



# The effectiveness of using Moringa oleifera leaves as an organic fertilizer.

Done by:

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## Content:

Subject	Page number
Abstract	2
Research question	3
Introduction and literature review	3
Research methodology	4-7
Results	7-10
Result analysis	11-12
Conclusion	12
Badges	13
References	14
Appendix	15

**Abstract :**

**The effectiveness of using Moringa oleifera leaves as an organic fertilizer.**

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Our research aims to study the effectiveness of using Moringa oleifera leaves as an organic fertilizer by answering the following questions:

- What is the effect of fertilizing Moringa oleifera leaves on plant growth (stem length and number of leaves)?
- How does the use of Moringa oleifera leaf extract affect soil properties (acidity, salinity, and conductivity)?

To answer these questions, we used leaves powder in different quantities to fertilize tomato plants and compare growth rates. We also prepared liquid fertilizer from moringa leaf extract and used to fertilize tomato plants and compared growth rates with another tomato plant fertilized with organic fertilizer, using ground cover protocol. The soil protocol was applied studying the soil characteristics (acidity, salinity, and conductivity) to study the fertilization effect of moringa leaves on these characteristics.

The results indicated the effectiveness of using Moringa oleifera leaves as an organic fertilizer, as the plant that was fertilized with Moringa leaf extract recorded higher growth rates within 5 weeks (37 cm) compared to the growth rate of (29.5 cm) for the plant that was fertilized with organic fertilizer and (22 cm) for the plant that was not. As it turned out, there were also higher values for the acidity, salinity and conductivity of the soil that was fertilized with moringa leaves, because the leaves contain high chemical elements percentages. Therefore, we must add specific powder amounts to get better plant growth.

Based on the research results, we recommend the need to intensify guidance campaigns for farmers to encourage them to grow moringa and use as organic fertilizer instead of chemical fertilizers and as fodder for their livestock . Also, by planting more moringa trees , the carbon will decrease in the atmosphere.

### **Key terminologies:**

- Moringa oleifera plant, scientific name (Moringa Oleifera) and belongs to the (Moringaceae) family .
- Fertilization: Adding fertilizers to the soil increasing its fertility.

### **Research questions:**

- 1- What is the effect of fertilizing Moringa oleifera leaves on plant growth (stem length and number of leaves)?
- 2- How does the use of Moringa oleifera leaf extract affect soil properties (acidity, salinity, and conductivity)?

### **Introduction and literature review:**

The Moringa tree, which is called the miracle tree due to its many nutritional and medicinal benefits, is scientifically known as: Moringa Oleifera (it belongs to the Moringaceae family (Wikipedia) and is considered an evergreen tree. This type has recently spread widely in the Sultanate due to its nutritional and health benefits. As for the available type In the Sultanate, it is Paregrina (Moringa), known locally as Al-Shu'a, and it has the same benefits as Moringa oleifera. The Moringa tree has the ability to adapt and grows in arid, hot, semi-arid, and dry lands, and in temperate and warm areas as well, as it is distinguished by its high ability to withstand drought and moderate frost. It does not need much water and rainwater is sufficient, so it can be grown even in mountains and deserts.

In this research, we will discuss the benefits of moringa in the field of agriculture, where we will study the effectiveness of moringa leaves as a fertilizer for plants, which can be used in the future as an organic fertilizer as an alternative to chemical fertilizers, which in turn will benefit the environment.

Among the previous research in this field is what was carried out by the Studies and Research Committee of the Egyptian Food Basket Association (comparing fertilizer use between regular fertilization and fertilization with moringa leaf extract for barley plants (2012) and the study conducted by the Vegetables Department at the Faculty of Agriculture at Assiut University (2022) on fertilizing the onion crop with moringa leaf extract. The results of the two studies showed the effectiveness of fertilizing with moringa leaves on the vegetative growth of the plant and increasing the resulting yield. There are also many studies that have shown the nutritional and health benefits of the moringa plant, as well as the environmental benefits, such as the possibility of using it to purify water and as fodder for animals.

