The effect of irrigation with fish-breeding pond water on soil properties

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Abstract:

The effect of irrigation with fish-breeding pond water on soil properties

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Our research aims to study the effect of irrigation with fish-breeding pond water on soil properties. We raised the following questions:

1 - What is the impact of fish waste on the properties of water?
2 – How do soil properties (acidity, salinity and conductivity) get affected when irrigating with the fish-breeding pond water?

To answer the first question, we applied water protocol on two samples of water. One before adding the fish to the water pond and the other after adding the fish. In addition, to answer the second question, we have collected soil samples before adding fish to the water pond and then two months after adding fish to the pond .We applied soil protocol to study the properties of each sample, in terms of acidity, salinity and conductivity.

The results indicated that the properties of the water change in terms of Ph, salinity and conductivity. The reason behind that is due to fish waste that contains mineral elements, which led to an increase in salinity and conductivity of the pond water. Moreover, the percentage of dissolved Oxygen increased from 2 to 8 due to the growth of algae in the pond water, which produces large quantities of Oxygen.

Furthermore, the soil properties changed after adding fish to the pond water, it became less salty and arable land due to the nutrients found in fish waste.

Therefore, we recommend adopting this method in line with hydroponics in order to rationalize water consumption and use fish wastes as an alternative to chemical fertilizers.

Key terms:

- Fish waste: is the organic matter that fish excrete in water.

- Aquaculture: is the practice of fish farming together with the cultivation of plants in water without soil.



Research questions:

1 - What is the impact of fish waste on the properties of water?

2 – How do soil properties (acidity, salinity and conductivity) get affected when irrigating with the fish-breeding water pond?

Introduction and literature review:

Many people raise fish in ponds in their homes, while others in large pools, and many of them are unaware of the benefits of fish-breeding pond water for plant growth as; it is changed from time to time and dumped without benefiting from it.

Many studies and research conducted on the effect of irrigation with fish-breeding ponds water and showed the great benefit of this water. It increases production and improves soil properties. A research published in (Iraqi Journal of Aquaculture, 2011) pointed out the importance of fish-breeding pond water. The journal mentioned that it is a good way to rationalize water consumption, particularly if used in hydroponics since these waters contain minerals and nutrients in its organic form. Thus, will reduce the use of fertilizers, reduce production costs, protect the environment from chemical fertilizers, and get clean food product free of chemical pollutants.

Since our school garden has high salinity, plants suffer from difficulty in growing. In addition, because the garden contains a pool to collect water, we decided to conduct this study to improve the characteristics of garden's soil by using the water of fish farming ponds and then generalize this experiment to farmers in order to reduce the use of chemical fertilizers. Then, get a product that does not contain chemicals.

Research methods:

Research plan:

1. Collect information on the topic of the research from books available in the Learning Resource Center and the internet.
2. Set a timetable to do the research plan.
3. Distribute roles between the research team.
4. Communicate with some specialists in Social Media Programs to determine the extent in which farmers use the waters of the fish-breeding ponds in agriculture.
5. Define the protocols needed to perform the research.
6. Determine the equipment and tools necessary to perform the work (pH meter and salinity and conductivity measuring device).
7. Bring some freshwater fish and place them in the pool of garden plants watering.
8. Apply the water protocol before placing the fish in the pond and then one month after placing it.
9. Apply the soil protocol to garden's soil before watering plants with fish-breeding pond water and then after 2 months.
10. Collect data and organize them in tables.
11. Insert data in the program's website
12. Data analysis and presenting it in charts.
13. Conclusion and recommendations.

Timetable of the research plan

Name of student	Task	Date
Jomana Jamal Al farsi Rahaf Thuwaini Al farsi	Look for information for the research topic from various resources.	**October 2019**
Jomana Jamal Al farsi Rahaf Thuwaini Al farsi	- Bring samples of water and soil to apply the protocols on them. - Add fish to the water pond.	**November 2019**
Jomana Jamal Al farsi Rahaf Thuwaini Al farsi	Bring samples of water and soil to apply the protocol on them again.	**January 2020**

Jomana Jamal Al farsi Rahaf Thuwaini Al farsi	interviews with specialists and people interested in agriculture	**January 2020**
Jomana Jamal Al farsi Rahaf Thuwaini Al farsi	Analyze and discuss the results and then complete and edit the research paper.	**January 2020**

Second: The Survey location

It is in the Sultanate of Oman – al Dhahira Governorate – Wilaya of Ibri – Dhahir al Fawaris village – (latitude: 23.37, longitude: 56.38) in December and January – cold weather (Temperature: 9- 20 C) – water and land cover protocols were used.

