

## **PRODUCING MORE WITH LESS WATER: FROM CONCEPT TO REALIZATION BY GREEN MOROCCO PLAN**

Ahmed El Bouari<sup>1</sup>, and Zakariae El Yacoubi<sup>2</sup>

### **ABSTRACT**

In Morocco, irrigated agriculture is increasingly confronted with a scarcity of water resources under the combined effects of successive and prolonged droughts and increased demand for water from economic sectors. Since 2008, the Government has launched a voluntarist and ambitious program to modernize irrigated agriculture to convert 550,000 ha of irrigated land into drip irrigation, in order to save about 1.4 billion m<sup>3</sup> of irrigation water and double the added value per cubic meter of water. This program, which mobilizes nearly 4 billion USD, is based on a systemic and participative approach for : i modernisation of collective irrigation systems in order to provide a water service to farmers that satisfies drip irrigation requirements at farm level ; ii equipment of agricultural farms with drip irrigation system by means of government subsidies that cover up to 100% of the investment cost, iii support to farmers for a better control and valuation of the irrigation water. Since the program's launch in 2008, an additional 400,000 ha of irrigated land have been converted to drip irrigation, bringing the total area equipped with this irrigation technique to 35% of the irrigated area at national level, as well as comprehensive modernization of collective irrigation systems. These efforts have allowed:

- save around 40% of the water used;
- increase crop yields by +30 to + 70%;
- double the value added per m<sup>3</sup> of water;
- improve water service at the level of irrigated collective perimeters;
- saving of electrical energy for the water

## **2. THE MANAGEMENT OF WATER SCARCITY IS CRUCIAL FOR AGRICULTURAL DEVELOPMENT IN MOROCCO**

With its relatively limited water potential and the increasingly frequent and severe droughts of recent decades, Morocco is seeing the increase in its water deficit, as evidenced by the observations made from one year to the next, in the immediate past. This deficit on one hand is due, to the increasing scarcity of water resources (rainfall, water supply to dams), and on the other hand the increase in water requirements because of demographic change and the development of economic activity.

For more than four decades, irrigated agriculture has been confronted with a growing scarcity of water resources under the combined effects of successive and prolonged droughts and the increasing demand for water from the industrial and drinking water supply sectors and tourism.

In this context of high tension on water resources and arable land, accentuated by the threats of climate change, irrigated agriculture is confronted with new demands and

---

<sup>1</sup> Director of Irrigation and Agricultural land development, Ministry of Agriculture – Morocco (bouariahmed@gmail.com)

<sup>2</sup> Head of Division of Hydro Agricultural Resources, Ministry of Agriculture – Morocco (zakariadiaea2@gmail.com)

the challenge of producing more with less water and in a sustainable and competitive way.

Management of water scarcity is increasingly required in irrigated agriculture to increase its resilience to mitigate climate change risks.

The phenomenon of limitation of water resources challenges public authorities and invites decision makers to work towards a rigorous and efficient management of water demand, particularly through the search for a better control of water efficiency in irrigation.

Even if margins for improving the hydraulic efficiency of collective irrigation networks are still possible, all the investigations carried out show that the challenge of improving the efficiency of irrigation lies in water application efficiency at the farm level. Indeed, the diagnoses made so far show that not only the margins of progress are important in the field of improving the water application efficiency, particularly in the case of surface irrigation which represents more than 80% of the irrigated area, but also at the level of the farm. The control of water can have multiplying effects on the valorization of the water. These multiple effects will increase farmers' incomes, competitiveness and sustainability of irrigation systems.

### **3. AN AMBITIOUS AND PROACTIVE PROGRAM TO MODERNIZE IRRIGATION AND SAVE IRRIGATION WATER**

In these conditions, Morocco launched in 2008 a new agricultural strategy “the Green Morocco Plan”. This strategy considers the control of the use of irrigation water as a capital measure aiming to remove the constraint of the scarcity of water resources and to meet the challenge of producing more with less water and in a competitive and sustainable way.

A program for the future of irrigated agriculture in Morocco has been initiated namely, “the National Program of Water Saving in Irrigation (PNEEI)”. This program covers an area of 550 000 ha, is based essentially on the modernization of collective irrigation networks and on the conversion of existing irrigation techniques, with low water application efficiency to more productive and efficient irrigation techniques such as drip irrigation, and.

The PNEEI program is conceived around following three components:

- The modernization of collective irrigation networks;
- The equipment of farms with drip irrigation system mainly through Government subsidies.
- Support to farmers to improve water productivity.

Collective conversion is a proactive initiative that puts the farmer at the heart of the process of transforming irrigation systems, production systems and water management systems. It's based on an integrated and participatory approach as shown in Figure 1.

For this purpose, information, awareness-raising and consultation actions for the farmers concerned and their associations are undertaken as early as the feasibility studies phase of the project starts (Figure 1).