## Research methodology:

### Research plan:

1. Collect information about the research topic from books available in the Learning Resource Center and from the information network.
2. Develop a research plan.
3. Establish a timetable for implementing the research plan.
4. Adopting experimental research to study the effect of fertilization with moringa leaf powder and extract (stem length and number of leaves).
5. Determine the protocols necessary to carry out the research.
6. Determine the necessary devices and tools to carry out the work (pH meter, salinity and conductivity measuring device, and metric tape).
7. Collect data and organize it into tables.
10. Entering data into the program's website
11. Analyze and represent data graphically
12. Reaching conclusions and recommendations.

### Timetable of the research plan implementation:

name	task	date
Rayan Al Farsi Maryam Al Farsi	Collect information on the research subject from various resources.	June 2023
Rayan Al Farsi Maryam Al Farsi	Sending a sample of Moringa oleifera leaf powder to the laboratory of the College of Agriculture at Sultan Qaboos University to examine the elements available in it.	19 July 2023
Rayan Al Farsi Maryam Al Farsi	Practical experimentation with using moringa leaf powder to fertilize tomato plants in different concentrations.	November 2023
Rayan Al Farsi Maryam Al Farsi	Practical experimentation with the use of moringa leaf extract in fertilizing tomato plants.	December 2023
Rayan Al Farsi Maryam Al Farsi	Observing the final results and writing the research.	January 2024

## Survey location

Sultanate of Oman - Al Dhahirah Governorate - Wilayat Ibri - Dhafer Al Fawares village - (latitude: 23.37 and longitude: 56.38) months of September and October - the weather is moderate, the temperature ranges between (24-30 C) water and dissolved oxygen protocols were used.



## Data collection and analysis:

### Protocols used in data collection:

Research question	Protocol	Mechanism of application
Q1	Land cover protocol	Observing the growth of tomato plants (stem length and number of leaves).
Q2	Soil protocol	Measurement of soil acidity, salinity and conductivity 5 weeks after fertilization.

## Practical experiments: Experiment (1):

### Fertilization with moringa leaf powder:



- 1- Collect moringa leaves, then dry and grind them to obtain a powder.
- 2- Put the same amount and type of soil in 3 pots, adding 10 grams of moringa leaf powder to one of the pots, 20 grams to the second pot, and leaving the third without adding anything.
- 3- Choose tomato seedlings of the same type, with the same height and number of leaves, and plant them in three pots, irrigating them with the same amount of water, and placing them in the same lighting and temperature for five weeks.
- 4- Measure the growth rate of each seedling by measuring the height and number of leaves weekly and recording the results in a table.
- 5- Measuring the acidity, salinity and conductivity of the soil at the beginning of the experiment and five weeks after the experiment was conducted.

### Experiment (2):

#### Fertilization with moringa leaf extract:

##### Preparation of moringa leaf extract



250g moringa leaves



Chop leaves + 2L water



Filter the mixture to obtain moringa liquid



Moringa leaves extract

1- Choose tomato seedlings of the same type and have the same height and number of leaves, plant them in the same type and amount of soil, and place them in the same lighting and temperature for five weeks.

2- Two seedlings were left without fertilization, two seedlings were added with organic fertilizer, and two seedlings were added with moringa leaf extract. The seedlings were irrigated with the same amount of water every two days.

3- Observing the growth of different seedlings in terms of their general appearance, measuring their height at the beginning of the experiment and after 5 weeks, and calculating the growth rate and number of leaves.

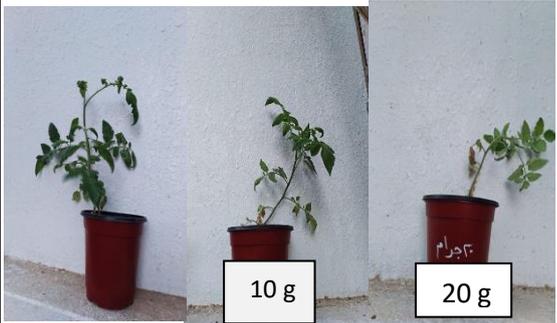
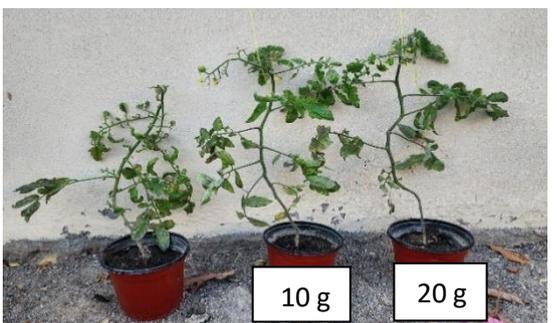
-To answer the second question in the research, data related to soil characteristics (acidity, salinity, and conductivity) were collected by studying soil samples from each pot according to the type of fertilization.

