

	<p>MEDA WATER PROGRAMME</p> <p><i>Euro-Mediterranean Regional Programme for Local Water Management</i></p> <p>IRWA</p> <p><u>Improvement of Irrigation Water Management in Lebanon and Jordan</u></p> <p>ME8/AIDCO/2001/0515/59776-P 007</p>
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IrWa Methodology

Extension services for the improvement of Water Management at On-farm Level in Jordan Valley

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List of acronyms

LRA: Litani River Authority
NCARTT: National Center for Agricultural Research and Technology transfer
NCARE: National Center for Agricultural Research and Extension
O&M Operation and Maintenance
MREA: Mission Régionale Eau Agriculture
GTZ: Gesellschaft für Technische Zusammenarbeit
KAC: King Abdullah Canal
T.O. Turn Out
JVA Jordan Valley Authority

Introduction

MEDA Water Programme is part of the European Union support for the improvement of water management in Middle East and North African (MENA) countries through cooperation between non-profit organizations from EU countries MENA countries. IrWa project (Improvement of Irrigation Management in Lebanon and Jordan) started in 2003, within the framework of the MEDA Water Programme, with the main objective of increasing crop production and farmers' income in Lebanon and in Jordan.

In Jordan Valley the main activities of the project, in collaboration with the NCARE, were aimed at improving irrigation management at on-farm level, adopting an approach based on multiple components, from financial support to the improvement of farm assets to technical assistance to management of fertilization and irrigation. Starting from the technical problems identified on the field, the project built a Pilot Extension Services to tackle two major constrains: irrigation and fertilization practices.

The aim of this document is to present the bottom up approach developed by the project; from the field problematic to the extension agent capacity building and management.

A STEP BY STEP APPROACH

Assessment technical constrains

30 farms in Jordan Valley were assessed by IrWa staff through open and close questionnaires and field measurements to identify critical points for improvement of irrigation and fertilization. These farms were selected by NCARE extension agents from three different regions in Jordan Valley; northern part (Al Kraemeh), middle (Ghor Kated) and southern part (Al Karamah) and were representative of the whole region situation¹.

Improper irrigation practices

Despite the national water shortage, low attention is paid by the farmers to irrigation scheduling and irrigation management (As e.g. none of the interviewed farmers could give their own consumption precisely). Improper filtration system, operation and maintenance practices and irrigation design induced critical financial losses for Jordanian farmers as yield is decrease due to the uneven water distribution and production cost is increased to tackle residual clogging problems (labor cost and material renewal). The evaluation of irrigation system uniformity, using the Low-Quarter Method, confirmed the previous observations. Indeed, the uniformity coefficient varied between 20.9% and 75%, which is low considering that most references present 80% as the minimum acceptable.

¹ Vegetables grower using open field and green houses, with a growing season starting from August/September and ending by May/June

A fertilization process based on empiric practices

Farmers usually do not use any soil analysis to design their fertigation planning and depend only on their own experience. The amount of fertilizer is fixed per area and per crop which result in overall use of fertilizers. Fertilizers injection is done through the main pump, in a very short period of time and without any control of the fertigation solution quality (EC and pH) suggesting an important efficiency lost.

The soil samplings confirmed the over fertilization as very high quantity of available N, P and K was found². Additional field analysis using NITRACHEK tool displayed an excessive amount of NO₃ in the soil and in crop sap³. Soil and water excessive EC were found as important constraints in Karamah region where treated mixed waste water compared to the north of the Jordan Valley irrigated with the fresh water from Yarmouk river. Soil pH is usually above 7.2 and should be reduced to improve element uptakes by the plant. Farmers mainly use organic matter (chicken manure or mixed chicken sheep, sheep cow) to ameliorate soil structure without taking into account the elements provided through mineralization (N specially).

Definition of the technical package

Greater concern for the irrigation network design should be taken to eliminate all the associated problems. EPANET software could be helpful to optimize irrigation network design and management but requires the training of local engineers and extension agents. In addition, PROSONIC tool, could allow calculating the pump curve when old material without any reference is used.

Finally, farmer operation and maintenance practices should be enhanced through training and field visit. Particular attention should be paid on fertilization injection that induces pipe clogging with improper filtration system.

