Farm-Level Water Management – Opportunities and Challenges in the Old Land

By
Dr.Sayed Ahmed Abd El-hafez

Chief Researcher, Soil & Water and Environment
Research Institute (SWERI)
Agricultural Research Center (ARC)
Ministry of Agriculture and Land Reclamation (MALR)

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Introduction and Justification:

- Agriculture in Egypt is almost entirely dependent on irrigation from the Nile since there is no significant rainfall excepts in a narrow strip a long the North Coast. The agricultural Land base consists of old land in the Nile Valley and Delta, rainfed areas, several Oases, and lands reclaimed from the desert since 1952 (the New Lands). The total irrigated area reached about 10 million feddan and the rainfed areas cover about 0.2 million feddan.
- Egypt's land is generally highly productive and, in combination with good climatic conditions (maximum sunlight, cool winter) ideally suited for intensive cultivation with a large variety of crops.

There are several constraints and questions (challenges) that need to be addressed in order to achieve sustainable increases in water productivity (On-farm water use efficiency) in Egypt including :-

- What are the technical options for maximizing water use efficiency, including water management options, crops, cropping patterns and varieties, and agronomic management?
- What water management guidelines are needed under conditions of water scarcity to produce more with less water?
- How does the farmer select his cropping patterns and inputs to maximize his income and water productivity? Can this be developed into a general decision support tool?
- How will land use change as climate, markets, trade, etc., change and how can changes of land use be predicted and/or managed to ensure sustainable agricultural production and livelihoods?

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- How can the production systems be sustainable under increasing risk of salinization and land degradation?
- How can farmers manage water more efficiently and what policy options/incentives are needed?
- What are the policies needed to encourage efficient water use in irrigated areas?
- How can marginal–quality water be utilized for high productivity without degrading the land?

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- The Nile Valley is a typical and may be the largest irrigated area in Egypt. Egypt is expanding irrigated areas, while water resources are not increasing. Sustainability is being threatened by excessive pressure and changing land use.
- Marginal–quality water is being used and sustainability is being threatened and challenged.
- National Research Institutes has done work in Egypt and results show the urgency in developing approaches to improve on-farm water use efficiency and protection of the ecosystems from the threat of increasing salinity and land degradation.

These problems define a common research task:

- To develop and integrate techniques and technologies with full community participation for the acquisition and supply of water to agriculture and for the efficient utilization of all sources of water in irrigated agricultural production.
- Egypt faces several challenges relating to water resource management for irrigation. These are the improvement of inefficient traditional surface irrigation systems in the old land, annual reductions in water availability per capita due to population expansion; soil and water resources degradation related to excessive irrigation; the need for cropping systems that rationalize the use of water; mismanagement and misdistribution of the open canal system; multiple supervision of the water distribution in the old lands by users and beneficiaries associations; and the projected/emerging environmental pressures in terms of natural resources, climate variability and change.

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- The government of Egypt is targeting about 2.0 million hectares of the surface irrigated land for on–farm water management improvement through strategic national projects. This is planned to be done by deploying improved on-farm irrigation systems (Laser leveling, gated pipes) and modified practices for better surface irrigation, including raised–bed planting; applying localized irrigation in fruits and vegetables fields; applying water according to crop requirements based on climatic conditions; and improving irrigation management at the 0n-farm level (irrigation schedule based on soil- water relations, deficit irrigation, alternate furrow irrigation , raised-bed irrigation, and surge irrigation, etc.).

Increase the efficiency

- **Developments to improve water use efficiency**

  To maximize the total amount of water available to agriculture a number of developments started, aimed at a more efficient use of the scarce water resources by improving irrigation efficiencies and reuse of drainage water that would otherwise be lost.
- **Irrigation improvement project (IIP)**

  IIP is an ambitious programme that is being carried out by Ministry of Water Resources and Irrigation (MWRI) in collaboration with MALR (Ministry of Agriculture and Land Reclamation) to a) Improve the irrigation efficiencies in the old land and b) improve the water distribution amongst the farmers.
- **Major components of the IIP are:**
  - Renovation and improvement of branch canals, including modular discharge regulators at the head of branch canals, cross regulators and downstream water control structures;
  - Conversion from rotational to continuous flow;
  - Mesqa improvement by conversion of low level mesqas to raised canals or pipelines;
  - Set-up of Water User Associations (WUA's);
  - Improve the On-farm water management (Integrated soil and water management practices)

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- The total area planned to be improved under the IIP programme by the year 2017 is about 3.5 million feddan of which some 70% is located in the Delta. To attain maximum benefit of these measures by the farmers, the IIP developments are supported through Irrigation Advisory Services (IAS). The IAS will also support WUA's that will be established outside the areas that are considered for IIP improvements.

