Sultanate Of Oman
Ministry Of Education

GLOBE OMAN
Asmaa Bint Umais Primary School (1-10)

The impact of fertilizer concentration on plant growth and soil pH

Prepared by the following students:

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Supervised by Mrs.:

1.Hidaya bint Sulaiman bin Said Al-Farsi

2.Fatma bint Humaid bin Naser AL-Alawi

February 2017

The Content

Acknowledgement:

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Abstract

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Teacher at Asmaa bint Omais School

Asmaa bin Umais School

Our research focuses on studying the impact of organic and chemical fertilizer concentration on plant growth and soil pH after noticing farmers' random use of these fertilizers and lack of awareness of fertilizers' impact on environment. We raised the following question: What is the impact of different quantities of chemical and organic fertilizers on plant growth and soil acidity?

We have applied the method of practical experimentation to discover this impact and used the Soil Protocol to measure the soil pH, and Land Cover Protocol to measure the plant growth lengths. We found that the natural fertilizer is the best, as it is safe for plant and environment, even if large quantities were used. Meanwhile, the random addition of chemical fertilizer increases soil salinity and pH and dries up the plant. In addition, it may seep into the groundwater and pollute it.

Based on these results, we recommend that the local institutions such as the Ministry of Agriculture, the Public Authority of Consumer Protection, the Ministry of Environment and Climate Affairs and the Ministry of Health should play a major role in warning farmers against the impact of random use of chemical fertilizers on plants, environment and man. In addition, people should be warned against eating the local fresh vegetables especially potherbs after buying them, as they should be kept for three days to make sure that they are free of nitrogen, phosphorus and potassium. These elements are lost during storage.

The Researcher Problem:

Out research aims to study the impact of organic and chemical fertilize concentration on plant growth and soil pH at Dhahir Al-Fawaris village, Al Dhahirah Governorate. When applying the Land Cover Protocol at one of the farms, we noticed that the alfalfa plant dried up at this farm. Thus, we met with the farm owner and asked him about the reason. He told us that this happened after fertilizing the crop with the aim of improving it.

The Research Question:

What is the impact of different quantities of chemical and organic fertilizer on plant growth and soil pH?

Hypothesis:

The addition of chemical or organic fertilizer improves plant growth and modifies soil pH.

Research Scope:

We conducted the research in January and February on samples from one of the farms of Dhahir Al-Fawaris Village, Al-Dhahirah Governorate.

The Research Procedures:

1- Meeting with some farmers at the village
2- Visiting the specified locations
3- Collecting information about the research from the books available at the Learning Resources Center, Internet and leaflets issued by the Ministry of Agriculture
4- Setting a timeline for the implementation of the research plan
5- Distributing roles among the team members
6- Using the Land Protocol to identify the soil (pH) through using the pH meter, as well as the Land Cover Protocol to measure the growth length of plants

7- Doing an interview with the Head of Fertilizer Section at the Department of Agricultural Development, Yanqul
8- Applying the empirical research to identify the impact of fertilizers on plant growth and soil pH.

The time table of (procedure of the research plan):

Student Name	**Role**	**Implementation Date**
Hafsah bint Sulaiman bin Saleh Al-Farsi Al-Ghayah bint Badr bin Salem Al-Farsi Al-Zahraa bint Ahmed bin Saleh Al-Farsi	Collecting data for the research from the different information sources	December 2016
Hafsah bint Sulaiman bin Saleh Al-Farsi Al-Ghayah bint Badr bin Salem Al-Farsi Al-Zahraa bint Ahmed bin Saleh Al-Farsi	Doing interviews with three farmers at the village	8 January 2017
Hafsah bint Sulaiman bin Saleh Al-Farsi Al-Ghayah bint Badr bin Salem Al-Farsi	Doing interviews with the agricultural engineer at the Department of Agricultural Development, Yanqul	10 January 2017
Hafsah bint Sulaiman bin Saleh Al-Farsi	Testing the impact of fertilizers on plants and observing their growth and pH	15 January -28 February
Al-Ghayah bint Badr bin Salem Al-Farsi	Observing the final results and then writing the research	15 January – 28 February
Al-Zahraa bint Ahmed bin Saleh Al-Farsi	Observing and interpreting the final results and completing the research	15 January – 28 February
Hafsah bint Sulaiman bin Saleh Al-Farsi Al-Ghayah bint Badr bin Salem Al-Farsi Al-Zahraa bint Ahmed bin Saleh Al-Farsi	Submitting recommendations and completing the research	7 March 2017

