



Sultanate of Oman
Ministry of Education
Althabti School for Basic
Education



Study the effect of iron rust As liquid fertilizer on plant growth

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Study the effect of iron rust As liquid fertilizer on plant growth

Preparation:Amna Al Bulushi & Genan Almaskry

Al-Thabiti School for Basic Education(5-10)

Sultanate of Oman-North Eastern Governorate

Executive Summary

We applied this research to answer these questions:

1-How effective is the iron rust solution as liquid fertilizer on plant growth?

2-How much is the concentration of essential elements when using an iron rust solution as a liquid fertilizer?

3-How are the soil properties affected when using an iron rust solution as liquid fertilize?

This research was applied in Oman(Ibra)in the North Eastern Governorate,we used an iron rust solution as a liquid fertilizer and mixed it with the soil,then we measure the growth of the tomato plant and compared its growth with another tomato plant in soil free from the iron solution by applying the land cover.

We sent two samples(water-iron rust solution)to the soil and water research center to find out the focus of the major elements of plant growth

We also made a comparison between the soil samples taken from agricultural land,one of them contains an iron rust solution and the other is free from the solution and compared the properties of the two samples by applying the soil protocol(acidity,Quantity of calcium carbonate,roots and rocks)

The results showed the rust solution had a negative effect on plant growth.The growth rate of tomato in the soil free from rust solution(0.75cm)compared to its growth rate in soil with a rust solution(0.325cm)

Also,this solution lacks the essential elements of plant growth compared to water rich by these elements.

Also,we concluded the iron rust solution increases the acidity and salinity of the soil compared to the soil-free from this solution its acidity decreases and approaches the equivalent nature.

On the basis of the research results,the researchers recommend not to use an iron rust solution as fertilizer because of ion(Fe^{3+})that not dissolved in water(chemistry book grade12)so the plant tissues cannot absorbed it and closes the soil pores (Jubouri,2018).

Terminologies and Definitions

Iron rust: It is the triple iron oxide,and it is not dissolved in the water with reddish brown.Its chemical formula($\text{Fe}_2\text{O}_3 \cdot x\text{H}_2\text{O}$)(Chemistry book for 12,page 68)

Liquid fertilizer:a material added to the soil in order to help the plant to grow, after adding water to it and using it in watering the plant.

The essential elements:the basic elements of plant growth are nitrogen,phosphorous,potassium,calcium,magnesium and sulfur.

Research questions

1- How effective is the iron rust solution as liquid fertilizer on plant growth?

2-How much is the concentration of essential elements when using an iron rust solution as a liquid fertilizer?

3-How are the soil properties affected when using an iron rust solution as liquid fertilize?

Introduction and literature review

The plant is the secret of life on the surface of the earth,and if the plant is absent,life is absent on the ground even if the water is found.The plant is the one that is all the basic food components and is the main stabilizer of solar optical energy on Earth,which God Almighty has given from the live characteristics and vital interactions that are able to

manufacture organic foodstuffs, vitamins and vital compounds that are boiled by human life.

There are many factors that plants need to support their growth process, the most important of which are: genetic factors, vital factors, and environmental factors (water, heat, light, ventilation, pH, soil content of nutrients)

In this research, we will study the soil content factor from the nutrients that the plant gets by adding fertilizers, as we have studied the effect of the use of an iron rust solution as a liquid fertilizer on the growth of the plant. As we have seen many videos on social media by those interested in agriculture that encourage the use of an iron rust solution in watering crops, thinking that it helps the plant to grow, so we wanted to make sure whether this method positively affects the growth of the plant.

According to the related studies that mentioned by Agricultural engineer Batool Al -Jubouri (Al -Jubouri, 2018), putting iron around trees useless because the iron ion (Fe^{3+}) are not dissolved in the water, so it cannot be entered into the tissues of the plant.

Research methodology

1. Research plan

Table(1) below shows the research plan and schedule:

Month	Tasks
Dec-Jan/2023	Conduct field visits to farmers, formulate the research problem and identify the necessary tools
Jan/2023	Data collection and analysis
Feb/2023	Conclusion and writing the research report
Feb/2023	Hand over final report

Table(1) Research Plan

Table(2)below shows tasks and distribution of responsibilities among the researchers:

Tasks	Responsible Research
Formulate the research problem and identify the necessary tools	(Amna-Genan)
Collect data through: Field visits to interview farmers and application of land cover protocol. Apply soil protocol and analyze data. Entry of data to website.	(Amna-Genan)
Reach conclusions through data that have been compiled Drafting the abstract and writing the paper	(Amna-Genan)