Third: Data collection and analysis:

The research question will be answered as follows:

1. Using soil protocol to determine the soil properties (structure, consistency, color and quantity of carbonate), pH of soil using pH meter، the salinity and conductivity of soil

2. Using water protocol to determine the properties of water(transparency, acidity, salinity, conductivity, and the amount of dissolved oxygen).

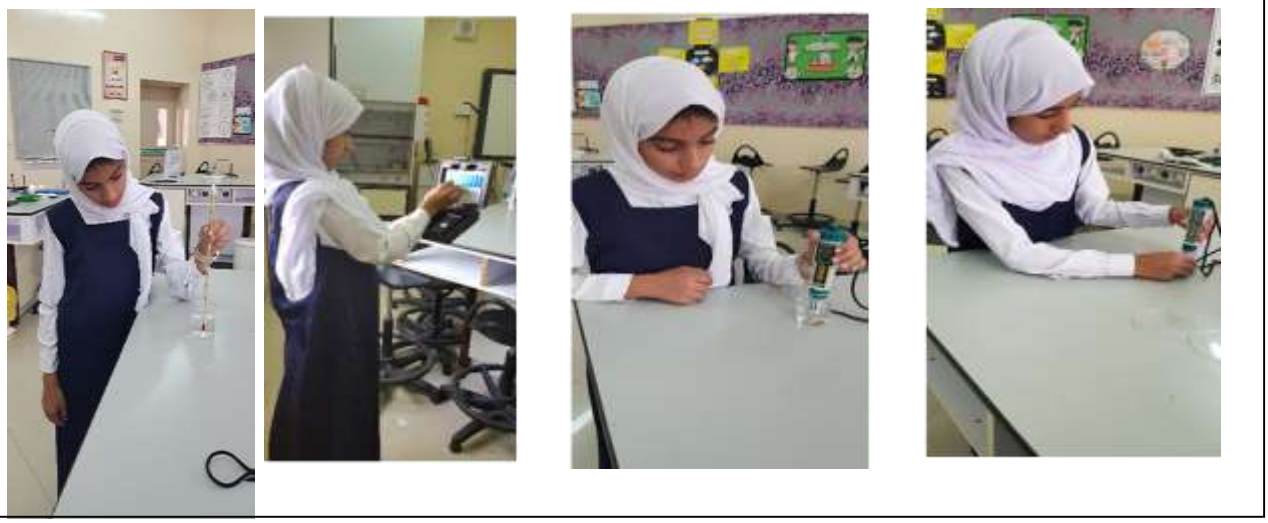
Methods of data collection:

First:

1. Samples were collected from the soil and water to measure the characteristics of each before adding fish to the pond of water using the globe program devices.

Students while applying soil protocol

Students during apply water protocol



Second:

Interviews:

an interview was conducted with Ali Albadi, an engineer at the Agricultural Dvelopment Department in Yanqul, and another interview was with the rural development guide at the Agricultural Development Department in Yanqul, Salma Almozahmi, and the following questions were asked to both of them separately:

1 – Are there farms that use aquaculture technology or plants aquaculture technology in the Wilaya or its villages?

2 – Do you recommend using the fish-breeding pond water to irrigate the plants? and why?

