



Ministry of Foreign Affairs of the
Netherlands



Participatory Action Research

Water Scarcity and Contamination in Duhok City

Educating farmers about productive hydroponic farming techniques using technology

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Executive Summary

On behalf of the Lifemakers Group, I participated in the PAR project as a team consisting of two female students specialized in the Department of Chemistry and Agricultural Engineering at the University of Duhok in cooperation with UNICEF, in Duhok Governorate, Kurdistan Region of Iraq, to raise awareness and interest in agriculture and its environmental impact. The group evaluated and demonstrated modern hydroponic farming techniques, educated farmers, and demonstrated the most important modern methods of agriculture and their sustainability features. The group conducted interviews and various works to collect data from various specializations, specifically farmers and agricultural specialists, as well as with owners of agricultural projects and influential activists in society and with environmental and health departments. We conducted various interviews with approximately 200 people with 9 groups. We discussed the importance of agriculture, its modern techniques, and the development we notice. We also gave them important ideas about matters Agricultural, the group received data from 181 participants through an online questionnaire and the result was interesting with their unique opinions, the importance of modern agriculture was noted when it is present in restaurants and hotels and it was scrutinized about the importance of its care

Introduction

The agricultural environment is of great importance in many aspects, the agricultural environment is a major source of food production for humans and animals, agriculture is the key point in addressing food problems and creating more job opportunities, especially in rural areas, thanks to its ability to combat environmental degradation and address water scarcity, as hydroponics has proven to be the optimal solution for sustainable food production.

Using modern technologies in agriculture, environmental sustainability can be achieved by improving the efficiency of resource use, reducing pollution and promoting the use of sustainable practices, achieving sustainability in agriculture contributes to preserving biodiversity, preserving soil and water quality, and enhancing the economic and social sustainability of agricultural communities

The benefits of agriculture outside the soil are saving a large percentage of water, saving and rationalizing and not wasting fertilizer. Thus, in addition to providing a lot of good and fatigue and natural effort as a storehouse of mineral nutrients, but the soil is psychologically unnecessary for plant growth.

Water is the essential element in hydroponics. We must have a suitable container to store water, which facilitates the process of accessing and using it. A pump is used to pump water to plants and ensure its regular flow. Hydroponic Supplies A tank to store a sufficient amount of water that will be used in agriculture. One of the biggest challenges in this century and in the near future is to maintain fresh water supplies suitable for human use, which is largely linked to global population growth and the subsequent increase in demand for food. 70% of fresh water use is currently wasted in agricultural practices, so it is necessary to develop technologies that increase agricultural outputs while reducing inputs.

* A pressing global problem emerged in the early twentieth century and up until the present time, which was represented by the irregular increase in population numbers. The United Nations Development Program (UNDP) revealed illogical differences in population rates between different regions of the world. These differences were accompanied by a significant difference in global resources, in addition to climate changes represented by rising temperatures, global warming, low rainfall rates, the spread of salinity, and other reasons that increased the phenomenon of drought and desertification in all its forms, from climatic drought represented by a decline in the amount of precipitation from snow, rain, and hail to agricultural drought resulting from a lack of moisture in the soil due to special soil conditions or the failure to use modern irrigation methods and hydrological drought, which includes low water flow Surface and groundwater scarcity. Water resources play a

vital role in human life and agricultural irrigation, and water efficiency in agriculture is the main choice. Estimates indicate that water use in the world is increasing rapidly with the growth of the world's population and the desire of consumers to eat more and more diverse foods. In addition, fresh water of good quality is precious, so water shortage is one of the greatest threats to life on Earth. Therefore, there is an urgent need to use water wisely while reducing the discharge of fertilizers and chemicals from natural sources.



◦ **Data Collection Activities:**

◦ **Interviews:**

- Number of interviews conducted: [22]
- Interviewees: Farmers from diverse backgrounds, including landowners and agricultural workers.
- Number of people: [106]
 - Summary:

As part of the project, we conducted interviews with 20 farmers across various rural areas. The discussions focused on their agricultural practices, challenges faced, and openness to adopting modern farming techniques. Some farmers expressed a preference for traditional methods over modern technologies. However, we introduced and explained the benefits of

innovative agricultural practices, such as greenhouse farming, hydroponics, and fish farming. Additionally, the interviews highlighted the potential of recycling water for irrigation and improving overall agricultural productivity.

