Sultanate of Oman
Ministry of Education
Um Hani School/ Al Dakheliah Governorate

Investigating the effectiveness of using Common reed (Phragmitesa ustralis) in fertilizing plants and its impact on water and soil

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List of Content

Page

Abstract 2

Definition of terms 3

Research questions 3

Introduction and Literature Review 3

Procedures: research plan 4

Study Site 7

Data Collection and Analysis 8

Results 9

Discussing Results 13

Summary 15

Acknowledgment 16

References 16

Abstract

Investigating the Effectiveness of Using Common Reed (Phragmites australis)in Fertilizing Plants and its Impact on Water and Soil

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This study investigated the effectiveness of using common reed in fertilizing plants and its effect on the water and the soil on which it grows. It was set out to answer the following questions:

1.How effective is the use of common reed in plant fertilization?

2. How do the properties of water are affected near the growth of the common reed compared to a far location?

3. How do the properties of soil are affected near the growth of the common reed compared to a far location?

This research was applied in Samail, Oman. First, the common reed was dried and grinded. Then, it was used to fertilize tomato plant. The growth rates of this plant were compared to another fertilized using organic fertilizer through the application of the land cover protocol. The water and soil protocols were also applied to measure the properties of connectivity, salinity and acidity to samples of water and soil from two different locations, one near the growth of the common reed and the other away in order to compare them.

The results of the study showed the effectiveness of using the common reed as a fertilizer. It was found that the growth rate of the tomato plant that was fertilized with the common reed is more than (14.5 cm, in three weeks) compared to the growth rate (11 cm, within three weeks) of the tomato plant which was fertilized using organic fertilizer. Less connectivity, salinity, and acidity properties of both water and soil were also found in the common reed growth area than in the distant region. This may indicates that the common reed has the ability to absorb various components and elements whether from water or soil.

The researchers recommend that the community should use the common reed as plant fertilizer.

Definition of terms

Common reed: It is a plant that belongs to the Angiospermsspecies. Its scientific name is Phragmites australis (Wikipedia).. This plant grows abundantly and it is characterized by rapid growth especially in watercourse areas.
Fertilization: is the process of adding fertilizers to the soil in order to increase their fertility to raise agricultural production.

Research Questions

This study was set out to answer three main research questions:
1. How effective is the use of common reed in plant fertilization?
2. How the properties of water are affected near the growth of the common reed compared to a far location?
3. How the properties of soil are affected near the growth of the common reed compared to a far location?

Introduction and Literature Review

Common reed is a plant that belongs to the Angiospermsspecies. This plant is widely spread over the valleys in Samail, Oman, especially those where water remains for a long time. The expansion of this plant is considered to be an environmental problem because it grows very close to the street and extends to a height of up to two meters, which impedes the vision of car drivers. In addition, it has the ability to absorb water which could cause the reduction of groundwater resources. The Municipality and Bee'ah Company have attempted to get rid of these plants by cutting or burning it, but it grows again and again in short terms. Due to the spread of this plant and the ability to absorb organic materials from the soil, this research sought to study the effectiveness of its use in plant fertilization to increase growth rates.

Based in previous research in this field, Mahmoud (2005) referred to the possibility of the environmental use of the common reed plant in the treatment and purification of sewage, in addition to its use in feeding animals such as sheep and cows since it contains 35% dry material and 12% 31% crude fiber, and 1.2% fat.

Research Procedures; Research Plan

1.Setting a timetable for the research plan.

Table (1) Study plan schedule

Time	**Work plan**
September- October/2017	Stating the research problem and deciding on the research instruments
November/2017- January/2018	Collecting and analyzing data
February/2018	Discussing the results and writing the research
March/2018	Submitting the research

2. Distributing the roles among the research team.

Table (2) the roles of the study team

Role	**Students**
Stating the problem clearly and preparing the instruments	Wejdan & Arwa
Collecting and analyzing the data according to the protocols applied	Wejdan, Arwa & Razan
Discussing the results and writing the research	Wejdan & Razan

3. Reviewing the related literature of the research topic by collecting information from the Learning Resource Center (LRC) at school such as encyclopedias and the Internet.
4. Selecting the different study sites and defining them precisely in order to start the process of application and data collection.

