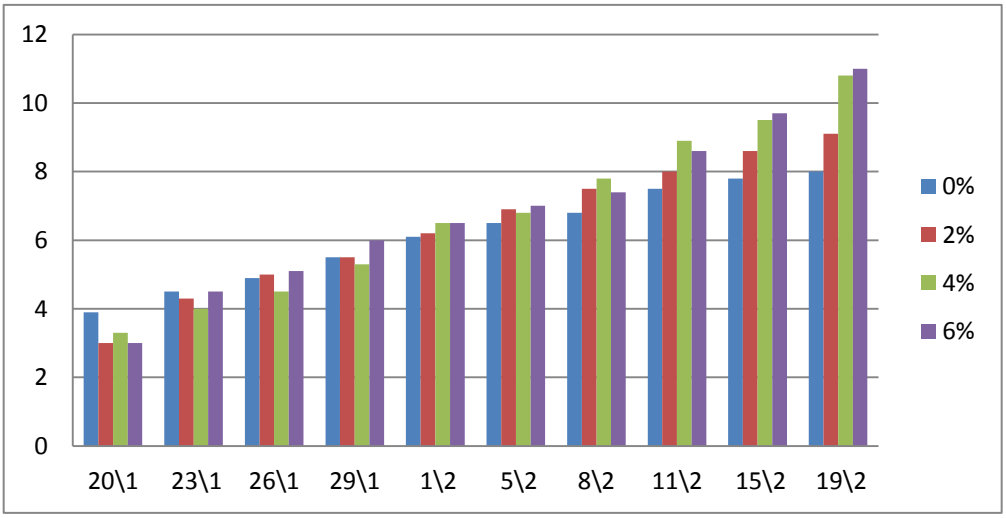
We collected the data on the for first 3 questions by preparing 4 pots with same soil and cowpea seeds then spraying the plants with yeast extract each plant with a different concentration and then observe the four samples and follow them daily to record the changes that occurred on the length of the plant, the size of the and number of leaves for a month.

To answer the fourth question we collected two samples of soil before starting the experiment and after to examine the acidity of the soil to conclude on whether the yeast extract has an effect on soil PH or not.

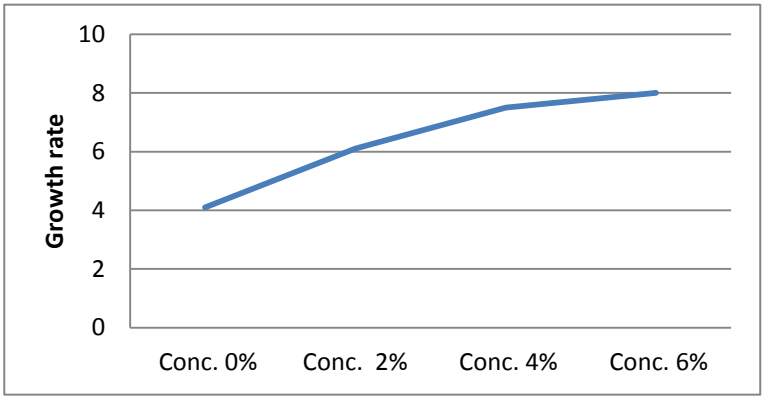
Results:

The following results answer the research questions (1):

Concentration / Date	0 %	%2	%4	%6
20\1\2019	3.9	3	3.3	3
23\1\2019	4.5	4.3	4	4.5
26\1\2019	4.9	5	4.5	5.1
29\1\2019	5.5	5.5	5.3	6
2\1\2019	6.1	6.2	6.5	6.5
5\2\2019	6.5	6.9	6.8	7
8\2\2019	6.8	7.5	7.8	7.4
11\2\2019	7.5	8	8.9	8.6
15\2\2019	7.8	8.6	9.5	9.7
19\2\2019	8	9.1	10.8	11
Growth rate	4.1 cm	6.1 cm	7.5 cm	8 cm



Graph (1): Plant growth for a month



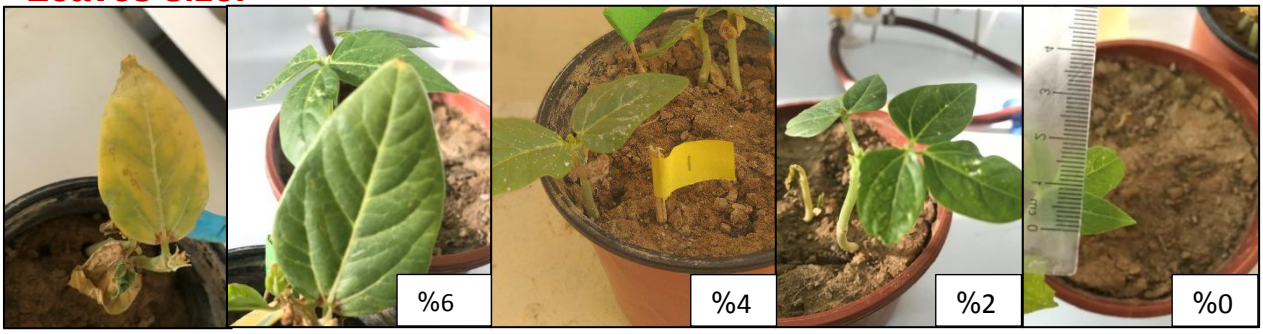
Graph (2): Growth rate of cowpea in each concentration

