The effectiveness of using coffee residues to fertilize the soil to Corn planting in Ibri Governorate

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Summary:

This research aims to study the effectiveness of using coffee residues to fertilize the soil in agriculture in Ibri, by answering the following questions:

1. How can coffee residues be used to fertilize the soil?
2. What are the properties of water and soil before and after adding the coffee residue to them? In terms of: (salinity, conductivity, acidity (pH), solubility of oxygen, carbonate ratio?
3. How effective is the use of coffee residues to increase agricultural production?

This research was applied in one of the villages of Ibri (Kawas), to answer the above questions. We relied on the method of scientific research where the corn plant was irrigated with water added to some coffee residue and compared the growth rates with another corn plant watered with normal water. That is by applying the water and soil protocol to measure the conductivity, salinity and acidity properties of the two normal water samples, the water added to the coffee residue, as well as the soil.

The results showed that the growth of the corn plant that was watered with water added to the coffee residue was better in terms of plant length and number of leaves more than the corn plant that was watered with normal water. It appeared through reading the water protocol that the acidity of the water added to the coffee residue was less than the acidity of normal water. The acidity rate also decreased after adding coffee. We conclude that the decrease in acidity of water and soil led to an increase in the growth of the corn plant.

The results of this research resulted in the validity of using coffee residues to fertilize the soil, and the growth of the plant in this case depends on the fertility of the soil or the amount of salts present in it after watering it with water added to the coffee residue. We found that the soil in Kawas village lacks fertility appropriate to grow the plant. Based on the results, we recommend the researchers, families, and farmers to fertilize the soil using coffee residue for cultivation. We also recommend that specialists conduct further studies on the ways in which coffee residues can be used to fertilize the soil. We recommend the Ministry of Agriculture to educate citizens about using coffee to fertilize the soil.

Basic terms

Coffee residue powder is the remaining material from the Arabic coffee.

Salinity is the quantitative concentration of mineral salts dissolved in water or soil and mainly formed and nitrates are from sodium and magnesium ions.

Fertilization is the process of adding material to the soil in order to increase their fertility.

Research questions:

1- How can coffee residues be used to fertilize the soil?

2- What are the properties of water and soil before and after adding the coffee residue to them? In terms of: acidity (ph) - conductivity - salinity - solubility of oxygen - the ratio of carbonates

3- How effective is the use of coffee residues to increase the agricultural production of corn?

Introduction and literature review:

The relationship between human and his natural environment has known evolution and change throughout history. Considering that agriculture is a human activity that values lands and natural resources in order to produce materials necessary for human and animal consumption, it has also known development during the twentieth century to include intensive agricultural systems. Resulting in imbalances and the emergence of natural problems due to excessive use of chemical inputs at the level of fertilization. (1)

Biological agriculture relies on organic fertilization to prevent soil degradation and increase its fertility, and to raise the production value of agricultural land and reduce pollution. Therefore, the use of organic waste is one of the important factors that lead to providing the needs of plants and soil fertilizers. Organic fertilization is also an important issue in modern agriculture, especially in poor sandy lands from the content of the organic material, as it is the food balance to meet the basic requirements of the plant as well as it reduces industrial fertilization. The organic material has the advantage of absorption of nutrients, which makes it more available in Root Spread Zone (2)

The people living in Ibri suffer from soil that lacks nutrients for agricultural crops, such as nitrogen, magnesium, phosphorus and potassium. Therefore,

farmers resort to using artificial fertilizers to fertilize the soil and supply it with nutrients that may be costly sometimes.

search methods:

First: The research plan:

1. Define the research problem and formulate research questions
2. Determine the location of the study
3. Set a schedule for the research plan

Table (1) shows the chronology of the research plan

The month	Work plan
September - October 2019	Formulating the research problem and determining the necessary tools
November - December 2019	Collecting and analyzing data and conducting scientific experiment
January 2020	Interviewing the specialists
February 2020	Reaching conclusions and writing the research
February 2020	Submit the search

Distribution of work roles to the research team, including preparation of tools and practical and field application.

