



Enhancing Food Security through Piloting Agroecology Practices and Capacity Building

Project Duration: 9 months

Location: Azraq, Jordan

Start Date: February 2022

End Date: January 2023

Project Funder: United Nations Development Programme

Beneficiaries: 40 small farms

Project Details

Problem Statement

Azraq lies to the east of Jordan in an arid portion of the country, but also boasts local agriculture and fertile soil that makes use of limited surface and groundwater resources. However, over the past several decades of intensive agriculture, the groundwater table of Azraq region is quickly declining which places great stress on agriculture productivity and profitability for the local community. Farmers have begun to abandon their farming operations in the face of harsher climate conditions and rising costs of agriculture production. The highlands face only 60mm of average annual rainfall, a declining groundwater table, and unsustainable exploitation of diminishing groundwater resources to supply current agricultural activities. The fast rate of groundwater consumption not only depletes groundwater aquifers but also increases the salinity of the remaining water, and by extension, the salinity of the soil once this water is extracted and applied in irrigation. This region of Jordan faces considerable limitations on financing and investment which limits the community's options for creating sustainable, resilience methods of agriculture. The purpose of this project is to remedy this challenge by introducing agroecology practices to farmers to improve the soil health, the soil's water retention, and advance water conservation practices.

Project Summary

The primary output of this project is an enhanced food system in Azraq, Jordan capable of providing a more resilient source of food and livelihood for the rural population. Agroecology is a sustainable and environmentally-oriented method of food production that yields agricultural, social, and economic benefits. Agroecology involves several core principles: nutrient and energy recycling, avoiding external inputs of fertilizers and herbicides, plant diversification, enriching biological soil activity, and integrating livestock into crop cultivation. These practices aim to improve the biodiversity and overall soil ecological health as a way of supporting agricultural production. Agroecology is a versatile method of agriculture that may be applied in a variety of climates and ecosystems, including the water-scarce, arid environment of Eastern Jordan. Agroecology has not been applied extensively in Azraq, Jordan. Consequently, farmers lack the knowledge and experience to implement these methods effectively. This project had four objectives:

1. Enhance food security through the improvement of agriculture production systems
2. Improve and facilitate communication between farmers, private and public organizations
3. Raise farmers' awareness of affordable and replicable agroecology practices such as intercropping and crop rotation
4. Education farmers to become better decision-makers on their land, crop, and water management practices

To achieve these objectives, six outcomes for implementing agroecological practices were achieved over the course of six months of field work:

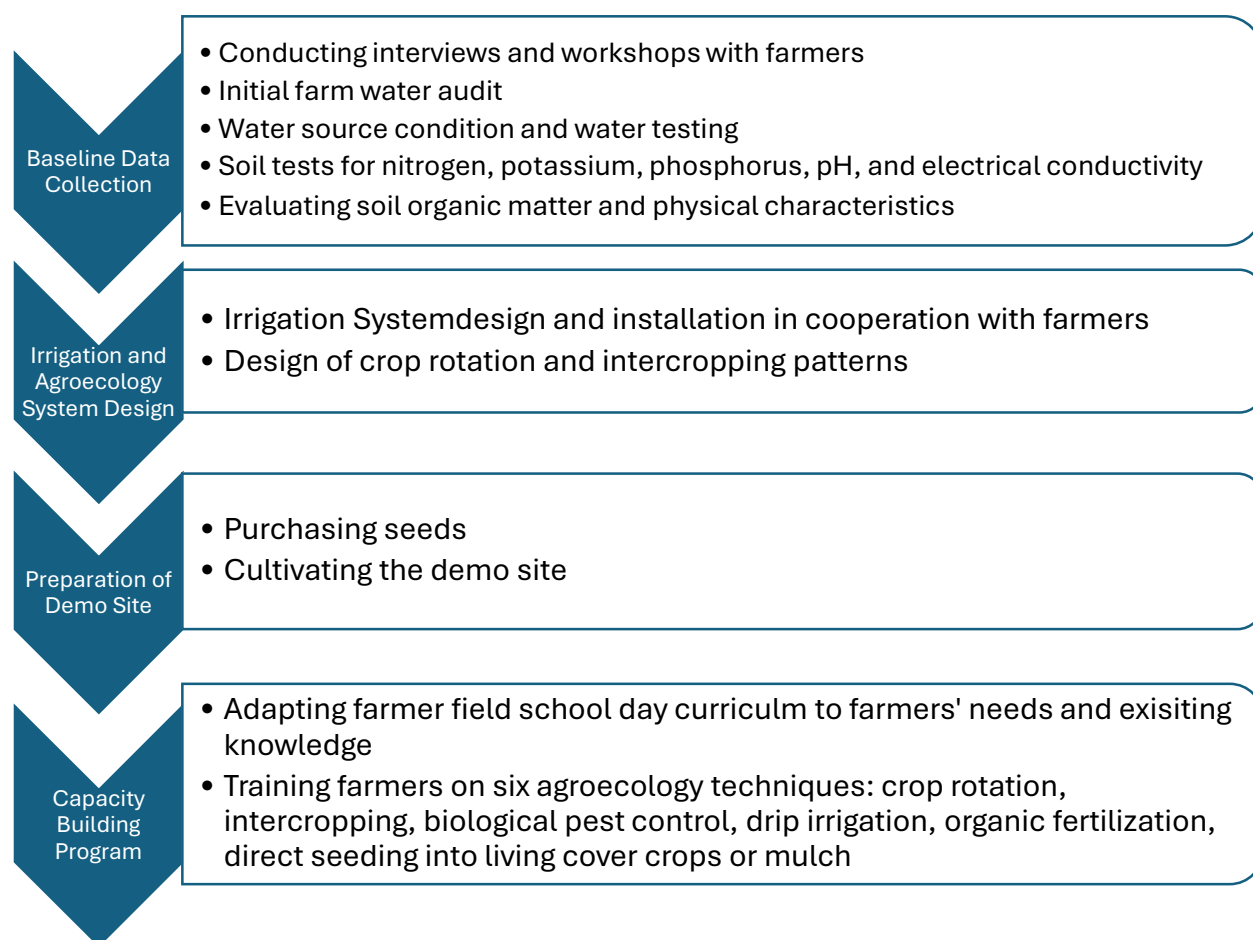
1. Crop Rotation
2. Intercropping
3. Biological pest control
4. Drip irrigation with inline, low-pressure emitters
5. Organic fertilizer
6. Direct seeding into biodegradable mulch