To answer the second question :the following table indicates the number of leaves in the cultivated seedlings ,which sprayed with different concentrations of the yeast extract:

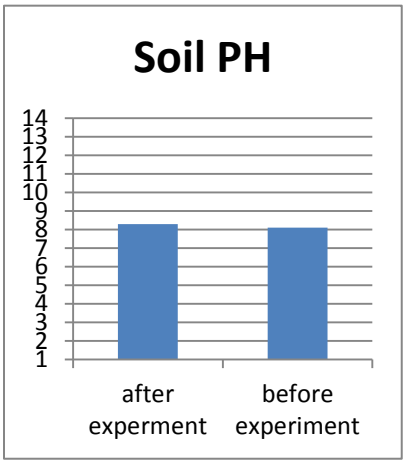
	Concentration 0%	Concentration 2%	Concentration 4%	Concentration 6%
Number of leaves	6	9	12	12

Table (6): numbers of developed

Leaves size:



Yellowing and burning the leaves of the plant that sprayed with a 6% yeast extract .



Graph (3): Soil PH

- Entering data in Globe.gov site

Discussion of results:

1- In order to answer the first research question, the data of the graph (1) and (2) indicate the growth rate of the cowpea plant that was sprayed with yeast extract. The plant that was sprayed with 6% yeast extract recorded the highest growth rate of 8 cm (11-3 = 8) while the plant sprayed with 0% yeast extract recorded the lowest growth rate of cm 4.1 (8-3.9 = 4.1). The second plant was sprayed with a 4% yeast extract had a growth rate of 7.5 cm followed by a plant that was sprayed with 2% yeast extract with growth rate of 6.1 cm.

The results showed the effectiveness of the yeast extract in increasing the plant growth rate faster than not using it. This indicates an important nutrients of yeast enter the plant in short time and easily that help to grow instead of relying on the absorption of roots from the soil only. The amount of nutrients that are absorbed by the roots, which enter the plant and benefit are less than the amount of nutrients that enter the plant by The stoma. Therefore, in order to support plant, increase the growth rate, productivity and quality, it is recommended to spray the plant with yeast extract in appropriate concentration

Several studies have indicated that the use of foliar fertilizer on the vegetative part of help plant to use 90% of the fertilizer while the same amount of fertilizer is placed in the soil, 10% of the nutrients obtained by the plant. [3]

2- To answer the second research question, the table (6) shows the difference in the number of plant leaves growing for each pot. The plant which was sprayed 6% and 4% yeast extract recorded the highest number of leaves was approximately 12 compared to the plant sprayed with 2% yeast extract which recorded 9 leaves. In addition to the first observation, yeast extract also increasing the vegetative density of the plant thus increasing the rate of photosynthesis and the speed of growth rate and productivity.
   The size of leaves sprayed with 6% yeast extract is much larger than the size of the leaves sprayed with 0% yeast extract during the month of measurements. The higher the concentration of the yeast extract the more beneficial nutrients enter the plant are therefore growing rapidly.
3- To answer the third research question, through the figure (5) in results shows the yellowing and burned leaves of the plant, which is sprayed with 6% yeast extract. From that we conclude that the yeast extract should be used with appropriate concentrations to the cowpea leafs. The 6% yeast extract did not fit the leaves but the one sprayed with 4% yeast extract did not burn so it is a suitable and harmless concentration. This is what Dr. Milad Zaki pointed out when he explained the things that farmers should care about when spraying with foliar fertilizer not to increase concentrations, especially in the case of fertilization of major elements so as not to burn leaves.[2]
4- The acidity data in graph (3) shows that there is no clear difference between pH before spraying the plant with the yeast extract and after spraying, we conclude that the use of yeast as a plant fertilizer does not affect acidity of the soil.

Through the application of the land cover protocol of the Environmental program (GLOBE) we obtained the data that indicated the effectiveness of the use of bread yeast which used in the house to increase the growth rate of plant in a short period and increase the number of leaves and their density and size .The method of scientific experimentation we have followed is the preparation of four different concentrations for yeast extract to find its effect. We found that certain concentrations should be used so as not to burn the leaves of plants.

Conclusion:

The research can be applied in another way so that the yeast extract is applied on the fruit directly and determine its effect in size if fruit produced. The soil protocol can also be applied to measure the conductivity and salinity before and after the use of yeast solutions. In addition, the strength of the research is the positive results of the yeast effect on the growth rate of plants . Finally, after these results, a yeast extract was used to spray the ornamental plants in the school to increase their quality and increase their growth rate and flowering.

Thanks and appreciation:

Our thanks and appreciation go to all the members of the GLOBE environmental team at the Ministry of Education, and we also thank the program supervisors and our teacher Aisha Al Mamari, the supervisor of the program in the school, for their continued guidance in the doin of this research. We also thank Al Kamil school for its cooperation and chemistry teacher Sheikha Al Hashimi and the laboratory technician for helping us in preparing the different concentrations of yeast extract.

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