- **Focus Group Discussions (FGDs):**

- Number of FGDs conducted: [15]
- Locations: Villages and rural areas, including the Yazidi village in Duhok Governorate.
- Participants: Each FGDs consist of 2-10 participants farmers and agricultural workers, including women with significant agricultural experience.
- Summary:

Focus group discussions covered topics such as greenhouse farming, hydroponics, fish farming, and water recycling. The participants were engaged in sharing their experiences and concerns regarding water shortages, high costs of modern equipment, and lack of essential services. A particular concern was raised by a Yazidi family facing health issues due to contaminated water, which has led to an increase in illness rates in their community.

- **Questionnaires:**

- Number of questionnaires distributed: [220]
- Type of collecting data: Quantitative and qualitative responses.
- Number of questionnaires returned: [220]
- Target population: Farmers, landowners, and agricultural workers from diverse socioeconomic backgrounds.

- **Summary:**

The distributed questionnaires provided valuable insights into the importance of modern farming techniques and their impact on community development.

Respondents highlighted the need for improved irrigation systems, affordable access to technology, and additional training to enhance their agricultural output.

Despite a strong interest in adopting modern practices, concerns were raised regarding the financial burden and accessibility of necessary resources.

Current Status of the Project

The project is progressing according to the established timeline. Workshops and lectures have been conducted, gathering valuable feedback and ideas from local farmers.

Preliminary data analysis is underway, with initial findings being compiled for submission to UNICEF. Farmers have shown interest in continuing collaboration, emphasizing the need for ongoing support and technical assistance to overcome existing barriers.

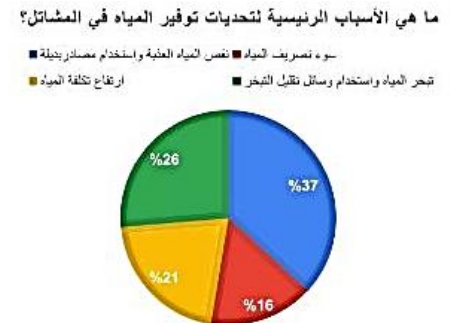
Results

The data we collected was unique and included all categories. As it appeared to us, there is a difference in the opinions of the countryside from the city. It is clear that the countryside and villages are more interested in agriculture, as we discussed and provided information through several different topics and our visits during agricultural projects. The agricultural graduates and farmers have a greater importance regarding their answers. We were interested according to the age group. The graduates were within the age of twenty, and some of them specialized in modern agricultural projects. There are also older farmers with agricultural lands who own orchards and have specialized in this experience for many years. Their fathers specialized in this experience..

220 people participated in providing this percentage of information, and their number was greater regarding villages and the countryside.

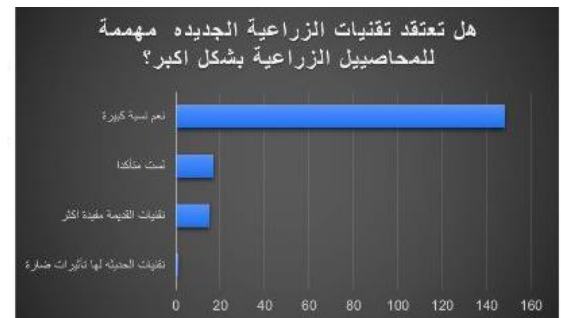


When asked about the challenges facing nurseries in water, which is water evaporation and the use of means to reduce evaporation by 26%, the biggest reason for their choice was the lack of fresh water and the use of alternative sources, and when they conducted poor water drainage by 16%, they chose the reason for the high cost of water by 21%.



Information about new technologies has a great impact on modern agriculture.