They both agreed on the following answers:

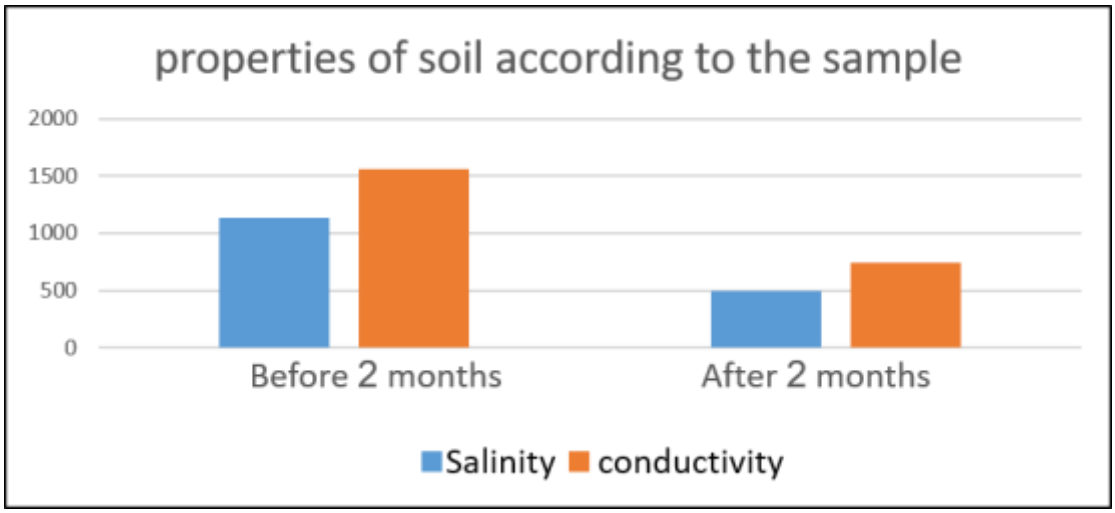
First: the technique is not widely used yet, but there are projects in progress that use this method.

Second : yes, we do recommend and encourage the use of this method, especially plants aquaculture technique where the water from a fish pond, which is rich in nutrients, is used to supply the plant with the elements it needs for its growth, then the water returns back to the fish pond. Thus, we rationalize water consumption and protect the environment by reducing the use of chemical fertilizers.

Results:

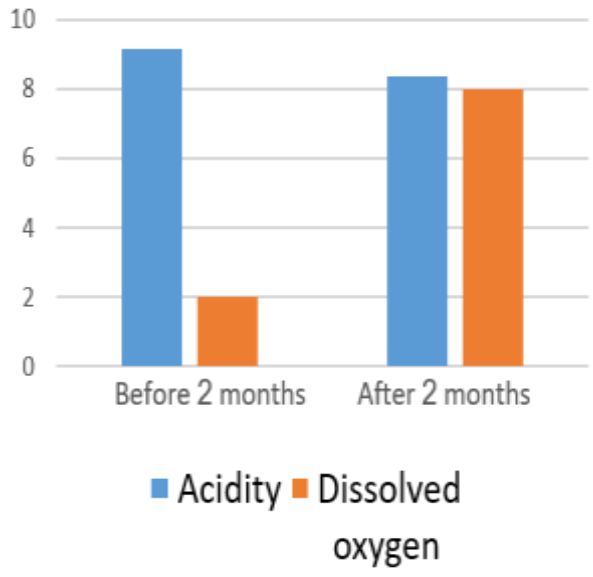
First: Soil characteristics data according to the sample using Globe program devices

Type of sample **Properties**	**The soil before adding fish to pond water**	**Soil two months after adding fish to pond water**
Transparency	More than 120	88
Carbonates	Many	Many
The number of roots	Few	Many
Soil type	Clay	Clay
Soil color	10YR: 4/4	10YR: 5/4
Acidity (pH)	8.21	8.06
Salinity (ppm)	1138	500
Conductivity (µs)	1558	740