Each of these outcomes provided vital input towards achieving the project's stated output of climate resilient food system based on more sustainable, agroecological methods of cultivation.

Project Activities

This project consisted of initial stakeholder workshops to hear from farmers' experiences and challenges in Azraq with a gender-mainstreaming lens to target women's voices. These workshops were followed-up with on-farm audits of irrigation systems to better quantify the needs of farmers in Azraq and co-develop interventions. MIRRA staff implemented a variety of agroecology

methods on four different pilot sites in Azraq followed by capacity building initiatives to train farmers on these techniques and disseminate results to the wider community via farmer field school days.



Advances in Local Infrastructure

This project provided an important capital investment by installing new irrigation systems, a crop rotation and intercropping design, as well as investment into the human capital of Azraq by training farmers on agroecology methods. MIRRA's team of engineers installed new drip irrigation systems, biological pest control, organic fertilizer, and biodegradable mulch. While MIRRA's climate-smart farm is based in the Jordan Valley located in the northwest corner of the country, this project diversified MIRRA's innovative footprint by targeting another agricultural region of the country and further advancing the technical capacity of farmers in Jordan facing unique challenges.

Project Impact According to OECD-DAC Evaluation Criteria

Project Relevance

Farmers in Azraq face numerous difficulties of high-water salinity from a decreasing water table, high energy costs, and a lack of support from the government and agriculture cooperatives. Critical inputs of fertilizers and pesticides are expensive, and some farmers report defective pesticides and herbicides sold by local suppliers that do not solve their pest and weeding problems. These challenges affect every aspect of farming which threatens their livelihoods as well as the region's wider financial stability and food security. Agroecology, in particular, is not used frequently which leaves farmers at a disadvantage of implementing these sustainable methods properly. MIRRA's agroecology technologies directly address each of these challenges making them relevant interventions for farmers in Azraq.



Picture 1: MIRRA's irrigation engineer, conducts an on-farm irrigation management assessment at a small farm in the Azraq region north east of Jordan.



Picture 2: MIRRA trainee installing sustainable irrigation systems to conserve water and enhance soil health in Azraq farms

Project Coherence

This project by UNDP coheres and reinforces MIRRA's previous project in Azraq: "Realizing Sustainable Agriculture and Efficient Water Management in the Azraq Basin through the Adaptation and Integration of Proven Technology and Community Partnerships." During this project, MIRRA supplied drip irrigation systems and magnetic water devices for controlling water salinity to two farms in Azraq which accomplished a 30-40% reduction in energy for groundwater pumping as well as a 35% reduction in water consumption. These technological improvements were accompanied by field training that hosted more than 40 farmers and a summer school that trained 15 youth on innovative technologies and sustainable agriculture. This intervention expands upon the goals of this project to new farms in Azraq in a way that avoids duplication of efforts while applying previous successful methodologies to new farms for a wider reach of intervention.