### Results:

#### Experiment (1): Fertilizing with different amounts of moringa powder

**First:** Observing the growth of the tomato plant two months after planting it in terms of its general appearance:

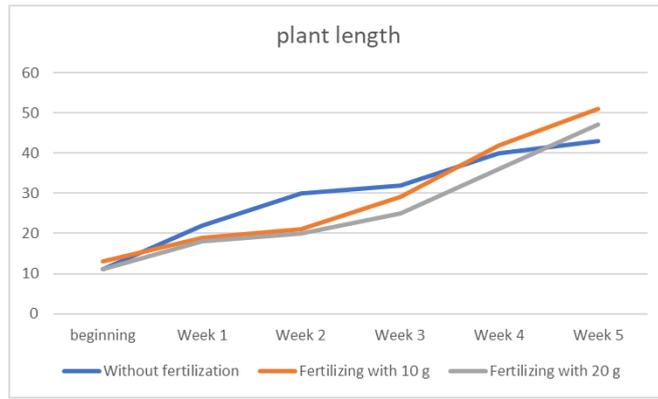
Table 1

Time	After 2 weeks	After 5 weeks
Picture		

**Second:** Monitoring the growth rate of tomato plants according to the amount of fertilizer:

Weeks	Without fertilization		Fertilizing with 10 g		Fertilizing with 20 g	
	Height (cm)	Number of leaves	Height (cm)	Number of leaves	Height (cm)	Number of leaves
beginning	11	3	13	3	11	3
Week 1	22	6	19	6	18	6
Week 2	30	8	21	9	20	8
Week 3	32	10	29	10	25	10
Week 4	40	9	42	13	36	11
Week 5	43	11	51	15	47	13
Growth rate	32	8	38	12	36	10

Table 2

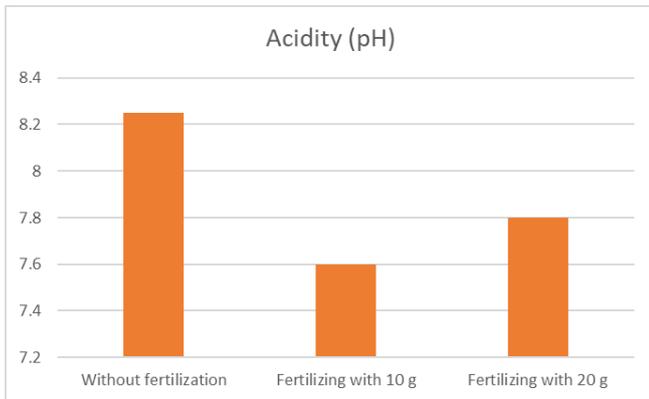


shape 1

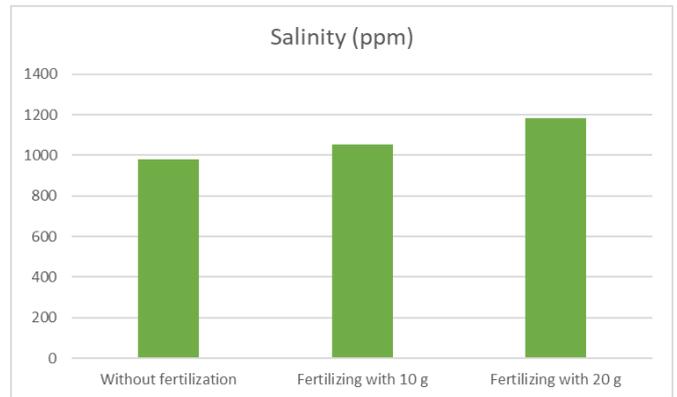
Third: Soil characteristics data in experiment (1):

Sample	Without fertilization	Fertilizing with 10 g	Fertilizing with 20 g
Acidity (pH)	8.25	7.6	7.8
Salinity (ppm)	981	1055	1185
Conductivity ( $\mu\text{S}/\text{cm}$ )	980	1100	1137

