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Boost your crop water productivity in selected farming systems: assess and adapt

Improving water productivity in the field with farmers: farmers field Schools on water *in Jordan*

Setting the context- Implementation site

The North Jordan Valley (NJV) is located in the northwest of Jordan and it has a subtropical climate with warm winters and hot summers, with a mean annual rainfall of about 350 mm. The warm climate made the area an important agricultural area that mainly produces citrus. Vegetables (e.g., hot peppers, eggplants, okra and others) and other fruit trees (e.g., banana, grapes and date palm) are cultivated in the area as well.

Water deficiency is evident in this area and the Jordan Valley Authority (JVA) adopted reduced water allocations (quotas) for farmers in NJV. For the local community in NJV, agriculture is the main employment sector and the main source of income. In addition to scarce water, the major challenges faced by farmers are the high prices of agricultural inputs and low yield prices. Producing more benefits with less water (increased water productivity) is one of the most strategic response to such challenges. Benefits can be either biophysical (yield, expressed in mass unit – kg), economical (returns, expressed in monetary terms – $) or even social when considering job created or dietary value.

The analysis of local crop production showed that there is a significant gap between the actual yields and the attainable yields. It was found also that the gap is not only a result of water shortage and climate variability but also due to the impact of suboptimal farming practices (e.g., irrigation system efficiency, irrigation scheduling, fertilizer and diseases management, etc.). The national baseline on water productivity (WP) for Jordan[1] conclude on the potential for increasing WP considering existing constraints (e.g., water shortage and economic situation). A main entry point is to act on the current farming practices (e.g., improved irrigation and fertilization management, and integrated pest and diseases control) by allowing farmers to learn by doing –improving their skills while experimenting on good farming practices along a series of crop seasons. The FAO famers' field schools (FFS) approach on agricultural water management applied in Jordan proved its effectiveness to enhance farmers' skills and their ownership over good farming practices that increase water productivity.

1 https://www.fao.org/3/cc1820en/cc1820en.pdf

Farmer field schools

Farmer Field Schools (FFS) is an interactive and participatory learning by doing approach. A voluntary group of farmers joins forces to experiment following a systematic approach where they enhance their understanding of agro-ecosystems and how they lead to production systems, the interventions for improved resilience in local conditions and ways to optimize the use of available resources (water, fertilizer, etc…). FFS aims to contribute to improve farmers' livelihoods and recognize their role as innovators and guardians of natural environments. FFS also offers farmers a place where they can meet, discuss and decide on a joint curriculum and practical experiments.

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FAO's FFS methodology and implementation

The FAO's FFS is organized in the form of regular facilitated meetings (preferably weekly) of a farmer group along the whole crop season from field preparation to harvesting; each meeting consists of the following sessions:

Agroecosystem analysis

The cornerstone of the FFS methodology is the agroecosystem analysis (AESA) which is a field-based analysis of the interactions between the crop and the other biotic and abiotic factors co-existing in the cropped field i.e., diseases, weeds, water, soil and weather conditions. AESA is implemented in four steps:

- Conducting field observations: in sub-groups, farmers observe the cropped field based on a range of monitoring indicators. They observe the interactions between various factors in the agroecosystem.
- Analyzing and recording findings: each sub-group records and analyze their findings from the field, including the creation of drawings of the field situation and elaborating decisions and recommendations.
- Presenting the feedback: in plenary each sub-group presents their results and conclusions. Feedbacks and questions from the other groups required the group to defend their decisions with logical arguments.
- Discussing actions to take: in a plenary, the participants synthesize the presentations, collectively agree, and decide what proper actions to implement based on the decisions they have taken.

Group dynamic exercise

- A short activity aiming at creating discussions on teamwork, problem-solving, leadership skills and other group development processes. It also serves as an icebreaker.

Unique topic

- Depending on the needs of the FFS group, a session is implemented to discuss a unique/special topic. The topics often involve small experiments to highlight particular technical issues. Other topics could be related to social, health or community issues.