Table (3) Study Sites

Site	**The Application**
The School	Planting tomato plants and observing the effectiveness of fertilizing
Common reed growth areas in the watercourse of Wadi Samail	Studying the water and soil properties
Far away of common reed growth location	Studying the water and soil properties

5. Identifying protocols that are appropriate for the data collection.

Table (4) The Protocols applied in the study

The application	**The Proper Protocol**
Gardening the plants and observing the effectiveness of fertilizing it with reed	The land cover protocol
Studying the water properties in the area close to and the area far from the growth of the reed	The water protocol
Studying the soil properties in the area close to and the area far from the growth of the reed	The soil protocol

6. Determining the devices and tools suitable for measuring the samples including pH meter, salinity and connectivity measurement, metric bar, ruler, sensitive balance, distilled water, cups, moving tool, transparency tube, thermometer, GPS, paper and pen.

7. Collecting the samples of water and soil for the study at the appropriate time and according to the specifications of the work team. Working papers were designed to record the growth data of the tomato plant every two days in addition to watering them in equal quantities each time.

8. Applying the protocols on the samples.

Table (5) The method of applying the protocols for collecting data

Research Questions	**The protocol**	**Application method**
Question 1	Land cover protocol	The common reed plants were cut, dried and grained and were prepared to be used as fertilizer. Tomato plants of the same species were grown on the same soil type and irrigated with the same amount of water. These plants were divided into four sections: one section was fertilized with the common reed, another was fertilized using the organic fertilizer, another was fertilized using a mixture of both the common reed and the organic fertilizer, and the last section was not fertilized. The growth rate of the four sections was observed and data were collected for three weeks.
Question 2	Water protocol	Studying the water properties (transparency, temperature, acidity, salinity and connectivity) on samples taken from the two locations an area close to and an area far from the growth of the common reed.
Question 3	Soil protocol	Studying the characteristic of soil (connectivity, salinity, acidity) on samples taken from the two locations an area close to and an area far from the growth of the common reed.

9. Collecting and organizing the data.
10. Entering data in the GLOBE program site (www.GLOBE.gov)

11.Analyzing data and representing them graphically.
12.Coordinating a visit to the Department for Agricultural Development to gather further scientific explanations of the data.
13.Coordinating of a visit to Bee'ah for further scientific explanations related to the common reed plant.
14. Discussing the findings and recommendations.

Study Site

This research plan was implemented in the state of Samail in Al-Dakhlia Governorate, Oman. The maps below show this geographical area.

Photos (1)& (2) show the geographical areas for the study site

Data Collection and Analysis

To address the first question, data were collected by measuring the growth of the stem of the tomato plants grown according to the type of fertilization that was used. The samples of the tomato plant were selected of the same species and planted in the same soil type and irrigated with the same amount of water divided into four sections depending on the type of fertilization (fertilized with common reed, fertilized with organic fertilizer, fertilized with a mixture of both common reed and organic fertilizer, not fertilized). The growth of each plant was then measured and the growth rates obtained by the studied samples were calculated and compared.

Photo (3), (4) & (5) show the activities applied to the tomato plants

To answer the second research question, data on water characteristics (transparency, temperature, connectivity, salinity, acidity) were collected at two sites on the wadi, one away from the presence of the common reed and one near the growth of it and then the data were compared.

Photos (6), (7), and (8) show applying the water protocol

To answer the third research question, data on soil characteristics, general characteristics, connectivity, salinity and acidity were collected at two sites on the Wadi, one away from the presence of the common reed and one near the growth of it and then the data were compared.

Photos (9) & (10) show applying the soil protocol

Results;

The collected data regarding the growth rate of the tomato plants according to the type of the fertilizer were presented in the following table.

Table (6) Growth rate of the tomato plants being studied

Day & Date	**Common reed Fertilization only**	**Organic fertilization only**	**Both Organic & common reed fertilization**	**Without Fertilization**
Tuesday January, 2nd	7.5 cm	7 cm	9.8 cm	9.2 cm
Thursday January, 4th	8 cm	7.2 cm	10.5 cm	9.8 cm
Sunday January, 7th	8.5 cm	7.4 cm	11 cm	9.8 cm
Tuesday January, 9th	8.7 cm	8.5 cm	11.5 cm	10 cm
Thursday January, 11th	11 cm	9 cm	12.3 cm	10.5 cm
Sunday January, 14th	11.8 cm	10 cm	12.6 cm	10.6 cm
Tuesday January, 16th	14 cm	11.2 cm	15.5 cm	10.6 cm
Thursday January, 18th	15.8 cm	13.2 cm	15.8 cm	12 cm
Sunday January, 21st	18 cm	16.3 cm	18 cm	14 cm
Tuesday January, 23rd	22 cm	18 cm	20 cm	14.7 cm
Growth Rate	**14.5 cm**	**11 cm**	**10.2 cm**	**5.5 cm**