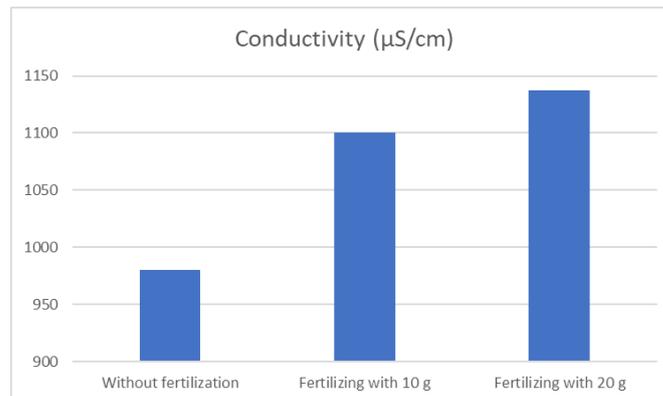
Table 3



Shape 2



Shape 3



Shape 4

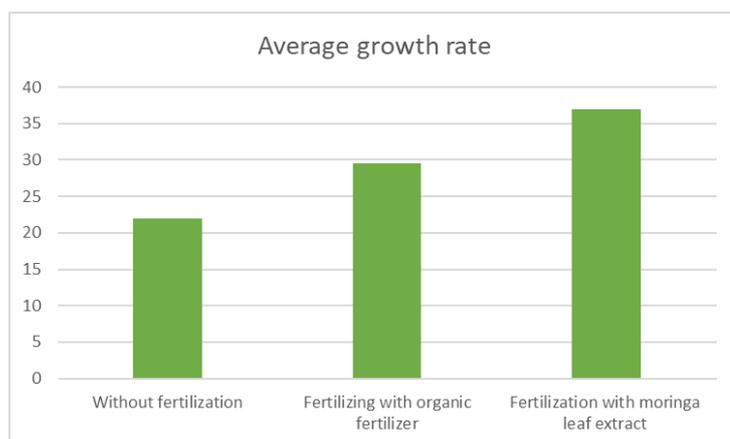
## Experiment (2):

First: Monitoring the growth rate of tomato plants according to the type of fertilizer:

Type of fertilization	Without fertilization				Fertilizing with organic fertilizer				Fertilization with moringa leaf extract			
	Plant 1		Plant 2		Plant 1		Plant 2		Plant 1		Plant 2	
Comparison	Height (cm)	Number of leaves	Height (cm)	Number of leaves	Height (cm)	Number of leaves	Height (cm)	Number of leaves	Height (cm)	Number of leaves	Height (cm)	Number of leaves
Beginning	10	3	12	3	12	3	11	3	11	3	10	3
Weeks later	30	8	36	8	40	9	42	9	48	12	47	11
Average growth rate per plant	20	5	24	5	28	6	31	6	37	9	37	8
Average growth rate	Height (cm) =22 Number of leaves= 5				Height (cm) =29.5 Number of leaves= 6				Height (cm) =37 Number of leaves= 8.5			
Picture												



Table 4

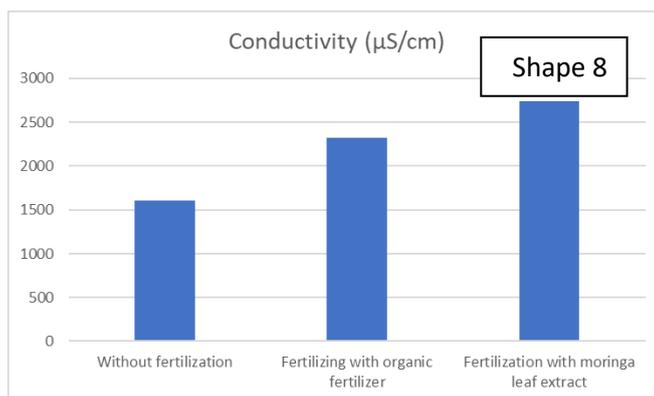
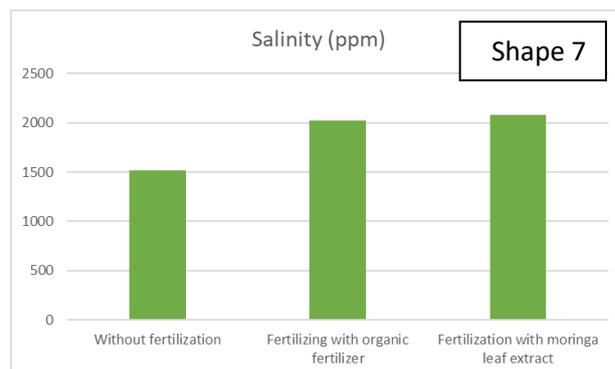
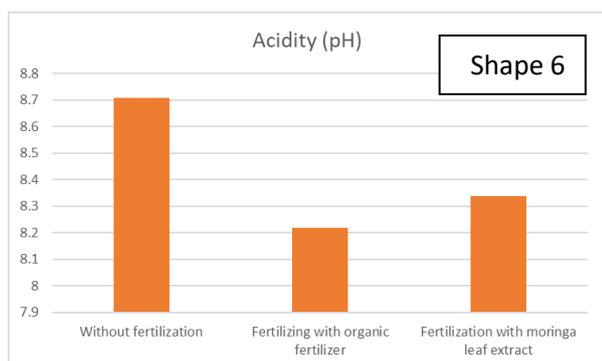