- Simulations with the NWRP Decision Support System (NWRP DSS) model for a typical distribution system showed an overall increase in irrigation efficiency from 0.61 to 0.66 and an increase in field application efficiency from 0.70 to 0.75. the resulting increase in consumptive use of water was 3.5% (due to improved water supply at the tail ends of the mesqas) whereas the drainage flows reduced by some 10%.

Integrated Irrigation Improvement and Management Project (IIIMP).

The IIP, MALR, EPADP (Egyptian Public Authority for Drainage Projects) and several institutional reform programmes on water management are expected to further develop and integrate into IIIMP.

The IIIMP aims to achieve an integrated planning, management and execution of all interventions needed at command level. Stated objectives of IIIMP are:

- Developing a framework for integrated water management plan and programme in selected command areas, combining water quantity and quality management through inter-agency and stakeholder consensus.
- Improving the institutional, financial, and environmental sustainability of water services through decentralization of water management, intensive user and private sector participation in the investment, and operation and maintenance at the district/branch canal levels and below and improved water quality management practices.

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- Establishment and expansion of WUA's and the Water Boards in line with Government Policy of integrated irrigation and drainage water management. This would include support for WUA's at the tertiary level and up scaling them to branch canal level and their incorporation in the water boards at the district level.

- The project started in 2004 with an initial coverage of 500,000 feddan in the Delta (Mahmoudia/Beheira – 196,000 feddan), Meet Yazid/Gharbaya and Kafr El Sheikh – 124,000 faddan) and Bahr Tanah/East Daqahlayia – 87,000 feddan), Middle Egypt (Serry/Menia- 76,000 feddan) and Upper Egypt, (Tomas and Afia/ Qena – 17,000 feddan).

Developments to improve drainage conditions

- Both **MWRI** and **MALR** consider subsurface drainage as a main tool to improve soil conditions and to sustain the soil fertility. Reported economic returns are high. There is an ongoing programme by the Egyptian Public Authority for Drainage Projects **(EPADP)** to implement subsurface drainage in the Nile Delta and Valley. The total area included in the programme is about 6.4 million feddan of which some 75% is already completed.
- In addition there is an ongoing drainage rehabilitation programme in areas where existing drainage systems were not properly designed to cope with very specific soil conditions. These areas are mainly concentrated in the Governorates of Menufia, Gharbia, Kalubia, some smaller areas are located in Beheira, Sharkia, Beni Suef, Fayoum, Qena and Sohag. The total area already rehabilitated is about 0.4 million fedddan. The target area to be implemented up to the year 2012 is 1.2 million feddan.

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- Considering the present development rates of new subsurface drainage systems and rehabilitation of older systems, it is assumed that by the year 2017 the subsurface drainage systems in the old lands are fully implemented and properly functioning. Other measures that will improve the field application efficiency are land leveling and controlled drainage. Laser land leveling in **IIP** areas showed promising results (saving irrigation water by 15-20%).
- Controlled drainage is especially effective in rice fields where considerable amounts of irrigation water can be saved (20-30%) by blocking the subsurface drainage system during the growing season. When drainage water cannot be recovered for reuse, controlled drainage would result in a seasonal water saving of about 1,400 m3/feddan.

Summary of measures to improve overall water use efficiency in agriculture (NWRP, 2017)

- **Horizontal expansion**

  Make further horizontal expansion depending on the availability of additional water

- **Improvement of irrigation efficiencies**

- Prioritize efficiency measures in effective areas
- Continue IIP and IIIMP related activities to rehabilitate the water distribution system in prioritized areas: (i.e. areas where drainage water would otherwise flow to sinks and where reuse of drainage water is not recommended because of adverse impacts)
- Provide Irrigation Advisory Services including all new development areas
- Apply canal lining in canal stretches that suffer from high leakage losses
- Apply laser land-leveling where possible and needed to increase field application efficiencies
- Apply controlled drainage during the cultivation of rice.
- Apply modern irrigation techniques in all new development areas with light textured soils.
- Gradually introduce modern irrigation techniques to replace traditional irrigation methods in the Oases and gradually phase out the cultivation of rice in these areas.
- Control well discharges in desert areas
- Improve O&M activities through private participation (Water Boards and Water User Associations)
- Reduce irrigation supply after rainfall, combined with extra storage upstream from barrages in the Delta.