Picture 3: A MIRRA trainee inspecting the irrigation system under an olive tree during a practical field training session at a farm in Azraq.

Project Effectiveness

This project achieved its stated objectives and was an effective intervention. The first objective of this project was to enhance food security through the improvement of agriculture production systems. MIRRA staff were able to prepare each demo site for the installation of new technologies and to design intercropping and crop rotation systems. Over the course of this project, five different agroecological practices were implemented: crop rotation, intercropping, biological pest control, organic fertilizer, direct seeding into biodegradable mulch. Farms received improvements to their infrastructure including low-pressure drip irrigation systems.

The second objective was to improve communication between farmers, private organizations, and public organizations. In the beginning phase of this project, MIRRA hosted two workshops with 22 small farmers of whom 20 were women (90% female participation). The first workshop was hosted on a small farm while the second workshop was hosted by the Azraq Women's Cooperative Society. In each of these workshops, farmers participated in open discussions about their experiences, challenges, and desires for change in their farming operations. MIRRA visited 19 different farms and conducted a complete audit of each farm's irrigation system for greater stakeholder engagement and data collection to ensure farmers' unique perspectives and needs were taken into consideration while designing agroecology interventions for each farm.

The third objective was to raise farmers' awareness of affordable and replicable agroecology practices. MIRRA implemented agroecology techniques on four different test sites in Azraq. Each of the pilot sites conducted their own farmer field school where they introduced the project objectives and gave tours of the agroecology methods installed on their farms.

The fourth objective was to educate farmers to become better decision makers on their land, crop, and water management practices. Each farmer participating in the project received approximately 7 months of training in the agroecology techniques installed on their farms. This project not only invested in new agriculture techniques but ensured each farmer was trained on how these techniques work.

Project Efficiency

MIRRA's direct engagement with farmers allowed this project to gain community trust and implement sustainable agroecology methods directly into the community that is in most need of this intervention. This project's approach of improving the infrastructure and the knowledge of farmers is highly cost-effective because small-scale investments into agroecology can greatly impact the productivity of farms over the long-term.

Project Impact

MIRRA implemented 6 different agroecology methods to four farms in Azraq. These methods impacted agriculture practices in three primary ways: water conservation, energy reduction, and improving the soil ecology on each farm to create a more sustainable and productive farming operation less dependent on expensive inputs such as fertilizers and pesticides.



Picture 4: Part of a pressurized irrigation system in a farm in the Azraq region, north east of Jordan.

Drip irrigation reduces the water consumption of farmers during irrigation and reduces water loss due to evaporation and runoff. Low-pressure drip irrigation conserves energy while also applying water in a targeted manner to the rootzone which improves the distribution uniformity (DU) of applying irrigation on a field. The DU ratio is a proportion ranging between 0 and 1 with values close to 1 representing highly uniform irrigation application. Classifications of efficient and inefficient DU ratios largely depend on the type of irrigation system used, however, values of .90 and above are considered efficient systems. High distribution uniformity reduces water consumption and improves water use efficiency. According to field data collected by MIRRA's monitoring efforts, the DU measure for one of the farm's irrigation systems witnessed important improvements.

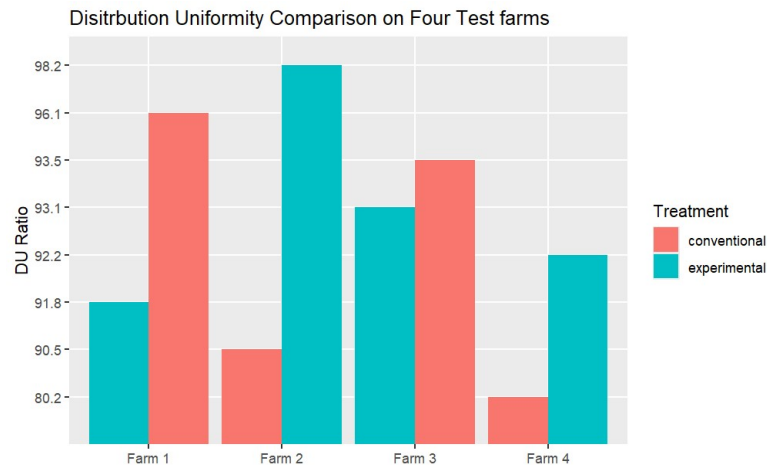


Figure 1: Results of comparing DU ratios on fields provided with conventional irrigation techniques with the modern irrigation techniques implemented on testing sites in Azraq with MIRRA's consultation