Table (2) shows the distribution of roles between the two researchers

The work	Female students performing work	execution time
Observing and analyzing the results of the experiment **Interview analysis**	Sarah Mohammed Al-Skeiti Zouina Saeed Al Mazrouei	December 2019
Using water and soil protocols	Sarah Mohammed Al-Skeiti	December 2019

	Zouina Saeed Al Mazrouei	
Writing conclusions, recommendations and completing the research	Sarah Mohammed Al-Skeiti Zouina Saeed Al Mazrouei	December 2019
Review and translate the research	Sarah Mohammed Al-Skeiti Zouina Saeed Al Mazrouei	January-February 2020

Follow the search plan:

- Collecting information on the research topic from the available books and the World Wide Web (Internet).
- Performing different measurements using the devices (conductivity) to determine the conductivity, salinity, acidity of water (ph) and soil before and after adding coffee residues, calculating the number of leaves of the plant and measuring the length of the plant.
- Implementation of water and soil protocols in the specified location of the study
- Get benefit from the results of local projects (the Agricultural Development Department project - the effect of coffee residues on fertilizing ornamental plants and external plants (Brotherhood University project Mentouri Constantine - the Republic of Algeria) that was implemented in the field of soil fertilization for the cultivation of bean plant).
- Arrange a visit to the General Directorate of Agriculture in Ibri to collect more data and answer some inquiries
- Conducting an interview with Eng. Nasser bin Ali Al Marshoudi / Director General of Agricultural Affairs in Ibri
- Interviewing the agricultural engineer: Saeed Al-Yaqoubi

- Adopting an experimental and investigative scientific research method to discover the effectiveness of using coffee residues to fertilize the soil by:
  1- Collect data and organize it into tables
  2- Entering data in the program's website (www.GLOBE.gov)
  3- Data analysis and graphical representation
  4- Finding the results and recommendations
  5- Writing the scientific research and designing the research poster

Second: The study site

This research was carried out in Kawas / Ibri / Al Dhahirah Governorate, which is considered a semi-desert region where the temperature in December (the month in which we conducted the scientific experiment) ranged between 20-30 degrees Celsius. Where we have applied a water and soil protocol to measure the properties of the water samples added to it coffee residue and compare it with the normal water samples taken from the same place where the map images below show this area.

Photos showing the geographical location of the experiment

Third: data collection and analysis:

- Data for the first question was collected by adding coffee residues to the water and making measurements along the length of the corn plant and the number of its leaves.
- Observing the effectiveness of reusing coffee residues in fertilizing the soil to grow the corn plant.

- The scientific experiment was implemented to obtain digital data on the acidity, conductivity and salinity properties of water and soil.
- We watered two corn plants planted in the same environment, the first is irrigated with normal water and the second with coffee residue, recording their lengths and the number of their leaves every two days during the week for a month then comparing them.

Fixed factors	independent factors	dependent factors
• **type of plant** • **temperature** • **amount of water** • **the light**	Water type 1. normal water 2. water with coffee residue	Plant growth

(The table shows the fixed, independent and dependent factors during the implementing of the scientific experiment)

The second question of the research was answered through the use of water and soil protocols and measurement (conductivity, acidity measurement using a device and ph papers, salinity measurement) on the experiment we conducted and compared them with water properties suitable for corn plant growth through articles published in scientific journals and websites.




(Applying water protocol activities to water samples before and after adding coffee to it in the laboratory)

(Applying the activities of the soil protocol to soil samples before and after adding coffee to it in the laboratory)

Table of soil properties

soil properties	Soil without coffee	Soil with coffee
Structure	a girlfriend	a girlfriend

The main color	10YR 4l4	10YR 3/3
Secondary color	10YR 4l3	10YR 3/4
Consistency	Fragile	Fragile
Web	silt	silt
Rocks	A few	A few
The roots	A few	A few
Carbonate	big	A few
Salinity ppm	643	945
Conductivity sμ	946	1344
PH	7.4	7.1
temperature	20	20

The answer of third question was done by comparing the results that we reached in the scientific experiment with the results of local and foreign projects that applied the project idea and the articles published in newspapers and websites.

The interviews:

Interview (1)

An interview was conducted with agricultural engineer Nasser bin Ali Al-Marshoudi / Director of the Agricultural Affairs Department in Ibri to know the effectiveness of using coffee residues in fertilizing the soil to grow corn. The following questions were asked:

1- What is the appropriate pH and salinity for fertile soil suitable for corn plant growth?

Corn can be grown in different types of soil, but the soil suitable for cultivation remains deep soil with good drainage. The pH ranges from 6.5 to 7.5

2- What are the elements that should be available in fertile soil?