Research method:

- **Tools:**

- pH meter

- Samples of the same type of soil

- Bags for growing plants (10)

- Samples of pepper seeds

- Organic fertilizer

- Industrial fertilizer

The research question will be answered as follows:

1- Using Land Protocol to determine soil pH by using pH meter and Land Cover Protocol to measure plant lengths

1- Interviews
2- Practical experimentation

Data collection methods:

1- Interviews:

- **Meeting with farmers:**

We conducted interviews with five farmers, and we asked them the following questions and their answers were as follows:

1- **What is the type of fertilizer you use in your farm?**
   - All farmers agreed that they use organic and chemical fertilizers to manure their farms.

2- **Who adds the fertilizer to plants?**
   - Farmers answered that the Asian worker is the one who adds fertilizers to plants.

3- **Do you set for him the fertilizer quantity?**
   - The five farmers agreed that there is no need to set the quantity, as the worker always takes a handful of fertilizer and disperse on plants.

4- **Do you believe that the fertilizers have negative impacts on man and environment?**

- The farmers agreed that these fertilizers do not have negative impacts on man and environment, but they improve crop growth.

- **Interview with agronomist Ali Al-Badi, head of Agricultural Development Section, at the Department of Agricultural Development, Yanqul**

The interview was made to know the impact of fertilizers on plant growth and the role of the institution in offering consultation to farmers about the appropriate quantity of fertilizers. He was asked the following questions:

1- What is the importance of fertilizer for plants?

- The fertilizer is of two types; organic and chemical, and the plant needs the fertilizer as it provides the plant with the necessary nutrients.

2- What is the type of fertilizers you recommend for farmers?

- I encourage farmers to use the organic fertilizer as it is safe for plants, human beings, animals and the environment. As Al-Dhahirah Governorate has poor soil, we recommend farmers to add the chemical fertilizer but carefully observing the quantity and appropriate timing for adding the fertilizer to the plants.

3- What are the negative impacts of fertilizers on human beings and environment?

- As mentioned previously, the organic fertilizers do not affect the human beings and the environment. However, the addition of chemical fertilizer in large quantities may lead to the dryness of plants and accumulation of nitrogen, phosphorus and potassium in the plant parts to be eaten by man. These elements reach man's body with high concentration, causing him diseases and poisoning. In addition, the fertilizers may pollute the groundwater, and if a large quantity of fertilizers is added to the plant, it will increase the concentration of salts in soil, and dry up the plant.

4- What is the role of Agricultural Development Center in guiding famers in the field of using fertilizers?

- The center is constantly sending out awareness messages, be it by awareness circulars or field visits. We encourage farmers to use the correct ratios of fertilizers for the specific needs of each crop, and to take

special care when it comes to using chemical fertilizers. We further encourage farmers to use modern agriculture methods like aquaponics which is safer for the environment and the ground water.

5- Is there a link between using fertilizers and high pH?

- As for pH, it has a relation to plant's ability to absorb salts from the soil. On a certain pH level, the plant will be able to absorb a certain amount of salts and nutrients, and on a certain level it won't be able to do so. The best pH number at which the plant can absorb nutrients ranges between 5 and 6. If the rate declines below 5 or increases above 6, the plant's ability to absorb nutrients from soil will decline.

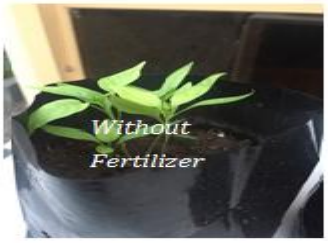
2- Practical Experimentation:

We did a practical experiment to study the impact of fertilizer concentration on the plant growth and soil pH through using natural and artificial fertilizer. We took the following steps:

1- We planted pepper seeds in soil in order to get seedlings to use them in the experiment, as January and February are appropriate for growth.
2- We brought 10 pot bags for this purpose, and divided them into two groups; each group has 5 bags.
3- We put 250 grams of the same kind of soil in each bag.
4- We added the first group of organic fertilizers as follows: the first bag without any fertilizer, the second has 20 g, the third (40 g), the fourth (60 g) and the fifth (80 g).
5- We add to the second group a chemical fertilizer as follows: First bag without any compost - Second 1 g of fertilizer - 3 5 g of fertilizer - 4 10 g of fertilizer - 15 g of fertilizer
6- We put the pepper seedlings in each bag, the length of each one reaches 3 cm
7- We have irrigated them with the same quantity of water every two days.
8- We exposed them to the same temperature and light.
9- We used to measure the length of plans every three days.