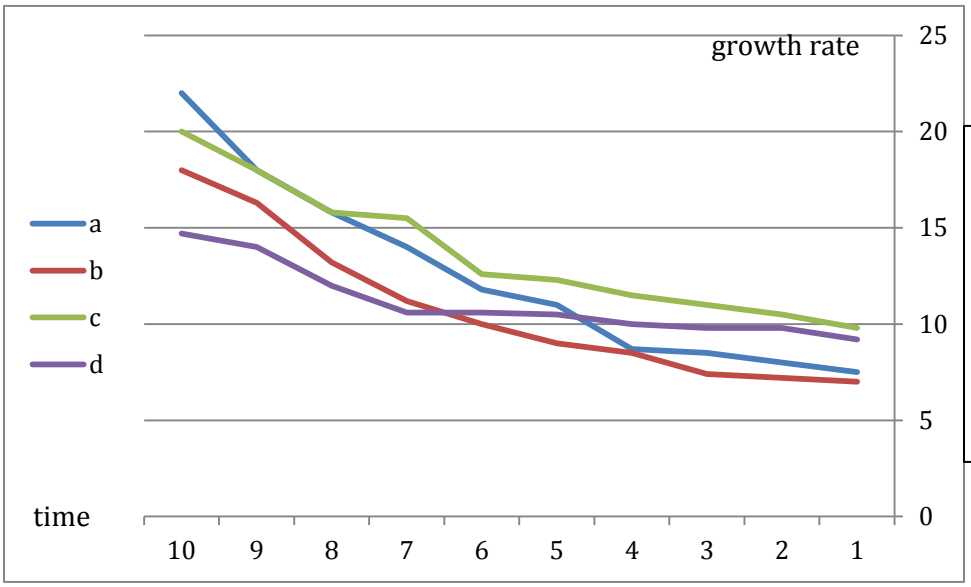
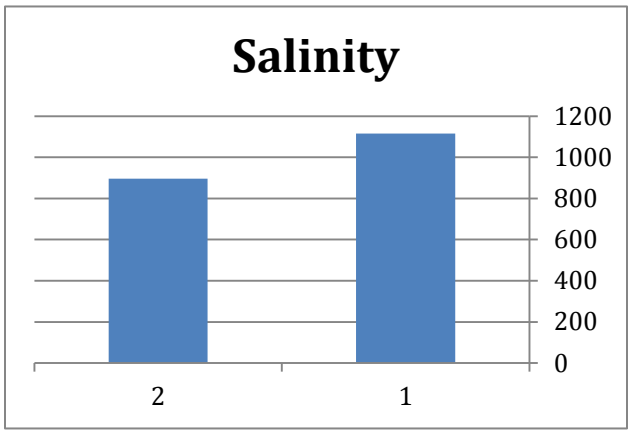


Figure (1) line graph of the growth rate for tomato plants

To address the second and the third data, the data regarding the features of both the water and soil at a site close to and another far from the growth of the common reed were presented in the following table.

Table (7) the features of water and soil according to the site

Site		Far location	Close to the common reed
Water	Transparency (cm)	110 cm	120 cm
	Temperature	24 – 9; 26am	24 – 9; 43 am
	Electrical connectivity (µs)	1551	1302
	Salinity (ppm)	1116 ppm	896 ppm
	Acidity (pH)	8.12	7. 98
Soil	Soil feature	Many stones and no roots	Stoned, sand and roots
	Electrical connectivity(µs)	306	260
	Salinity (ppm)	226 ppm	183 ppm
	Acidity (pH)	9.1	8.7
The coordinates of the site (GPS)		23.3139 58.0069	23.3053 58.0203