Salts should be available for germination and fruition, such as nitrogen, potassium and phosphorous.

3- What is the nutritional value of corn?

A corn plant is a very important plant for humans and animals ... for an animal is considered among the important feeds and for humans it is a fruitful plant and it is not clear to everyone the importance of corn seeds.

Interview (2)

An interview was conducted with the agricultural engineer Saeed bin Muhammad Al-Ghuraibi / Head of Statistics at the Agricultural Development Department in Ibri to know the effectiveness of using coffee residues to fertilize the soil to grow the corn plant .. The following questions were asked:

1.Is the coffee residue previously used to fertilize the soil?

Yes, there are some experiments on using coffee residues to fertilize the soil, as it helps the growth and balance of plants. It is also rich in nutrients such as (potassium, copper, magnesium, phosphorus, nitrogen).

2. What are the properties that must be available in the water and soil to grow the corn plant in terms of pH and salinity?

The corn plant is considered one of the plants sensitive to soil salinity and alkalinity, as well as water. Therefore, fertilizers

containing phosphorus, potassium and nitrogen are added to increase the resistance of the plant to salinity.

3. From your point of view, do coffee residues work as an organic fertilizer?

Yes, coffee residue can be considered an organic fertilizer because it is a natural supplement to the plant because it contains nitrogen.

4. Have the coffee residue been previously used as an organic fertilizer by farmers?

No, this method has never been used by farmers.

Results:

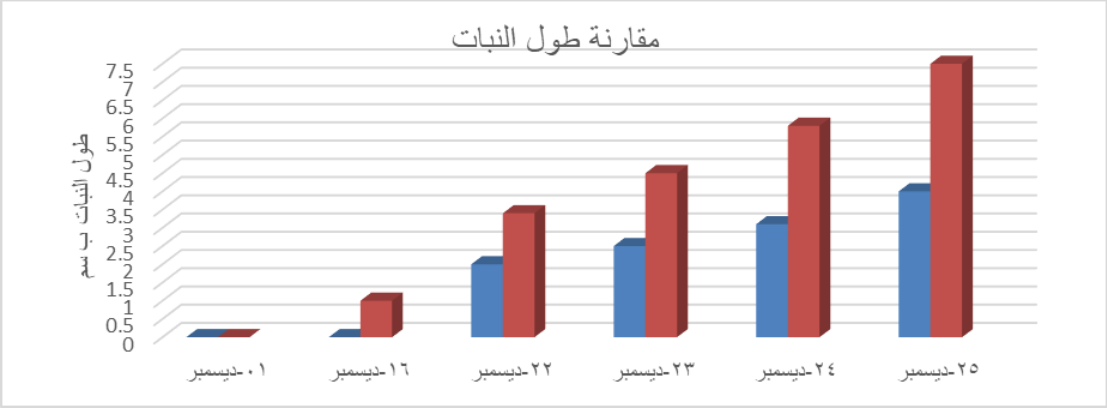
we reached data shown in the graph

First: Comparing the the number of leaves in each plant

The Date	1-Dec-19	16-Dec-19	22-Dec-19	23-Dec-19	24-Dec-19	25-Dec-19
The number of leaves of the first plant	0	0	1	2	3	4
The number of leaves of the second plant	0	1	2	3	4	5