Implementing FFS on water productivity

- Ten FFSs were carried out between 2019 and 2022 in Al-Mashare' area in the NJV focusing on the Good Agricultural Practices (GAP) for improving irrigation and fertilization management, for rationalizing pest managements, and for increasing water productivity, of grape, citrus, hot peppers, eggplants, okra, and potato. Each FFS is on one crop only at a time.
- The FFSs were implemented following the FAO-FFS approach in which farmers learn by doing and experimenting/observing and by identify the problems and solutions through group discussions guided by well-trained facilitators.
- Each FFS implemented a demonstration (experimental) field where a selection of GAPs were implemented by farmers themselves and compared the results with a nearby field applying traditional practices (both fields belong to one of the farmers participating in the FFS).
- Each FFS consisted of around 20-25 farmers and around 25 meetings were conducted during the crop season; each meeting addressed in addition to the regular activities, a specific topic related to farming practices. The main farming practices addressed during the FFSs activities are summarized in table 1.
- At the end of a full cycle, a graduation ceremony was used to invite the whole community to learn from the FFS experience.


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Table 1: Farming practices implemented through FFSs including the objective of the FFS for each practice, the method applied by the FFS in the demonstration field and the method applied by traditional farmers.

Farming practice	Objectives of the FFS	Demonstration field (FFS practice)	Traditional farmer field (traditional practices)
Fertilizer management	Decrease the cost of using fertilizers and adding fertilizers based on the plant growth stage and need.	Adding a mixture of mono-fertilizers which cost less than the compound fertilizers.	Adding compound- fertilizers (as farmers usually do). Farmers in many cases use more fertilizers than needed and sometimes use unsuitable fertilizers.
	Increase the efficiency of fertilizers use by using the fertilizer injector.	Installing a fertilizer injector to inject fertilizers along the irrigation event. Thus, the plant will absorb fertilizers more efficient.	Adding fertilizers by pass for few minutes at the beginning or at the end of irrigation event. This method lead to leach fertilizers before the plants use it.
Irrigation management	Better irrigation scheduling to improve water use efficiency.	Divide the available amount of irrigation water to irrigate two or three times per week depending on hand test for the soil moisture. Encourage the farmers to establish or increase the size of the water storage ponds to have more flexibility regarding irrigation timing and amounts. Moreover, explore the possibility to add aquaculture.	Irrigating based on the water delivery schedule (water turns). This method limits the flexibility to control the irrigation timing and amounts.
	Increasing the efficiency of the irrigation systems.	Installing a well-designed drip irrigation system with good distribution efficiency and uniformity (80%). This will allow for equitable water distribution within the field. Identifying the size of the plot to be irrigated at once based on the pump capacity.	Using the existed drip irrigation system with low distribution efficiency and uniformity (~65%). This will cause under or over irrigation of some parts in the fields.
Disease and pest control	Decrease the cost of using disease and pest control and to reach more efficient use of the pesticides.	Remove infected leaves from the plot (manual control). Use hot spot pest control rather than spraying the whole field. Control the irrigation water amounts to avoid specific diseases caused by over or under irrigation. Using suitable treatments for each diseases or insect.	Following fixed spraying schedule for the whole field, which is unnecessary. Sometimes farmers use unsuitable treatments.

Main results and conclusions

- Helped farmers to use the production inputs (e.g., fertilizer and pesticides, water, etc...) more efficiently while producing better yield in term of quantity and quality. Thus, increasing farmers' income and assist in achieving more sustainable environment and resources. At the end of the FFSs, good agricultural practices helped farmers to reduce of pesticides and fertilizer use overall (up to 50 percent), increasing the yield by 20 percent – 40 percent, therefore increasing WP (yield/m^3 and JD/m^3).
- Allowed experience and knowing sharing between farmers.
- Allowed improving the coordination and trust between farmers and also between farmers and the facilitators (from the extension services of the ministry of Agriculture).
- Improved the ability of farmers to make the proper decisions related to changes in the farming practices through conducting the Agroecosystem analysis at their farms and the interpretation of their observations.

Recommendations

- FFS is one of the approach of extension that works particularly well with small farmers. It can be part of a larger portfolio of extension approaches.
- The process of improving farmers' skills through FFSs is a slow process that required continuous efforts and support. Therefore, it is recommended to establish a FFS unit within the Ministry of Agriculture (MoA), well-structured in terms of human resources and financial means (Institutionalizing FFSs).
- Capacity building for the agricultural extension staff on the FFS approach and on specific technical topics (e.g. irrigation management, advanced agricultural practices, hydroponic, etc.) is needed to enable them to support effectively the farmer groups.
- FFSs effective implementation requires also maintaining strong coordination between the MoA and farmers' associations, academia, national agricultural research center, and the private sector. Resources persons may be called upon to answer to specific questions of farmers groups.
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