Shape 5

## Second: Soil characteristics data in experiment (2):

Sample	Without fertilization	Fertilizing with organic fertilizer	Fertilization with moringa leaf extract
Acidity (pH)	8.71	8.22	8.34
Salinity (ppm)	1515	2026	2078
Conductivity ( $\mu\text{S}/\text{cm}$ )	1606	2320	2740

Table 5



The data has been entered and sent to the program website ([www.globe.gov](http://www.globe.gov)) Via App (DATA ENTRY).

The GLOBE Program  
Science Data Entry

pH Expand/Collapse Re

Measured with: pH Meter \*

pH Paper

pH Meter

1 \*

If salt added, conductivity  $\mu\text{S}/\text{c}$

pH 8.36

Value of buffers used

pH 4  pH 7  pH 10

The GLOBE Program  
Science Data Entry

Electrical Expand/Collapse Re

Conductivity

Temperature of water sample being tested  $^{\circ}\text{C}$

27

Conductivity of standard  $\mu\text{S}/\text{cm}$

12880

1 \*

Conductivity  $\mu\text{S}/\text{c}$

1743

Comments

## Results analysis:

From the data collected we find that:

⌘ From the graph in Figure (5), the tomato plant that was fertilized with moringa leaf extract recorded a higher growth rate (37 cm), and the number of its leaves increased at a greater rate (8 leaves), and its stem appeared thicker and its leaves were wider, and it began to flower and bear fruit in a shorter period. It is clear from Table (4) that the plant that was fertilized with organic fertilizer (29.5 cm) follows it and appears healthy in appearance, but its stem is thinner than the plant that was fertilized with moringa leaf extract, while the plant that was not fertilized had a lower growth rate (22 cm) and appears quite healthy. But its stem is less thick and the number of leaves is less.

⌘ As for the growth rate of tomatoes according to the amount of moringa powder used, Figure (1) shows that adding (10 grams) of leaf powder to fertilization gave better growth results (38 cm) and it also took less time for flowering and fruiting than fertilizing with 20 grams (36 cm) or not. Fertilization (32 cm)

⌘ Through the previous results, we conclude the effectiveness of using extract or powder of moringa leaves in fertilizing the plant, as this was evident in the greater and faster growth rates of tomato plants compared to organic fertilizer, and this is due to the fact that moringa leaves contain major elements (nitrogen, phosphorus, and potassium) and microelements (iron, manganese, and zinc). And copper, boron, molybdenum, and chlorine) that the plant needs, and whose availability in moringa leaf powder was confirmed through examination in the laboratories of Sultan Qaboos University (Appendix 1), and what was confirmed by the study (uses of moringa in the field of plant production), which was published on the Agriculture Life website on Facebook on 18 /2/2016.

⌘ On the other hand, leaf powder or extract should not be added to the soil in large quantities, as the leaves containing high percentages of chemical elements lead to an increase in soil salinity, which in turn will negatively affect plant growth, as shown in Table (3) (from 981 to 1185ppm) and Table (5) (from 1515 to 2078ppm) and graphs (3) and (7). The plant should also never be left without fertilization because that weakens the plant's growth as it does not get enough of the nutrients necessary for its growth, as this appears in Charts (1 and 5).