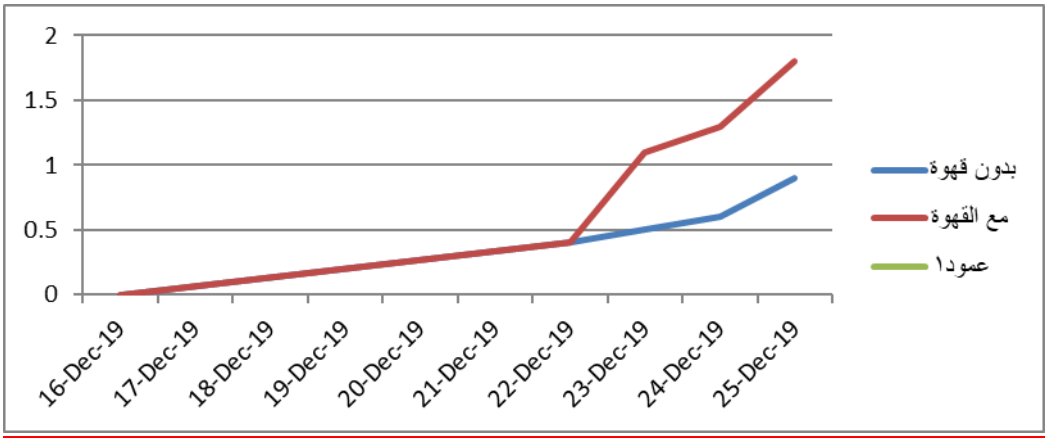
Second: Comparing the plant length

The Date	1-Dec-19	16-Dec-19	22-Dec-19	23-Dec-19	24-Dec-19	25-Dec-19
stem length without coffee	0	0	2	2.5	3.1	4
stem length with the addition of coffee	0	1	3.4	4.5	5.8	705



Third: Comparing the corn stem length in the two plants

The Date	16-Dec-19	22-Dec-19	23-Dec-19	24-Dec-19	25-Dec-19
The growth rate of corn length without coffee	0	0.4	0.5	0.6	0.9
The growth rate of corn length with coffee	0	0.4	1.1	1.3	1.8



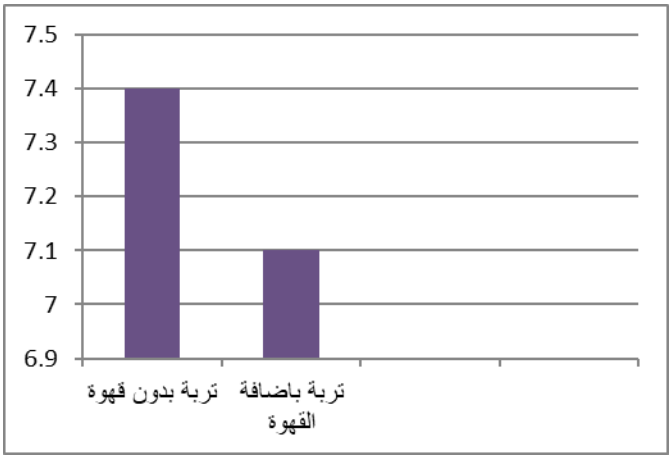
The following table shows the record of water protocol measurements on the water sample to which coffee residue is added, in an attempt to answer the second question.

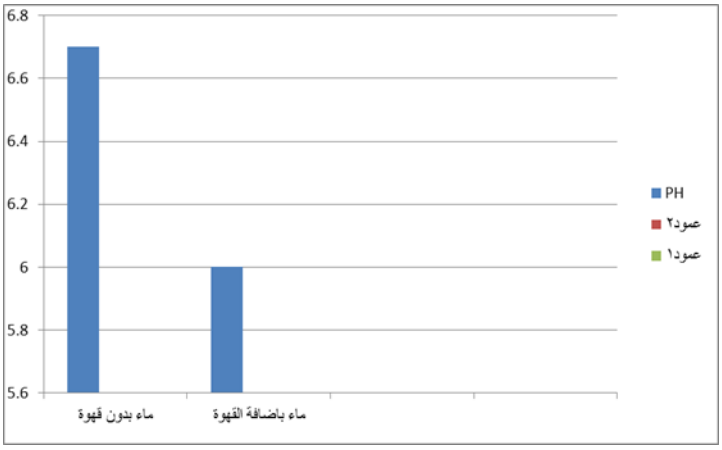
Table (١): Comparing the characteristics of normal water and the water to which coffee residue is added

Properties	Date	Normal water	water with coffee residue addition
Acidity (ph.)	14- December, 2019	6.7	6
Salinity	14- December, 2019	267	591
conductivity	14 -December, 2019	342	1201

Table (2) Comparing the characteristics of normal soil and the soil with coffee residue addition

Properties	Date	The soil with coffee residue addition	Soil without adding coffee
Acidity (ph.)	14- December, 2019	7.4	7.1
Salinity	14- December, 2019	643	945
conductivity	14 -December, 2019	946	1344





By comparing previous results with articles published for scientific research, we found the following:

Division of vegetables according to their tolerance to soil acidity in an article published on the Facebook page of export crops in Egypt (1)