Table(2)Distribution of Tasks & esponsibilities

Search for information related to the subject of the research through the following resources:

- World Wide Web
- Globe Notes to the Soil Protocol
- Chemistry book for grade 12 and Soil fertility and plant feeding book

Identification of different study sites in preparation for the application process in order to collect data necessary for research

Task	Site
Cultivation of tomato. observing the effectiveness of iron rust solution in its growth by applying the land cover protocol	School Garden
Examine the samples and find concentration essential elements in two samples(water only-iron rust solution)	Soil and Water Research Center
Study of soil characteristics by application of the soil protocol on two samples of a house garden (soil only-soil with iron rust solution)	Farm in Ibra city

Table(3)Application of the Research Plan

Determination of the appropriate equipment and tools to carry out the work(pH meter,GPS,electronic balance,ruler,paper,pen,computer, vinegar,plantation vessels,distilled water)

Application of sampling research through the implementation of appropriate protocol activities(land cover and soil).

Application Mechanism	Protocol	Research Question
Cultivation of tomato in same type of soil and watering the same amount of water and receive the same amount of light in two vessels 1-vessele(1)water only 2-vessele(2)iron rust solution two vessele were placed in the school garden	Land Cover	Question(1)
Send two samples(water only-iron rust solution)to the center of soil and water research to find the concentration essential elements in each sample		Question(2)
Study soil properties(acidity, amount of calcium carbonate,rocks and roots)on two samples of a house garden(soil only-soil with iron rust solution)	Soil	Question(3)

Table(4)Mechanisms of protocols application for data collection

Design a table(Annexes1)to record the measurements of the leg length,measurements were taken every six days.

Data collection and processing.

Soil Protocol application data were entered to(www.glob.gov)web site.

2. Interview

Interview Engineer Naser AL wahibi to discuss the results of sample analysis.

Research site

The research was carried out in Ebra city during the period of (January-February) where the temperatures range (24-29). The tomato was planted in the school garden by applying the land cover protocol and two samples were taken from a farm in Ibra city (soil-soil and rust solution) to apply soil protocol.



2

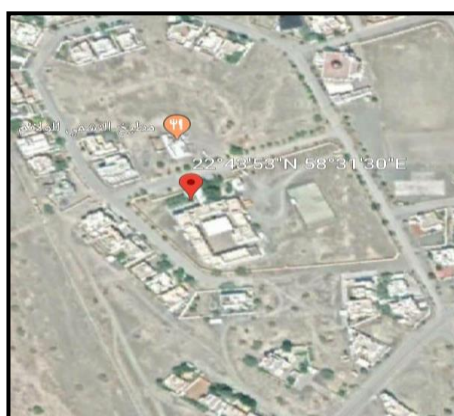


1

Image(1)and(2)the geographical location farm(Ibra)



4



3

Image(3)and(4)the geographical location of the Al -Thabiti School Park

Collecting and analyzing data

The first question data was collected by measuring the growth of the tomato plant in the school garden. All two vessels were irrigated with the same amount and type of water, same number of tomato seeds were planted, same amount and type of soil was added, same amount of light was received except that one of them was added to it iron rust solution as a liquid fertilizer and the other was not added to it solution. After that we compared the plant growth by observation and write there growth in notes every six days.



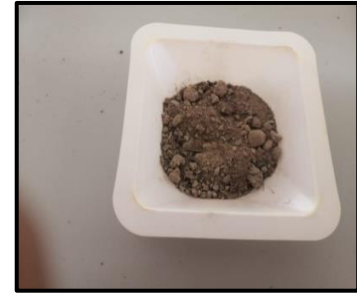
Pictures(5),(6)and(7)shows the application of activities on tomato plants in the school garden

The second question data was collected by sending two samples to (soil and water research center) and a analysis to find out the focus of the major elements (water- iron rust solution)



Image (8) shows the two samples

As for the third question of the research, the data was collected by applying the soil protocol on two samples (soil-soil and rust solution) and comparing their properties (Quantity of roots, rocks, calcium carbonate and acidity)



Pictures (9,10,11) shows the soil protocol application

The following table also shows the characteristics(soil-soil and rust solution)from a farm on a break

Soil + iron rust solution	soil	Comparison
High	High	Quantity of rocks
High	High	Quantity of roots
Medium	Medium	Quantity of calcium carbonate
5.4	6.2	Acidity

Table(5)soil samples data according to the materials added to them

Interviews

An interview was conducted with the engineer/Nasser Al -Wihibi, a plant nutrition researcher, and he reported that the use of iron rust as a liquid fertilizer is not beneficial for the plant. The iron here is in the form of a triple iron that is not dissolved in the water and the plant cannot absorb it.