⌘ Many studies have indicated the possibility of using moringa leaves as animal feed (Afaq Environment and Development Electronic Magazine - Issue 133) because they contain large amounts of protein, which increases the productivity of milk and meat. This is actually what is being applied now in Al Dhahirah Governorate, where the General Directorate of Wealth has Agriculture, fisheries and water resources by encouraging citizens to plant

moringa trees and distributing seedlings to them for free in order to use its leaves and non-dry fruits as animal feed and its flowers are important for beekeepers. Some families also produce oil from moringa seeds that is used in cosmetics and treating joint pain.

### **Conclusion:**

⌘ We thank God Almighty for the completion of this research, in which we used the GLOBE protocols (the soil protocol, the ground cover protocol, and the water protocol) to study the effectiveness of using Moringa oleifera leaves as an organic fertilizer, as it became clear from the data collected that the effectiveness of its use as an organic fertilizer is through what we observed of the growth rates. The highest fertilizer is for plants, but it must be added to the plant in regulated quantities so that it does not negatively affect its growth, because it contains large quantities and high percentages of chemical elements.

⌘ These conclusions lead us to the need to intensify guidance campaigns for farmers, encourage them to grow moringa trees and use it as an organic fertilizer instead of chemical fertilizers and as fodder for their livestock (as a better alternative to clover). Also, by planting more moringa trees, the carbon will decrease in the atmosphere.

### **Thanks and Appreciation:**

Praise and thanks be to God always and forever, who facilitated the completion of this research. Then we extend our sincere thanks and appreciation to the honorable assistant principal of the school for her continuous cooperation and constant support for the GLOBE program team. We also thank the honorable Mr. Badr Al-Maamari, a scientific innovation specialist, for his continuous follow-up and tireless efforts to highlight the program's activities, as well as thanks to the workers in the laboratories of Sultan Qaboos University for their cooperation in examining the samples. We thank all the faculty members who cooperated with us at the school, and thanks, of course, go to Ms. Hidaya Al Farsi for giving us the opportunity to conduct this research and following up with us during its preparation.

## **Badges :**

### 1- I am a collaborator:

The timetable for implementing the research plan shows the role of each student in the research and the cooperation of the two students in analyzing the data and reaching conclusions.

### 2- I am stem professional:

Through cooperation with the laboratories of the College of Agriculture at Sultan Qaboos University to examine moringa leaf powder and find out the chemical elements in it.

### 3- I am data scientist:

By collecting data for calculating stem length and number of leaves for plants that were used in practical experiments in the research, organizing the data into tables and graphs, analyzing it, and reviewing studies related to the research topic.

## References:

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appendix:



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 Sultanate of Oman  
 Tel: 24146801 Email: caaru@squ.edu.om

TEST REPORT

Booking NO. : CAARU/E/23/671	Report NO: CAARU/SQU/E/23/156
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SAMPLE SUBMITTED BY PARTY

Name of the Customer : Ms. Halima Mohammed Al-Muqbali  
 Name of the Company : Ministry of Education  
 Address : Oman  
 Sample Described by the Customer : -  
 NO. Of samples given by the Customer : 01  
 Quantity of the Sample Received :-  
 Code No. / Batch No. of the Sample : N/A  
 D.O.M : N/A  
 D.O.E : N/A  
 Manufactured by : N/A  
 Date of Sample Receipt : 19/07/2023  
 Date of Start of Analysis : 23/07/2023  
 Date of Completion of Analysis : 25/07/2023  
 Date of Final Report: 24/07/2023



Central Analytical and Applied Research Unit  
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 Sultanate of Oman  
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Sample ID given by the Customer	Method/Instrument
Moringa Powder	ICP-OES

Results Unit in PPM

S.NO	CAARU REF	SAMPLE ID	Zn	Pb	Cd	Ni	Ba	Fe	B	Mn	Cr	Cu	Al	Sr	Na	K	Ca	Mg	As	Hg	Ag	P	Si	Sn	Se
1	CAARU-23-671-E	MORINGA POWDER	0.15	ND	ND	ND	ND	103.74	134.83	28.81	ND	9.66	78.33	317.39	1101.97	6613.92	30815.91	12612.74	ND	ND	ND	2280.19	61.35	ND	ND

ND-NOT DETECTED

Sample ID	PH
Moringa Powder	5.48 @ 24.3 °C