(1https://www.facebook.com/infozera3a/posts/761793677201838 (/

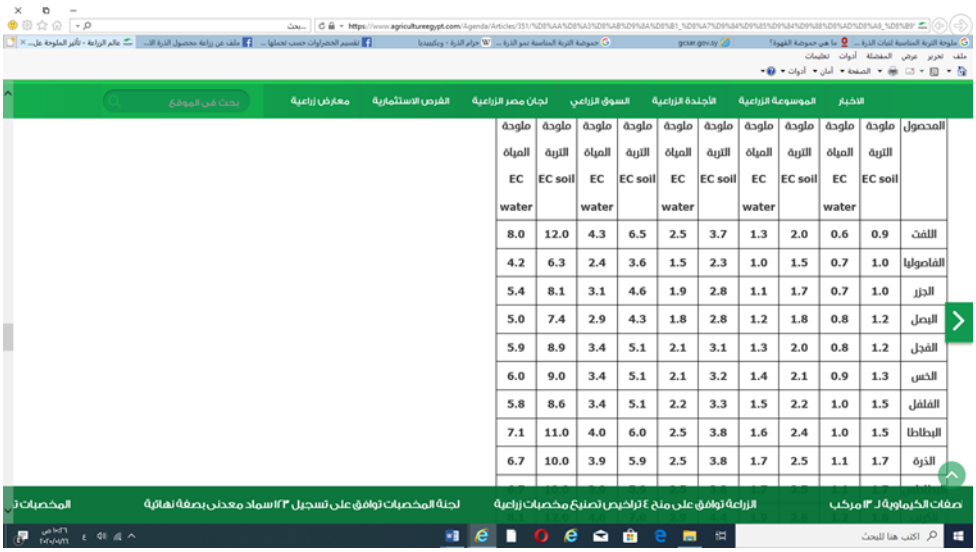
Articles:

An article was pointed out on the diversified agricultural page of Amateen on Facebook

21 October 2016

(Corn is a summer crop that is suitable for growing high temperatures. The optimum temperature for germination ranges between 32-35 ° C. Where the grains can germinate after 5-10 days in appropriate conditions, and the grains cannot germinate at temperatures below 5 ° C or higher than 45 ° C. The vegetative growth of corn plants developed an average temperature of 27 ° C during the summer months, and the corn needs to provide moisture and warm during flowering. (1)

In another article, published by the Egyptian Agriculture Network website ... that explains the salinity of water and soil suitable for crop growth, which is consistent with the results we obtained.



المحصول	ملوحة التربة EC soil	ملوحة المياة EC water	ملوحة التربة EC soil	ملوحة المياة EC water	ملوحة التربة EC soil	ملوحة المياة EC water	ملوحة التربة EC soil	ملوحة المياة EC water	ملوحة التربة EC soil	ملوحة المياة EC water
اللفت	0.9	0.6	2.0	1.3	3.7	2.5	6.5	4.3	12.0	8.0
الفاصوليا	1.0	0.7	1.5	1.0	2.3	1.5	3.6	2.4	6.3	4.2
الجزر	1.0	0.7	1.7	1.1	2.8	1.9	4.6	3.1	8.1	5.4
البصل	1.2	0.8	1.8	1.2	2.8	1.8	4.3	2.9	7.4	5.0
الفجل	1.2	0.8	2.0	1.3	3.1	2.1	5.1	3.4	8.9	5.9
الخس	1.3	0.9	2.1	1.4	3.2	2.1	5.1	3.4	9.0	6.0
الفلفل	1.5	1.0	2.2	1.5	3.3	2.2	5.1	3.4	8.6	5.8
البطاطا	1.5	1.0	2.4	1.6	3.8	2.5	6.0	4.0	11.0	7.1
الذرة	1.7	1.1	2.5	1.7	3.8	2.5	5.9	3.9	10.0	6.7

(1) https://www.facebook.com/959090560874131/posts/1103502903099562/

(2) https://www.agricultureegypt.com/Agenda/Articles/351/%D8%AA%D8%A3%D8%AB%D9%8A%D8%B1_%D8%A7%D9%84%D9%85%D9%84%D9%88%D8%AD%D8%A9_%D8%B9%D9%84%D9%89_%D8%A7%D9%84%D8%AE%D8%B6%D8%B1%D9%88%D8%A7%D8%AA/