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- **Improve drainage conditions**

  Continue sub-surface drainage program of **EPADP**, with the intent to integrate the activities with IIP into **IIIMP**

- **Reuse of drainage water**
- **Review the drainage water reuse policy of Egypt, including:-**
- **Constraints to Improve Water productivity:**

Research findings, Guidelines and recommendation for improving water productivity in Egyptian agriculture

- Egypt through its national agricultural research systems, and in coordination and collaboration with regional and international research institutions such as ICARDA, has over the past two decades conducted work to develop and or improve the agriculture systems. These efforts include, crop improvements, better and efficient irrigation methods and systems, and better soil, crop, and land management practices.
- ICARDA on its extensive experience in Egypt, propose new research that complements its past and on- going activities. These include ICARDA/ESCWA joint work on empirical estimates to on–farm water use efficiency in Egypt. Testing and evaluation of on-farm level interventions showed irrigation water consumption on farmers' fields fell by about 30%, with correspondingly reduced pumping costs. Labor costs for land preparation, irrigation and weed control fell by 35%. Yields were the same or higher than the conventional system, and farmers' net income increased by 15%. Crop water productivity increased by over 30% and the net return per unit of water was 20% higher than the conventional irrigation. The package was transferred to farmers' by national counterparts through field visits, farmers' field schools, workshops, meetings with development technicians, policy makers, and publications.

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- Most farmers in the benchmark communities and neighbourin communities have already adopted the new package.
- Other development projects in Egypt have adopted the package including; The East delta Rural Development project Financed by IFAD and the world Bank, the crop intensification project of Middle Egypt Financed by IFAD and the Irrigation Improvement projects (IIP) in Behaira and Kafr El-Shiekh Governorates.
- The national extension system is transferring the package to six additional governorates in Egypt.

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- Thus, project interventions, originally test at a few pilot sites, are being rapidly scaled out over a large area by a range of partners, leading to substantial impacts on water productivity and farm incomes.
- The fundamental scope of the irrigation Benchmark project; more emphasis was given to introduce and implement new water saving technologies as well as farmer' participation and involvement water user associations and other community organizations as well as the governmental organizations and, particularly, those concerned in the Extension Service of the Ministry of Agriculture.
- On farm trials were conducted at several locations representing the old land site (El-Monofia Governorate) to generate the data required for modeling water productivity , the sustainable use and the management of the water resources, as well as to fill the gaps in the available information necessary for improving scarce water management and water saving .
- In addition , this is important piece of work was looking for introducing new simple accepted techniques with the involvement and partnership of farmers to increase crop water productivity , reduce water losses and achieving a better water saving.

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- The on-farm conducted trails recommended wide furrow irrigation technique and deficit irrigation as simple tools to be easily implemented by the farmers and leading to an increase in the crop production, improving the crop water productivity and above all saving appreciable volumes of water as compared with those the farmer is practicing.
- The raised bed furrow technique showed very satisfactory results in the different investigated sites (old lands, and marginal lands) under cropping with the main winter crops (Wheat, Berseem) and summer crops (Corn , Cotton).
- This technique, besides saving around 25% of the applied water by farmers for most crops, it increased the crop production of the main investigated crops by nearly 10% more than that already produced from farmer practices.
- Furthermore, the implementation of such simple technique resulted in average water saving amounting 20-22% of that corresponding to the basin irrigation the farmers are practicing.

Generally The wide furrows that saved considerable amounts of irrigation water produced a higher production, thereby, increasing the crop water productivity to values around 30% over farmer irrigation practices. The deficit irrigation technique showed its beneficial effect on maximizing the utility of the applied water attaining to an acceptable production showing values very near to the ones that farmer is applied in excess. The findings of the trials carried out in the selected sites (Old land and marginal salt affected soils) showed that the implementation of such technique, where relatively a high proportion of the applied water is saved, did not result in any significant losses in the yield production for the major winter and summer crops.

This report (White paper) includes the guidelines for water saving extension , water conservation extension, government agencies and their tasks, appropriated soil and water conservation technologies and how to develop subsidies and incentives and how they should be used in the favor of increasing crop water productivity and in which form both can be provided to the farmers, in addition to the supporting tools to improve crop water productivity in Egyptian Agriculture, based on the main research findings, recommendations and the workable packages of the irrigation benchmark project outputs (see the attached guidelines and recommendations plus the inventory study on water productivity in Egypt).


THANKS