Cheap screen filter is the most common filtration system encountered but has two disadvantages; too large meshes and easily damaged during manipulation. On the contrary, disc filters are well adapted to the field rustic conditions, easy to clean, cheap and functional with precise meshes. Also, disc filter could be proposed as substitute of screen filter but cannot be the only on farm filtration system used due the poor physical quality of water stored in the farm reservoir. As matter of facts, the traditional horizontal sand filter, with its current coarse media and improper design, is not preventing dripper clogging. To counterbalance this problem the MREA, has developed in collaboration with ACP, a vertical sand filter which fits the filtration requirement of pressurized system in the Jordan Valley (Luc Armand, 2005). This filter locally manufactured has already been tested combined with disc filter by MREA and should be promoted in the Jordan Valley to encourage farmer to switch from their traditional system.

² The fertilization assessment was based on data collected in the "Mémento fertilisation des cultures légumières" published by the French research station Ctifl (Centre technique interprofessionnel des fruits et légumes)

³ Tomato, peper and eggplant sap were interpreted according to the PILazo methodology

An optimized design for the on farm irrigation system has been drawn by IrWa staff using the software EPANET and the ultrasonic flow meter PROSONIC. The new design is then discussed and approved by each farmer.

On the basis of the new design, the project equipped 30 pilot farms in Jordan Valley with advanced tools and materials.

Vertical sand filters

The model installed, designed by MREA (Mission Régional Eau Agriculture) is characterized by vertical tanks, horizontal diffusers of appropriate number, proper media (silica or 0.5-1.2 mm quartzite), pressure gauge at inlet and outlet in order to decide the back-flushing whenever the in/out pressure differential reaches 0.5 bar, extra valve for control of pressure at back flushing, extra opening at the bottom to facilitate the extraction of media and cleaning operations.

Fertigation devices

Fertigation optimization is in fact strictly related to irrigation management, as high water distribution uniformity is required to ensure a proper fertilizer application.

The improvement in dosage, distribution and scheduling of fertilizers leads to reduce the amount of fertilizers used obtaining at the same time high yields.

Fertigation tanks as a first step and water-driven proportional injectors (Dosatron) as advanced systems for the rationalization of fertigation practices were installed in the pilot farms and farmers were trained to use them.

Disk filters

Disk filters are installed after the fertigation devices, they ensure the filtration of possible suspended particles of fertilizers and enhance the level of filtration provided by the sand filters. This model substitutes the screen filter more commonly used in the Jordan valley, being easier to clean, more durable and more reliable in the results of filtration..

According to the previous observation fertilization practices can be optimized by:

Fertilization application may be reduced and save some inputs cost and reduce environmental burdens.

- Planning fertilization using soil analysis and regular monitoring of NO₃ available in the soil and up took by the plant;
- Adapting fertilization practices to crop stages and weather;
- Using acidifying fertilizers (MAP, Ammonium sulphate, ammonium nitrate, urea, nitric or phosphoric acids);
- Promoting adapted injection material (fertigation tanks and Dosatron) to control injection rate and fertigation solution quality.

A field work based on farmer association collaboration

The support given to farmers association aims at encouraging membership, enhancing participation, increasing visibility and ensuring sustainability to the project activities.

From their part, pilot farmers provide the associations a contribution corresponding to the 20% of the value of the equipment received. By this way, they participate the sustainability of the associated activities and share the benefits with other association members. In addition, they engage in introducing the modifications indicated by IrWa specialists.

IrWa Project established fruitful partnerships with other institution working in the Jordan Valley in related fields of activities, through exchange of technical experiences and support to farmers associations (e.g. the diffusion of sand filter prototypes and the support to Melon Producers and Exporters Association in partnership with MREA, or the support to Water Users Associations and the diffusion of the Guidelines for Reclaimed water irrigation in collaboration with GTZ, German Cooperation Institution). In IrWa Project vision, co-ordination, complementarities and synergy among existing organisations and activities in this field are indispensable.