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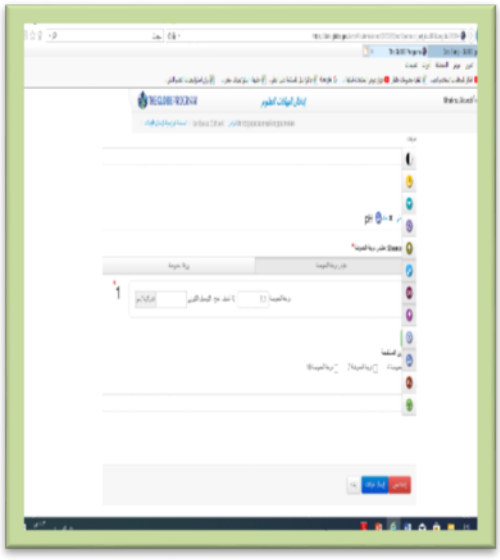

Discuss the results:

Through the results that we obtained, the first question was answered, as it was found through the table of plant lengths that when adding coffee to the soil we noticed a difference in the length of the corn plant and the number of its leaves. The highest length of the corn plant in the soil which contained coffee residues reached (7.5) cm, while the highest growth length of the corn plant in the soil watered with normal water was (4) cm. The number of corn plant leaves in the soil containing the coffee residue was (5), while the number of corn plant leaves in the soil watered with normal water was (4). Therefore, the coffee residues in the soil helped provide nutrients suitable for growth Plant.

The results of the study showed (the effect of fertilizing coffee residues on salinity, soil acidity and some morphological and physiological properties of bean plant)

First: a change in the chemical properties of the soil by decreasing the pH and increasing the conductivity level

Second: The great importance of what is contained in coffee residues from materials that lead to increasing soil fertility and land productivity, so we suggest directing attention to this neglected product, which is classified as waste and its exploitation in all fields, whether economic, environmental and health. (1)

Also, through the results that were recorded and analyzed, the second question of the study was answered, where we noted that there is a difference in both acidity, salinity and conductivity of the soil to which we watered with coffee residues and that is watered with normal water.
We found through the measurements that the soil to which the coffee residue was added was more acidic, where it reached (ph = 7.1), and the soil to which the coffee residue was not added was less acidic, where it reached (ph = 7.4)
The acidity suitable for corn plants is from 6.5 to 7.5 (the acidity of the water to which the coffee is added is appropriate). The results of the sample analysis showed (the acidity of the water to which the coffee residue = 6.5). The salinity rate for both types approximates and the corn plant is average Sensitivity to salinity, where the engineer: Nasser Al-Marshoudi explained that the suitable acidity for corn plant growth is 7.

The agricultural engineer: Saeed Al-Yaqoubi stressed the validity of this water to irrigate the plants, adding that the growth of the plant depends on the salinity and fertility of the soil, because the normal water lacks some of the nutrients for the plant.
These data give a good indication of the validity of the use of the water to which coffee residues are added in the cultivation of the corn plant. A comparison of the results showed that the rate of plant length growth when adding coffee residues to water is greater than the average length of the plant when using normal water. , Which means that coffee residues can be used to fertilize the soil.

Conclusion:

We thank Allah for completing this research, through which we reached the effectiveness of using coffee residues to fertilize the soil after adding it to irrigation water. Through the water protocol, we concluded the positive effect of the use of coffee residues on the growth of the corn plant. As the length of the plant and the number of its leaves increased. It means its positive impact on soil

fertility. We can also continue scientific observations on the effect of fertilizing coffee residues on the fruits of the corn plant.

We can also apply such research using other natural fertilizers such as ash and eggshells to help in germinating plants and increasing their fruits.

Through the use of the results of both experience and interviews and the use of the water protocol, we found that it is possible to use the water added to it coffee residues in the irrigation of plants. The growth of plants irrigated with water added to the coffee residue depends on the soil because it compensates for the lost elements in this water.

Thanks and appreciation:

We extend our thanks and appreciation to Miss Hidaya Al Farsi from Fida School for her cooperation in preparing the research and entering data, as well as Mr. Mohammad Al Ghafri, the program supervisor in Al Dhahirah Governorate for his guidance in preparing the research. We also thank Eng. Nasser bin Ali Al-Marshoudi, Director General of the Agricultural Affairs Department, Ibri, for the information he provided us with regard to the plant needs of the nutrients needed in the soil for its growth. We also thank Eng. Saeed Al Yaqoubi for the information he provided. We commend the management of the Ibri School for Basic Education about providing support and various facilities for conducting this research, and in conclusion, we thank all those who have had a role in presenting this research.

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(diversified agricultural page of Amateen on Facebook)

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