Pictures (12) Interview with Eng. Nasser Al -Wahaibi

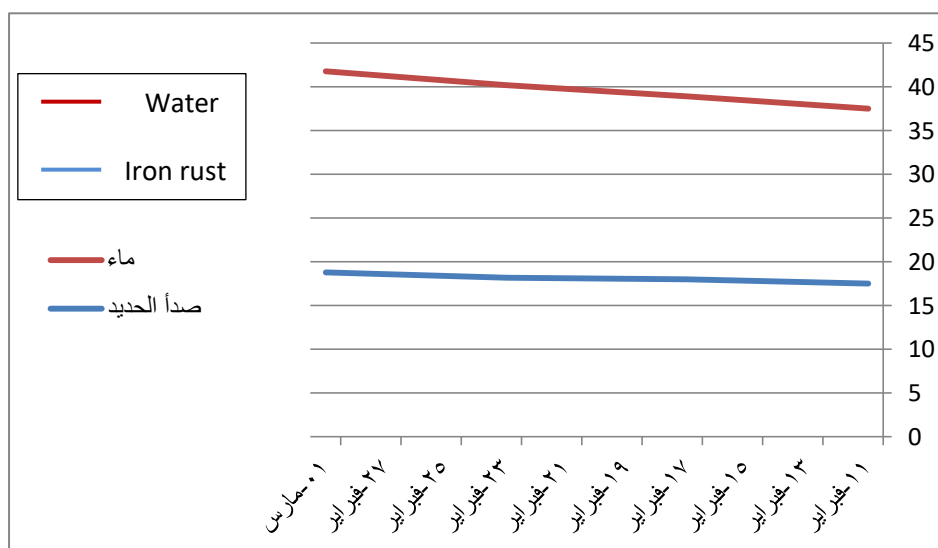
Results

The following table shows the data collected by measuring the growth rate of tomato plant

The results of the first question:


Liquid iron rust fertilizer	Water (cm)	Plant type	Date
17.5	20	tomato	11/2
18	20.9	tomato	17/2
18.2	22	tomato	23/2
18.8	23	tomato	1/3
0.325	0.75	tomato	Growth Rate

Table(6) shows the growth of the tomato plant



The graph(1) shows the growth rate of tomatoes

Results of the second question:


 وزارة الثروة الزراعية والسمكية وموارد المياه
 المديرية العامة للصحة الزراعية والحيوانية
 مركز بحوث التربة والمياه - قسم بحوث التربة

Registration : 223116032
 Order No : 606
 Order Date : 2022-03-06

رقم القيد : 223116032
 رقم الطلب : 606
 تاريخ الطلب : 06-03-2022

نتائج تحليل عينات Samples Analysis Result

Applicant Details :

Name : مدرسة التايبي للتعليم الاساسي
 Address : محافظة شمال الشرقية - ولاية إبراء - التايبي


بيانات مقدم الطلب :
 الاسم :
 العنوان :


Water sample analysis results


Ca	K	Mg	Cl	Na	pH	E.C	Sample Id	
PPM	PPM	PPM	PPM	PPM		dS/m	Unit	#
-	-	-	70 >	9 >	6.5-8.4	3 >	Acceptable	
44.4	8.19	4.8	81.7	109.9	7.6	0.79	519	1
0.48	0.05	0.10		0.14	4.77	2.30	520	2

نتائج تحليل عينات المياه

الخلاصة:
 ملاحظة رقم (1) عينة مياه ورقم(2) محللول الصدا


 Analyzed by
 مديرين سعيد الجحاني


 Reviewed by
 رئيس قسم بحوث التربة


 Approved by
 مدير مركز بحوث التربة والمياه

Table(7)concentrations of major elements

Results of the third question:

The table also shows the properties(soil-soil and iron rust solution) from a farm in Ibra.

Soil + iron rust solution	soil	Comparison
High	High	Quantity of rocks
High	High	Quantity of roots
Medium	Medium	Quantity of calcium carbonate
5.4	6.2	Acidity

Table(8)soil sample data according to the materials added to it

Enter soil data on the program site(www.globe.gov)via(Data Entry), where a new work site was added and the search data is added.