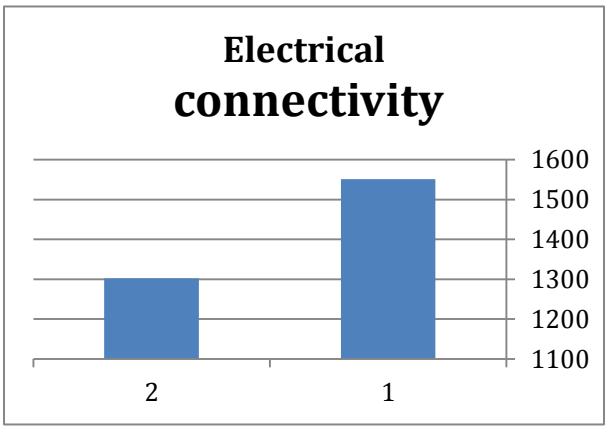
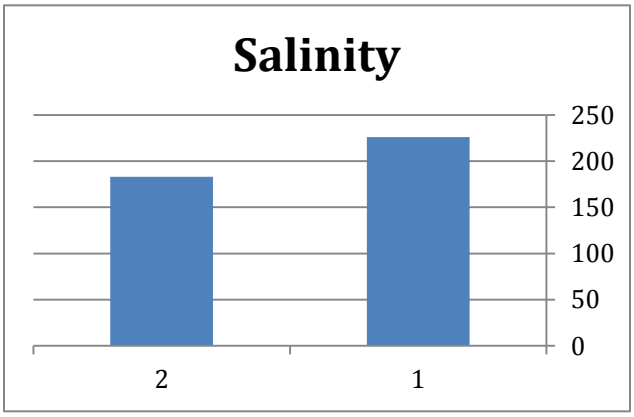


Figure (2) connectivity and salinity for the two samples of water (1away, 2 near)



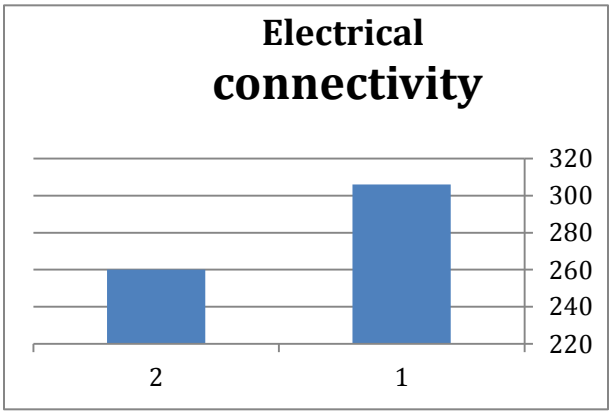


Figure (3) connectivity and salinity for the two samples of soil(1away, 2 near)

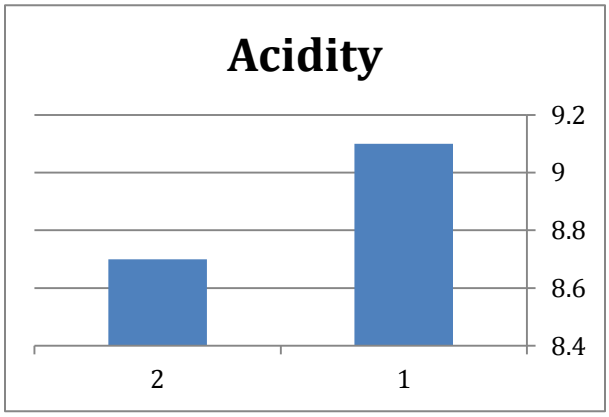


Figure (4) Acidity and salinity for the two samples of soil(1away, 2 near)

The collected data were entered and sent to the program website (www.GLOBE.gov) via the application (DATA ENTRY).