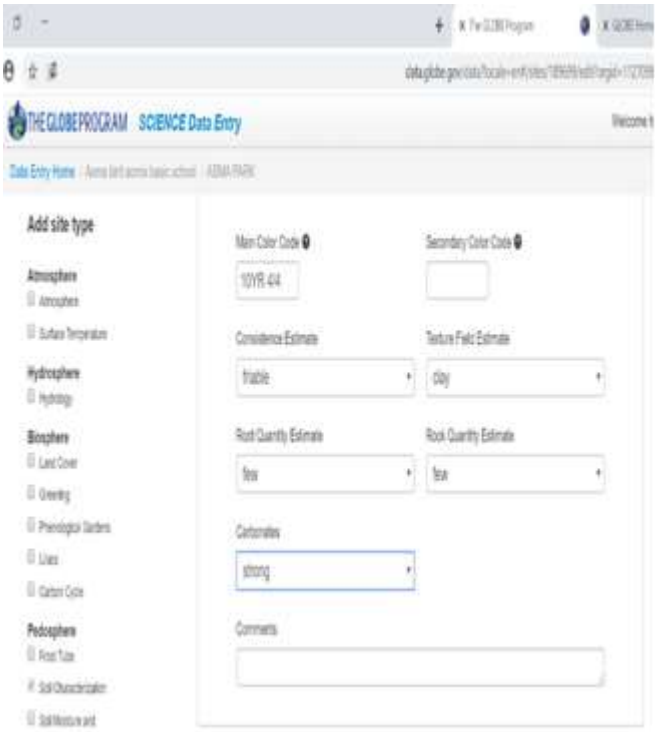


Second: Water properties data according to the sample using GLOBE program devices

Properties	before adding fish to the pond	two months after adding fish to the pond
Transparency	more than 120	88
Temperature	22 C	23 C
Acidity (pH)	9.16	8.38
Salinity (PPT)	636	665
Conductivity (µs)	903	940
Dissolved Oxygen	2	8



The data was entered and sent to the program's website (www.globe.gov)



Discuss the results:

- The first question was answered by comparing the properties of water before adding fish to the pond and after adding it. We noted that after adding fish to the water its acidity decreased, and salinity and conductivity increased due to the fish waste which is rich in mineral elements and the amount of dissolved oxygen increased from 2 to 8 due to the growth of algae producing oxygen.

- The second question was answered by comparing the characteristics of the soil before adding fish to the pond and two months after adding it. We noticed through the results that the properties of the soil change after watering it with the water to which the fish were added to. Salinity and conductivity decreased significantly while the change in acidity was little and this makes the soil suitable for cultivation because the fish waste helped in that since it contains mineral and nutritional elements such as nitrogen in their organic form and this helped to modify the properties of the soil and encourage the root growth of the plants, which reflects positively on the growth and development of the vegetable and fruit group of plants, and this is confirmed by the study published in the Iraqi Journal of aquaculture which was published in 2011 entitled (the effect of irrigation with wastewater in fish farming ponds on the productivity and quality of tomatoes grown in greenhouses) as also confirmed by the Rural Development Adviser at the Department of Agricultural Development in Yanqil eng. Salma Al-Muzahmi

Recommendations:

We recommend that farmers need to adopt fish-plant farming so that the water of the fishpond is used to irrigate the plants and then return to the pond again, which in turn reduces water consumption as this water is rich in nutrients. It also reduces the use of chemical fertilizers to improve the soil properties and supply the plant with the nutrients it needs. Thus, protecting the environment from the damage of chemical fertilizers and obtaining a clean food product free from chemical pollutants.

We also recommend applying the research again with a comparison of the growth of a particular plant, such as tomatoes or leafy vegetables when irrigated with plain water and water of fish farming ponds, using the ground cover protocol.

Conclusion:

We thank God Almighty for completing this research. We used the GLOBE (Soil and Water Protocol) protocols, through which we reached the importance of using Plant fish farming in order to rationalize water consumption and reduce the use of chemical fertilizers and obtain products free from chemical pollutants where we noted the positive effect of using water Aquarium fish farming on soil properties.

Thanks, and appreciation:

We extend our sincere thanks and appreciation to the school Mistress for her continuous cooperation and permanent support to the GLOBE program team and to Mr. Muhammad Al Ghafri, the program supervisor in the governorate for his continuous follow-up. We also thank the specialists from Agricultural Development Department for their cooperation in providing us with important information related to the results of the research. And of course, we thank T. Hedaya Al-Farsi for giving us the opportunity to conduct this research and her continuous follow us while preparing it.

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