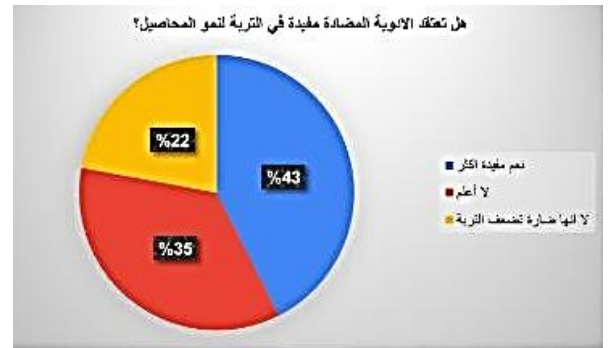
It gave a large number of information about modern agricultural techniques, which are more important for agricultural crops.



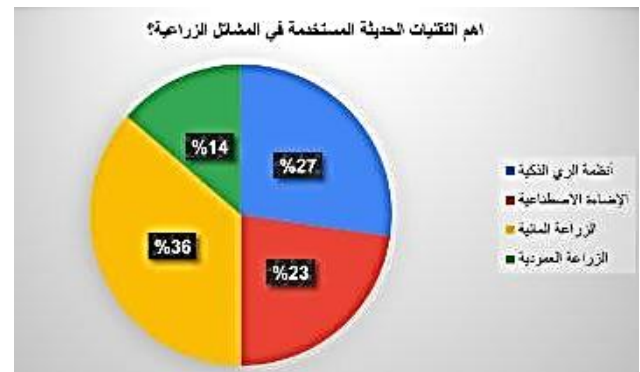
While most of the choices indicated the importance of water in agriculture, they were according to the important systems for agriculture, as 63 people chose the water system, 55 people chose the hydroponic system, and 24 people chose the hydroponic system, with the largest percentages according to their interest in agriculture.



The percentage of benefit of the anti-drugs was greater than their harm to the crops, which have positives and negatives for agricultural growth, as (43) indicated and (35) said that it has harms, and there they gave us several reasons.



One of the interviews we went to was in the nurseries, and we gathered about 20 youth ambassadors and discussed with them agricultural matters and the importance of nurseries for agriculture. A number of them have agricultural lands and care about them, and they gave us the most prominent techniques, according to their importance:



36% are the hydroponic agricultural system, 27% are smart irrigation systems, 23% are artificial lighting, and 14% are the vertical farming system.

Discussion

The evidence we have collected on the study and research of modern agricultural techniques and the use of water for them, through the development of agricultural methods and the use of technology for them, has allowed us to notice a huge difference in irrigation and growth and we discussed it with farmers and professors specialized in agriculture and those with agricultural projects and rural homes. During our tours, we gathered a portion of the youth in each interview and presented questionnaires to them, including with youth ambassadors and some civil organizations and institutions. We noticed that rural homes until now use unfiltered and undrinkable water, and this increases the rate of diseases and environmental degradation.

We went to the greenhouses, nurseries, the hydroponic project, the departments, the university, the rural houses, the villages, the marshlands and the agricultural areas. There were minor mistakes due to the lack of interest in water and health, including our impact on an area that had agricultural projects and also rural houses in it about the reason for the

unclean used standing water from the houses coming out and standing in a stagnant place. We gathered the farmers and talked about the fact that this water, if it remains stagnant, will affect the soil and absorb it, and here it leads to an unsafe crisis for agriculture. After that, they decided to filter that water and use it for agriculture, and here the damage to that place is reduced.

Recommendations

1. We recommend the alternative solution (ABEER) as a promising nutrient solution prepared from fertilizers available in local markets, easy to prepare, and low cost, according to the stages of plant growth in the NFT technology, as an alternative to the use of expensive and unsafe standard solutions in growing various types of vegetables and spreading the culture of hydroponics after solving the problem of nutrient solutions.
2. To achieve economic feasibility and move towards adopting hydroponics, we recommend planting in the low-cost alternative solution (ABEER) and dispensing with the high-cost standard solution (Cooper).

Conclusion

1. The possibility of preparing an alternative solution and overcoming one of the most important obstacles to the spread of hydroponics, which is the unavailability of standard solutions in local markets, the difficulty of obtaining their salts and preparing them, and their high cost, in addition to obtaining productivity with quality specifications similar to the productivity of the plant in the standard solution.
2. Growing broccoli in the low-cost ABEER alternative solution and improving plant productivity and product characteristics by spraying with *Moringa oleifera* leaf extract gave the highest net profit per plant and profit percentage compared to plants grown in the high-priced and prohibited Cooper standard solution.