رمز اللون الرئيسي 7.5YR:6/2

رمز اللون الثانوي

الاحقية تقدير friable

تقدير ملمس التربة في الحقل loam

تقدير كمية الجذر many

تقدير كمية الصخور many

الكربونات slight

تعليقات

خط العرض 22.4122

خط الطول 58.3255

ارتفاع 390

Set elevation

مصدر البيانات الاحداثيات

خريطة قمر صناعي

حموضة التربة إنشاء

أفق المرز العقلي 1 (0سم - 10سم)

طريقة الحموضة pH Meter

حموضة التربة 6.2

إرسال البيانات

Pictures(13,14,15)Enter soil data on the site

رمز اللون الرئيسي 7.5YR:6/2

رمز اللون الثانوي

الاحقية تقدير friable

تقدير ملمس التربة في الحقل loam

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خريطة قمر صناعي

خط العرض 22.4122

خط الطول 58.3255

ارتفاع 390

Set elevation

مصدر البيانات الاحداثيات

خريطة قمر صناعي

Pictures(16,17and18)Enter data(soil and rust solution)on the site

Discuss of results

To answer the first question in the research:

To answer this question, we planted the tomato plant in two vessels, where all factors were fixed except that one of them was added to it iron rust solution as a liquid fertilizer and the other was not added to it this solution. By looking at table(6)and graphic(1): The growth rate of plant when watered with water(0.75) is **fastre** than the other plant(0.325)by double.

From here we conclude that the use of an iron rust solution has a negative effect on the growth of the plant when using it as a liquid fertilizer.

Through the interviews we had, Eng. Nasser Al -Wahaibi (Nutrition and Plant Researcher) stated that the use of iron rust is not beneficial to the plant, as the iron is a triple ion that is not dissolved in water that cannot be entered into the tissues of the plant.



picture(19)tomato plant in two vessels

To answer the second question of the research:

By looking at Table(7)for sample(water- iron rust solution)can be noticed:

- a. The salinity of the water sample is low compared to the salinity of the iron rust solution.
- b. The pH of pure water is(7.6)which higher than PH of the rust solution(4.7)and became acidic nature.
- c. The elements in water such as:(sodium-potassium-calcium-magnesium-chlorine) are higher than rust solution.

From here we find that the growth of the plant when watered with water is better than the rust solution because the presence of elements (sodium-potassium-calcium-magnesium-chlorine) is a higher rate that has a positive effect on the growth of the plant, it is important for the plant because it enters into the composition of the cell and some of them in the composition of chlorophyll components and the figuration of organic compounds Like sugars and proteins and facilitating vital interactions (soil fertility and plant feeding, 2013)

As for the solution of iron rust with a formula ($\text{Fe}_2\text{O}_3 \cdot x\text{H}_2\text{O}$) the presence of iron in this way makes it not dissolved in water (a chemistry book for grade 12) and therefore the plant tissue cannot absorb it, but rather a danger to the plant by closing the soil pores, which deprives some roots of breathing and weakens growth. The plant based on what Nasser Al-Wahaibi indicated

To answer the third question:

By looking at table (8), both samples contain a high amount of rocks, roots and a medium amount of calcium carbonate but the acidity of soil that mixed by rust solution is increased compared the other soil.

Conclusion

The results of the research indicated that the iron rust solution has a negative effect on the growth of the plant, as the growth of the tomato plant in the soil mixed with a rust solution (0.325 cm) compared to its growth rate in other soil (0.75 cm)

The iron rust solution lacks the major essential elements of plant growth compared to water rich in these elements. In addition, we concluded that the soil acidity increases by adding an iron rust solution compared to other soils that reduce its acidity and approach the equal nature.

On the basis of the research results, the researchers recommend that the iron rust solution cannot be used as a liquid fertilization because of iron ion (Fe^{3+}) that is not dissolved in water, so the tissues of the plant are not absorbed, but it closes the soil pores, therefore it prevents the plant from breathing and the plant weakens.

Thanks and appreciation

The researchers would like to express a great deal of thanks and appreciation to all those provided any kind of help and support throughout the research journey, especially to:

Mr. Ahmed Al Balushi, the national coordinator of the program who provided guidance to the researchers in order to correctly fine-tune the research.

Ms. Yousra Al Dhawi for her role in directing, supervising and easing all difficulties the researchers have faced during the research.

General Directorate of Agriculture and Livestock in the governorates of North and South Al Sharqia for the support and coordination with the Soil and Water Research Center to examine the samples.

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4. Articles from the Internet
Al -Jubouri, Batoul. (2018, September 30). **Methods of inserting the Iron for the Soil**, Retrieved February 11, 2023 from <https://flesteen.news/p/35150>

Optional badges

Be a collaborator: Distribute the research work to the two students while they are implementing and writing the research report

Be a data scientist: The two students entered the soil data in the GLOBE website that was used in the research

Make an impact: Disseminate the results of the research to parents and farmers on the effect of negative iron rust solution on plants