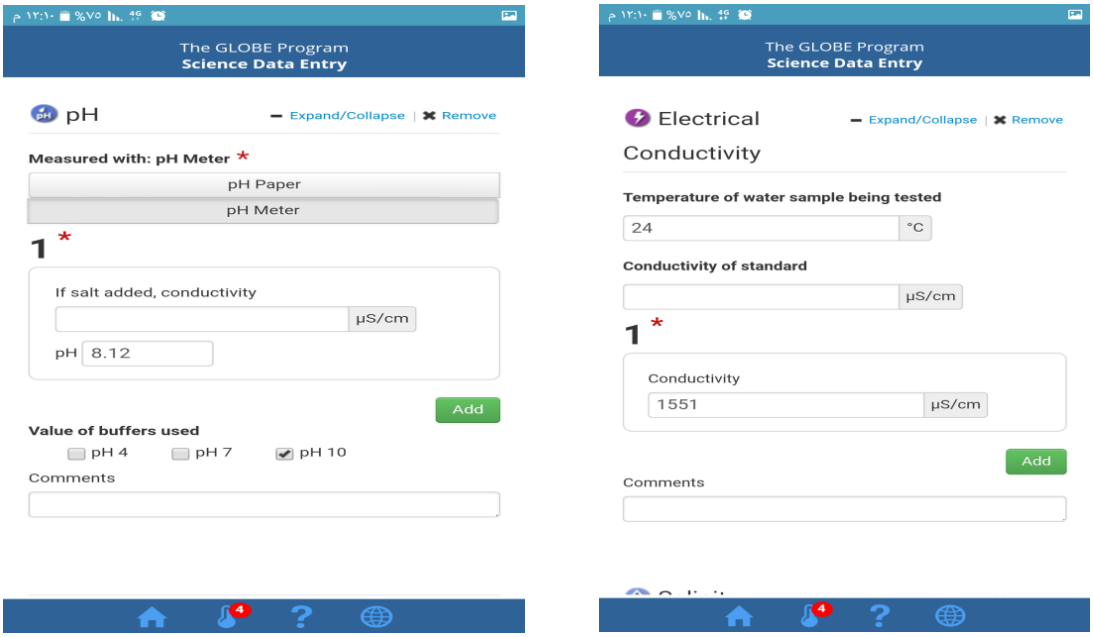


Photo (11) & (13) Data entry in GLOBE website

Discussing Results

Research Question One

Table(1) shows the growth of tomato plants according to the type of fertilizer used. It is clear from figure (1) that the plant that was fertilized using common reed recorded a higher growth rate (22 - 7.5 = 14.5 cm), followed by the plant that was fertilized using organic fertilizer (18 - 7 = 11 cm). The use of a mixture of the common reed and organic fertilizer recorded a growth rate of (20- 9.8 = 10.2 cm), and finally the plant that was not fertilized had a lower growth rate (14.7- 9.2 = 5.5 cm).

These data demonstrate the effectiveness of using a common reed plants as fertilizer as they help to increase the growth of plants. According to the recorded growth rate, tomato plants that were fertilized with the common reed achieved

good growth rates and increased the growth speed compared to the one fertilized using organic fertilizer only. It was also found that the use of the common reed alone in the process of fertilization is more powerful than mixing it with organic fertilizer. Plants cannot be left without fertilization because this weakens their growth as it was found in this study.

The common reed plant has the ability to absorb organic materials from the soil (Mahmoud, 2005). This ability makes the organic materials on plant composition stable .Accordingly, it provides an opportunity to obtain a rich source of organic materials which can be exploited to fertilize crops to increase soil fertility and contributes to the growth of plants.

Agricultural specialists in the Department of Agricultural Development have indicated that some cattle owners have used dung to feed their cows, and have not been used to feed sheep because of what they described as the dry nature of this plant, which sheep cannot eat. The idea of using the common reed to fertilize the plant has also been accepted by these specialists, as this idea revolves around the mind of a specialist but has not been studied before.

Research Question Two

According to Table (7), the results for the characteristics of the water in two different locations show higher salinity, connectivity and acidity in the water sample at a location on the valley far from the area where the common reed grow. Yet, the water transparency was (110 cm) less than the sample near the common reed.

The presence of less salinity and acidity in the water sample near the growth of the common reed compared to the sample far from it may indicate that the existence of these plants contributed to the absorption of salts and substances which affect the pH of water.

Common reed plants have the ability to absorb a large amount of water, such as the water of the growing valleys that grow near it. This is one of the reasons why Bee’ah Company, that is responsible for waste tries, to get rid of these plants either by uprooting them or burning them.

Research Question Three

The results of the soil characteristics at two different locations as illustrated in table (7) reveal higher salinity, connectivity and acidity in the soil sample taken from a location far from the common reed plants.

The decrease in salinity and acidity in the soil sample on which the common reed grows compared to the sample which is planted far from the growth of the common reed may indicate that the presence of the common reed contributed to the absorption of salts and substances affecting the pH of the soil, as the absorption of these components reduced its rate in the soil on which it grows compared to soil that is far from the growth of the common reed.

This ability to absorb elements from the soil and water gives us a clear indication of the rich amount of elements that this plant can provide. This encourages us to think deeply to find ways to use these plants in the appropriate environmental uses.

Note; there may be other reasons for different properties of water and soil of both sites that not considered in this research.

Summary

This study sought to explore the effectiveness of the use of common reed plants in fertilizing plants. It was found that higher growth rates were recorded when using these plants as fertilizer. The study also investigated the difference in the characteristics of water and soil between two areas, namely the growth zone of the common reed and the other far from it. Lower connectivity, salinity and acidity in the growth area of the plant were found indicating the ability of these plants to absorb the elements and components that affect the salinity and acidity of both the water and soil they grow on it.

Based on these results, further research should be done to utilize the common reed in fertilizing different plants and to find out other environmental uses for it. In terms of engineering and technology, we need to design appropriate equipment for the drying and grinding the common reed plants in additionto finding more innovations that will expand the overall utilization of this plant.

Acknowledgment

Praise be to Allah and prayer and peace be upon His Messenger.
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