Variables:

Fixed variables	Independent variables	Dependent variables
Type of seeds, soil type and quantity, quantity of water, temperature and light	Quantity of fertilizer	Growth of plant and soil pH



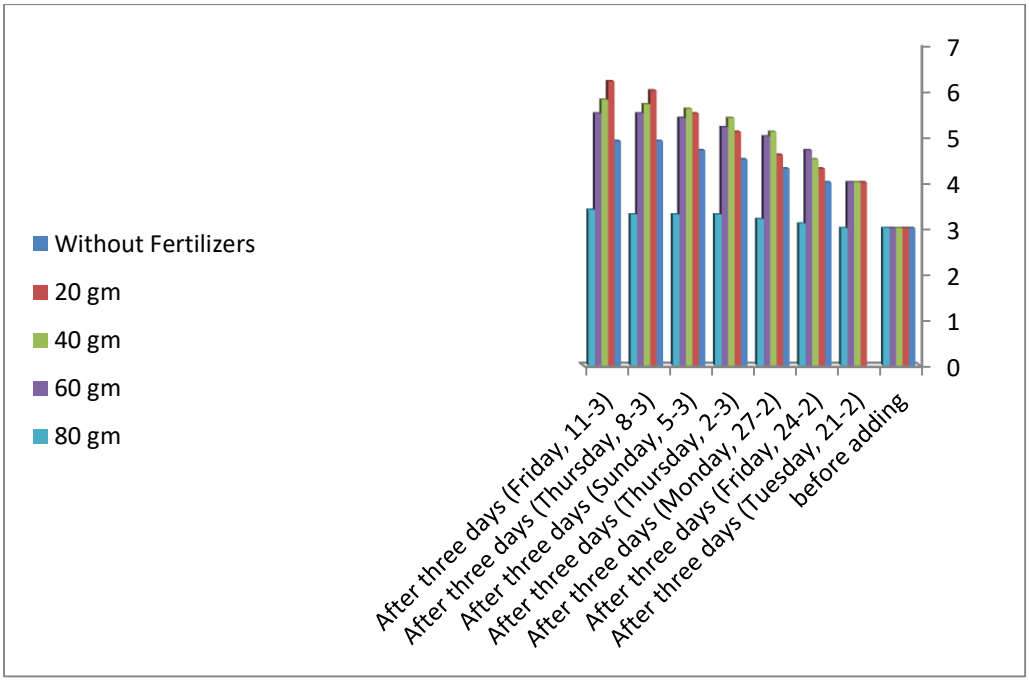
Data:

1- After collection, the data, it was classified in tables for comparisons as follows:

a) Organic fertilizers

- **Plant growth**

Measurement time	Without Fertilizers	20 g	40 g	60 g	80 g
Before addition	3cm	3cm	3cm	3cm	3cm
After three days (Tuesday, 21-2)	3.5 cm	4 cm	4 cm	4 cm	3 cm
After three days (Friday, 24-2)	4 cm	4.3 cm	4.5 cm	4.7 cm	3.1 cm
After three days (Monday, 27-2)	4.3 cm	4.6 cm	5.1 cm	5 cm	3.2 cm
After three days (Thursday, 2-3)	4.5 cm	5.1 cm	5.4 cm	5.2 cm	3.3 cm
After three days (Sunday, 5-3)	4.7 cm	5.5 cm	5.6 cm	5.4 cm	3.3 cm
After three days (Thursday, 8-3)	4.9 cm	6 cm	5.7 cm	5.5 cm	3.3 cm
After three days (Friday, 11-3)	4.9 cm	6.2 cm	5.8 cm	5.5 cm	3.4 cm



Soil pH

Quantity	Without Fertilizers	20 g	40 g	60 g	80 g
pH level	8.98	8.58	8.48	8.38	8.33