Challenges faced and Limitation:

Lack of essential services: Farmers reported difficulties in accessing proper irrigation systems and basic infrastructure.

Water contamination: Contaminated water remains a significant issue, especially in the Yazidi village, contributing to health problems and reduced agricultural productivity.

Preference for traditional methods: Many farmers expressed hesitation in adopting modern techniques due to high costs and unfamiliarity.

High costs: The financial burden of modern agricultural equipment and resources poses a challenge for many farmers.

Limited training opportunities: Farmers highlighted the need for more comprehensive training programs to familiarize them with new technologies.

Transportation and infrastructure: Poor road conditions and limited transportation options hinder the movement of agricultural products to markets, affecting profitability.

Would you like me to format the file for you and provide the completed document?

Appendices

Q1Do you have agricultural land?

- A. Yes
- B. no

If yes, where is your land located?

Q2 Does agriculture depend a large part on rainfall?

- A. A/Yes, a large percentage
- B. B/moderate
- C. C/It is not important to depend
- D. D/Rainwater is not good for agriculture.

Q3 Do you think new agricultural technologies are more important for agricultural crops?

- A. Yes, a large percentage
- B. Old techniques are more useful
- C. Modern technologies have harmful effects
- D. I'm not sure

Q4 In your opinion, the most important types of hydroponics?

- A. Drip system
- B. Antenna spectrum system
- C. Hydroponic
- D. Plastic house system
- E. traditional system

Q5 Do you think we can use used water for irrigation?

- A. Yes
- B. no
- C. It will hurt
- D. I don't know

Q6 Do you think pesticides are useful in soil for crop growth?

- A. Yes, it is more useful
- B. No, it is harmful and weakens the soil
- C. I don't know

Q7 using hydroponics?

- A. maize
- B. potato
- C. Lettuce and cucumber
- D. I don't know

Q8 What pH should I use for my plants?

- A. More than seven
- B. Less than seven
- C. About 6-7
- D. About 7_9

Q9 How can we save water in agriculture?

- A. Drip irrigation
- B. Spraying method
- C. Watering at a specific time
- D. I'm not sure

Q10 How often should I empty and replace my reservoir and nutrient solution?

- A. Between five and seven days
- B. A month
- C. Almost two days
- D. I don't know

Q11 What do you think are the benefits of sprinklers?

- A. Regular distribution of water on agricultural land
- B. Fertilizing and spraying agricultural land with pesticides
- C. Save a lot of costs used in bringing in workers to water the plants.
- D. It is used to protect plants from frost in cold weather conditions.
- E. It can protect it in high temperatures.
- F. They all matter together...

Q12 What are the main causes of water conservation challenges in nurseries?

- A. Fresh water shortage and use Alternative sources
- B. Poor water drainage
- C. High cost of water
- D. Water evaporation and use of means of reducing

Q13 Reasons facing nurseries?

Evaporation

- A. Leaf fall Temperature changes
- B. Drought, flooding and over-irrigation)
- C. Loss of flowers
- D. Stem rot Temperature changes
- E. Sunlight arrival Direct (temperature increase)

Q14 The most important modern technologies used in agricultural nurseries?

- A. Smart irrigation systems
- B. Artificial lighting
- C. Hydroponics
- D. Vertical farming

Q15 How to protect your crop when the wind speed increases in summer???

- A. Closing the direction from which the wind blows
- B. Providing sufficient relative humidity
- C. Increasing water drainage and irrigation
- D. Regular fertilization

Q16 What is the suitable soil for agriculture in reserves???

- A. Light to medium soil
- B. Acid soil
- C. Clay soil
- D. Soil with lower salinity
- E. Alkaline soil
- F. Soil that drains water more

Q17 What are the main causes of water supply challenges in nurseries?

- A. Shortage of fresh water and use of alternative sources
- B. Poor water drainage
- C. High cost of water
- D. Water evaporation and use of evaporation reduction methods

Q18 Advantages of hydroponics over traditional agriculture?

- A. Production of high quality food for a larger population.
- B. No need to use pesticides like traditional agriculture and it is free of diseases and develops faster
- C. Reduced water consumption
- D. Time saving system

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