Organic fertilizers reduce the use of chemical fertilizers and enhance the biological activity of soil which is a more environmentally friendly and sustainable model of agriculture. It also replaces on-farm manure as a source of fertilizer saving time and water/ soil contamination. Several farmers reported struggling with pests and weeds. Installing biological pest control reduces the soil and water contamination from pesticides thereby supporting biological activity of the soil. Crop rotation and intercropping increase land productivity, keeps soil fertile, increases soil biological activity, and reduces pests and plant diseases. Direct seeding into mulch creates numerous soil benefits. First, it reduces the energy consumption needed to prepare the seedbed. It reduces erosion due to wind, limits the growth of weeds and therefore herbicide use, in addition to improving carbon sequestration.

Moreover, the capacity building element of this project ensured that participating farmers are knowledgeable about the technologies installed on their farms. Farmer field schools spread awareness in the community about the benefits of agroecology methods and empowered farmers with the knowledge necessary to continue implementing these methods into the future. While it is difficult to fully quantify the impact capacity building has had on farmers, the project

Project Sustainability

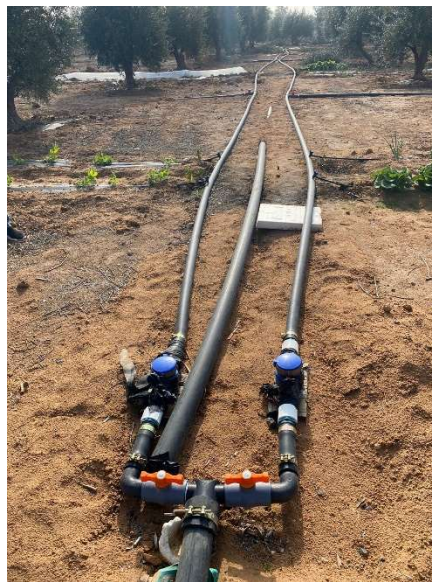
The interventions completed under this project are an investment into agriculture based on rich soil ecology soil, sustainable practices, and knowledgeable farmers who can continue practicing agroecology even after the conclusion of the project. The drip irrigation systems as well as crop rotation and intercropping methods represent capital and human resource infrastructural improvements that will persist for years after this project. While support from the private sector, agriculture cooperatives, and the Ministry of Agriculture remains limited, participating farmers

have been equipped with the knowledge to continue practicing agroecology into the future. The necessary knowledge and equipment for agroecology has been established which decreases farmers' dependence on outside guidance. Consequently, farmers can expect to continue benefiting from this project's intervention for several seasons.

Stakeholder Engagement with Strategic Groups

Project Beneficiaries

The main beneficiaries of this project are small farmers within Azraq, Jordan. This project involved pilot testing of agro-smart technologies on four small farms less than 50 dunams within Azraq Agricultural Directorate. Moreover, this project targeted indirect beneficiaries including neighboring farmers as well as members of the community who attended farmer field schools and demonstrations of all piloted technologies at these four test sites.



Picture 5: Main and submain lines of a drip irrigation system in a farm in the Azraq region, north east of Jordan

Project Engagement with Farmers

Farmers were the primary stakeholder during all phases and activities of this project. In the beginning stages of the project, two workshops were held in order to co-learn and co-develop agroecology methods to best suit the challenges and expressed wishes of farmers. Their operational challenges and goals drove the calculation of which technologies to implement. Moreover, MIRRA surveyed a sample of farms in order to map the precise conditions and limitations farms may face. These preliminary data collection mechanisms were done in

collaboration with farmers to build dialogue, mutual trust, and transparency with how agroecological practices may be implemented.

Moreover, the farmers at each of the four pilot sites demonstrated these technologies to other members of the community thereby achieving a larger, indirect set of farmers who received greater awareness and knowledge about the impact of agroecological methods for more sustainable agriculture.

Project Engagement with Women

Over 90% of workshop participants in the beginning phase of the project were women from ages ranging from women in their early twenties to women in their sixties with many years of agricultural experience. This project achieved a very high representation of women farmers across many generations who provided important feedback on the challenges facing Azraq's agriculture sector. By integrating women's voices into the design of the project, MIRRA and UNDP were able to achieve a gender sensitive and responsive approach towards understanding the social, economic, and climate variables impacting local agriculture.