TRANSFERT OF KNOWLEDGE: SETTLEMENT OF PILOT EXTENSION SERVICE FOR IRRIGATION MANAGEMENT

Current situation of Extension service

In Jordan, the private sector appears to be the most reliable source of information for farmers concerning new agricultural technologies and technical services. Its tendency is to favour capitalist intensive enterprises and to induce over use of agricultural inputs. In Jordan, the public extension service is subjected to the major bottle necks that limit its services reliability. Indeed, low skills of Extension Staff, insufficient logistic facilities, lack of working methodologies for on-farm assessment and low motivation of extension agents result in the promotion of a top-down approach where farmers are expected to contact extension agents rather than vice versa.

Since recently the extension service was under the responsibility of MoA and NCARTT. In July 2007, NCARTT mission included the extension from the MoA to become the NCARE (National Center for Agricultural Research and Extension). As the expansion of NCARE mission implies stronger focus on extension service, the centre will have to reoriented professional and financial means from academic research to applied research activities to be able to answer technical constrains met by local farmers. During the last 3 years, IrWa has developed, in collaboration with NCARE, a pilot project of extension service following the methodology presented bellow.

Phase 1: Extension Agents Capacity Building

To accomplish IrWa mission 6 extension agents were put at the disposition of the project for 2 day/weeks. Only two extension agents were specialized in fertilization and irrigation. The rest of the group did not have the skills to provide technical assistance. Specialisation of extension agents is one of the main limiting factors in the success of their work also as a first step the project concentrated on their capacity building through:

- Theoretical training in class rooms
- Field days
- Learning by doing process directly in contact with farmers

Exchange with farmers

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Irrigation

Training on irrigation design, good operation and maintenance practices and optimisation of filtration was provided mainly by IrWa irrigation engineers. Additional training sessions were organised in collaboration with the MREA and a local expert for specific technical topics.

The extension agents were taught:

- How to calibrate a pump using PROSONIC
- How to design adapted irrigation network using EPANET
- How to provide farmers with adapted operation and maintenance procedure
- Filtration characteristic and needs

Fertilization procedure

A clear lack of methodology and technical skills were found in subjects related with fertilization. Training on: sampling procedure, field EC and pH measurement and soil test interpretation were provided by IrWa Agricultural expert in collaboration with GTZ reclaimed water project. PILazo methodology and NITRATEST tester were introduced in the training program to provide extension agents with tool that allow rapid fertigation assessment through soil and plant sap analysis. Finally, an Excel sheet was developed to assess framers' fertigation practices and provide adapted procedure staking into consideration soil analysis.

Technical sheets and Task Definition

All the subjected presented during the training session were sum up in 10 technical sheets that were done bought for extension agents and farmers. Task definitions, activities and time schedule were discussed and approved by the extension agents before field work implementation around 3 main topics: irrigation, fertilization and demo plot organisation (see appendix 1, 2 and 3). For each subject 2 extension agents were clearly allocated with specific objectives to reach.

Phase 2: Field work organisation

Field work coordination was organized by IrWa agricultural expert in collaboration with NCARTT national coordinator. The strategy adopted was firstly to understand farmer technical questions and improve exchange between farmers and extension agents through regular farm visits and secondly to realize demo plots on appropriate irrigation and fertilization practices.

The pilot farms following work, previously done by IrWa irrigation was hand out to NCARE extension agents. The optimized irrigation systems installed in the 30 pilot farms are now monitored by them under the supervision of IrWa Agricultural expert. A field visit sheet is used to evaluate periodically the performance of the system and the application by the farmers of the recommendations provided by IrWa team. The farmers have been ranked in three categories according to their management skills (low, medium, advanced), so that the follow up is calibrated in order to allow all the farmers to reach a proper operation and management system.

6 pilot farms have been selected between the 30 in Jordan Valley to realize demo plots on fertilization management. Main aim of the demo plots is to demonstrate the possibility of reduction of Nitrogen quantity and so fertilization application, without reduction of yield. The monitoring of on farms activities has been attributed to 2 extension agents, in charge of identify the area, visit weekly the farm, take measurements of Nitrogen level in the soil and in the plant sap, discuss with the farmer the evolution of the crop, identify problems and propose solutions.