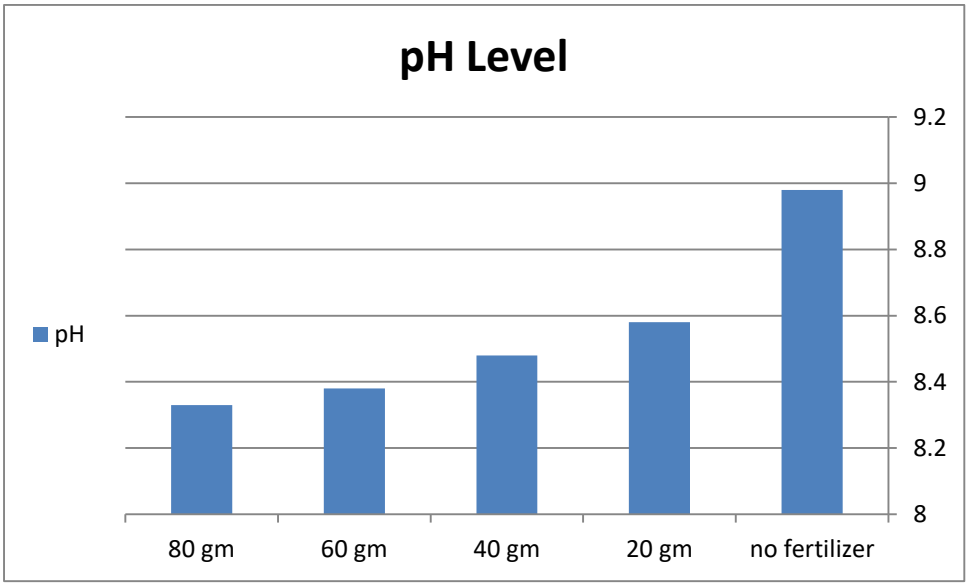
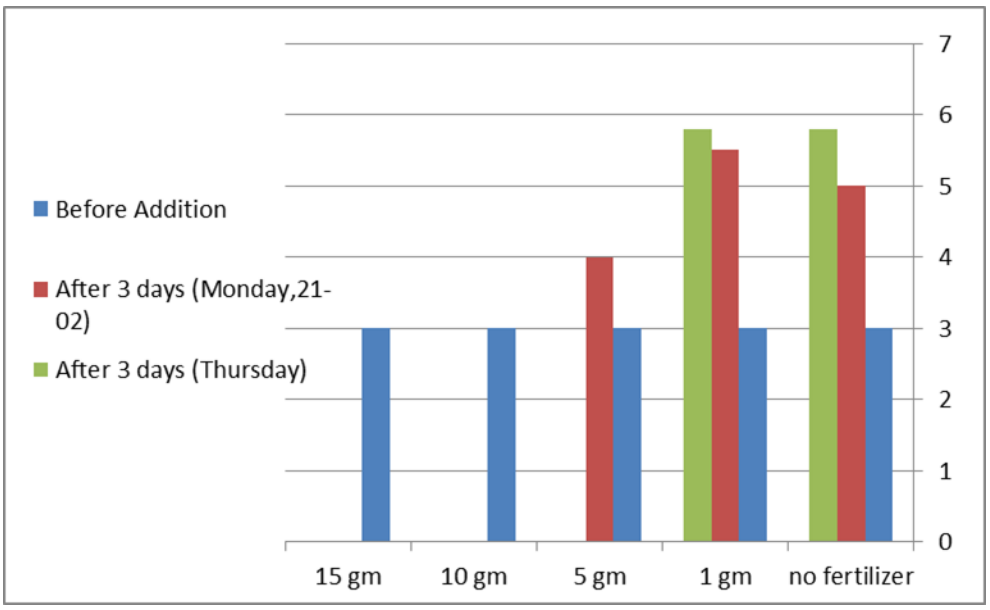


Chart (1)

b) Chemical Fertilizer:

Measurement Time	Without Fertilizer	1 g	5 g	10 g	15 g
Before Addition	3 cm	3 cm	3 cm	3 cm	3 cm
After 3 days (Monday, 21-02)	5 cm	5.5 cm	7 cm	(Plant dried up after 3 days of addition)	(Plant dried up after one day of addition)
After 3 days (Thursday 24-02)	5.8 cm	5.8 cm	(Plant dried up after 6 days of addition)	-	-



Soil pH

Quantity	Without Fertilizer	1 g	5 g	10 g	15 g
pH	8.79	9.44	9.46	9.67	9.72

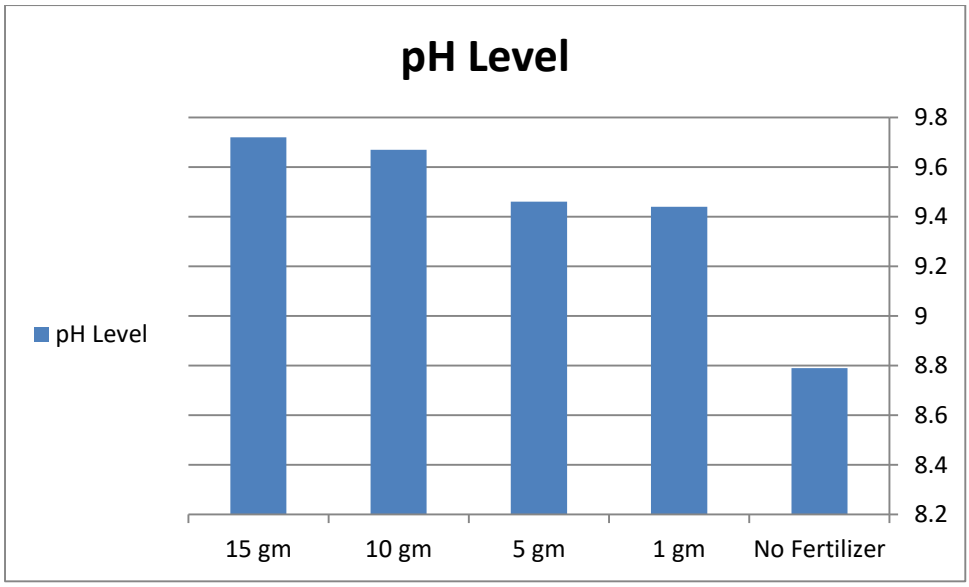


Chart 2

Data Analysis

Through the collected data, we observed the following:

- The addition of organic fertilizer to the plant reduces soil pH level, and when the fertilizer increases, the soil pH level declines. It was (8.98) in the bag that does not contain fertilizer, and became (8.33) in the bag that contains 80 grams of organic fertilizer.
- The growth percentages were relatively similar in the bags that contain 20, 40 and 60 grams of organic fertilizer, while the growth of the plant in the bag containing 80 grams of fertilizer was lower.
- The addition of chemical fertilizer to the plant led to the death of the plant in the bags containing 5, 10 and 15 grams of fertilizer, due to the increase of salts in the soil, which resulted in the efflux of water from the plant cells through the osmosis process. Thus, the plant withered and died.

The Results:

- The organic fertilizers lead to greater plant growth. They provide the plant with the necessary nutrients, and thus improve the properties of soil and reduce its pH, as we observed from the chart (1).
- The plant growth rate in the bag containing 80 grams of organic fertilizer was lower than that of other plants, because increasing the amount of fertilizer leads to increased salts in the soil. This in turn adversely affects the growth of the plant.
- Adding chemical fertilizer to the plant increases the pH level of soil and raises the amount of salts in the soil. This leads to the wilt of the plant and its death, as we noted from the chart (2).
- High soil pH affects plant growth. It affects the ability of the plant to absorb salts from the soil. In the range of 5pH to 7pH, the plant absorbs the salts effectively. However, if the pH level increases or decreases below this range, the plant's ability to absorb salts will decline.

Recommendations:

1- We call upon the Ministry of Agriculture, represented by the agricultural development departments of the regions, to instruct farmers, whether through circulation of awareness material or face to face visits, on the quantity and type of fertilizers and the appropriate time to add them to the plant.

2- Citizens should be warned against the damage of industrial fertilizers to humans and environment in general and groundwater in particular. They should be urged to use organic fertilizers and avoid industrial fertilizers as much as possible. Citizens should also be instructed not to use industrial fertilizers except for necessity, and with specified quantities, and not to leave the matter for the non-informed staff.

3- The consumer should be warned against using the fresh local vegetables, especially potherbs, immediately after buying, but they should be kept for three days to ensure that they are free of nitrogen, phosphorus and potassium.

4- Farmers should be instructed to fertilize vegetables at least one or two weeks before offering them to the market, in order to get rid of the nitrogen, phosphorus and potassium or residues that may harm the consumer.

5- We call upon the Consumer Protection Authority to examine the amount of chemical residues (nitrogen, phosphorus and potassium salts) in fresh local vegetables, especially leaf vegetables, to make sure that such chemicals exist only at the rates appropriate for the human consumption.

Conclusion:

We thank God for the completion of this research, whose results helped us conduct awareness campaigns and publish leaflets for farmers to educate them on the correct fertilization methods and the appropriate time for fertilization before marketing.

We also sent text messages to parents via the text messaging program, alerting them to keep the fresh vegetables for three days before eating them to make sure they are free from the residues of chemical fertilizers.

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