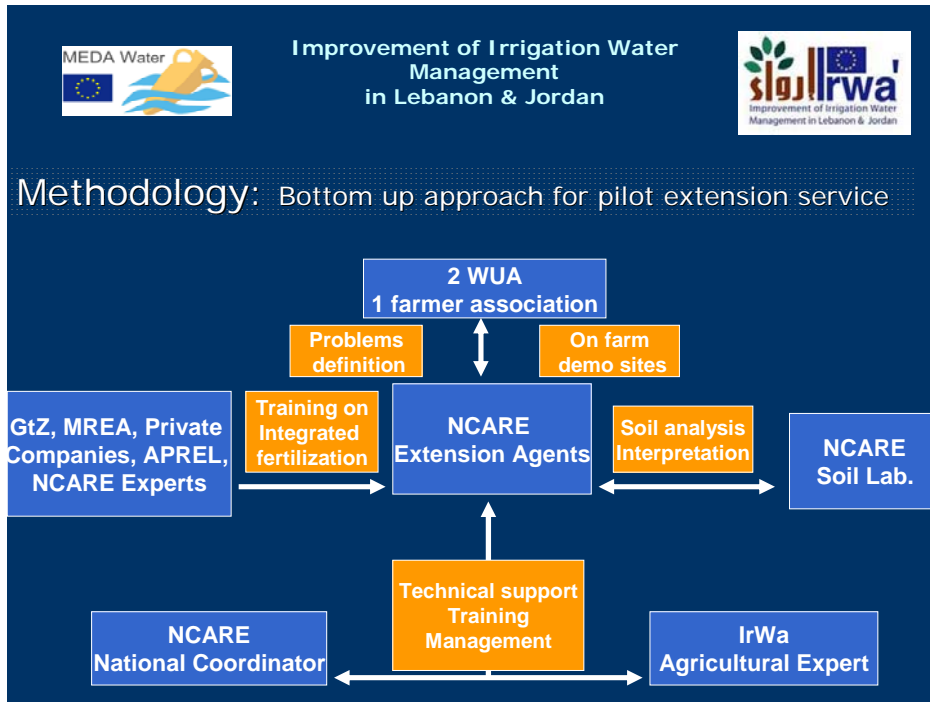
Finally, 2 extension Agents were allocated to the organization and management of a demo plot on the Evaluation of Nitrogen Fertilization for Tomato grown under Greenhouse using Different Organic Manure sources was orginsied in Deir Allah research center. The objective is to establish sound and economical fertigation planning taking into account the furniture of the soil and organic matter using Nitrachek tool and PILazo method. The rational for the establishment of this demo plots has been provided by the study conducted about fertilization practices during the previous agricultural season, after a mission by the expert provided by APREL for the support to the definition of a strategy for the improvement of fertilization management.

Training organisation and field days

A programme of training to be conducted through field days is planned to be realized by the extension agents, using the training materials developed by the project, part autonomously and part with the collaboration of MREA. The aim is to train 480 farmers of the area in the operation and management routine, and to demonstrate them the results (in term of crop uniformity and diminution of clogging in the network) of the system studied and installed by Irwa team.

Overall management

The management of the field work was organised by IrWa Agricultural Extpert in collaboration with the National coordinator (figure X). Weekly meeting to follow up the work advancement were organised in Deir Allah Research centre. Additional field visit to the demo plots were done monthly to meet farmers and be sure that of the farmer XXX. A final evaluation of the work was done every 6 month and incentives distributed according to the grade of the evaluation.



Bottom up approach

Conclusion

IrWa Project proved to be a source of useful experiences and observations, which will be systemized in practical Recommendations handbooks in order to build a reference for future activities in on farm irrigation management. The key asset of the project is the work of a team composed by different specialists (in irrigation, fertilization, different crops), able to establish stable relationships with the farmers, with the aim of enhancing the trust of farmers in extension services efficacy. At the same time the project aims at enhancing the capacity of specialists to bring the research results at the reach of the farmers (technology transfer).

The cooperation with other institutions will guarantee complementarities between all efforts, reducing repetitions and increasing the benefits.

The first follow-up visits in the pilot farms showed that the farmers evaluated positively the impact of the intervention realized in their farms, taking as main indicator the higher uniformity of the crops in the field