The hydro-agricultural development model is based on modern technologies to optimize the use of water and energy in the whole system (Figures 2, 3, 4, 5), through:

- a modern transport network equipped with automatic regulation and remote management;
- a pumping station with a regulation system by variable speed pumps to optimize energy consumption;
- a collective pre-filtration station to ensure water quality that meets the requirements of drip irrigation;
- a pressurized distribution network with an on-demand service an individualized intakes and flowmeters at each farm;
- the equipment of parcels with drip irrigation system mainly by means of Government subsidies;
- and finally, support for farmers to improve water application at farm level and improve the process of agricultural production.

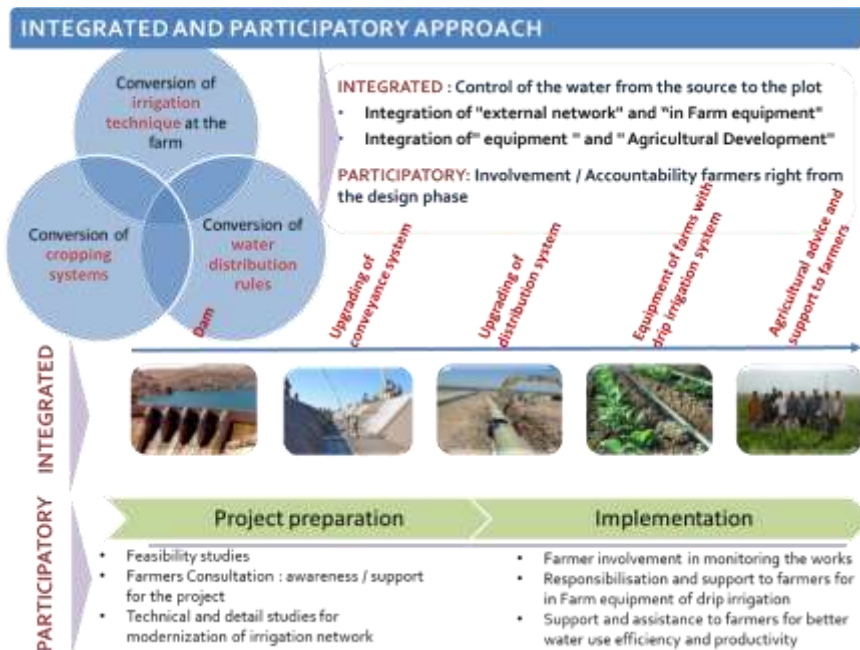
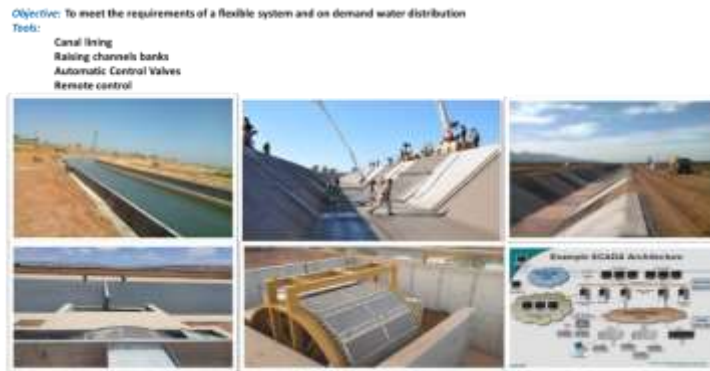


Figure 1. Program implementation approach



**Figure 2.** Model based on modern technology to optimize the use of water and energy

### Modernization of Transfer system



**Figure 3.** Modernization of transfer system

### Modernization of distribution networks



**Figure 4.** Modernization of distribution system

### Equipment of farmer's plots with drip irrigation systems and support to farmers



**Figure 5.** Equipment of farmer's plots with drip irrigation systems and support to farmers

## 4. PROMISING RESULTS AND IMPACTS

The progress made by irrigated agriculture since the launch of the PNEI program in 2008 is convincing in terms of the generalization of drip irrigation techniques with all the benefits of increasing agricultural productivity, increasing farm income and

conserving water resources. Thus, the unprecedented development of drip irrigation on more than 560,000 hectares (Figure 6) has made it possible to extend water-saving irrigation on nearly 35% of the total irrigated land at the national level, whereas it was only 9% before the launch of the program in 2008.

The integrated modernization of the collective irrigation networks has enabled small farmers to access modern irrigation techniques and thus ensure the transition from low-value traditional agriculture to high-value modern agriculture. It resulted in significant leaps across the value chain of the saving and the valuation of water (Figure 7):

- Water savings are estimated at more than 1.4 billion cubic meters per year.
- The increase in crop yields ranging from 67% to 100% on average.
- The increase in cultural intensification, which has increased on average from 100% to 130%.
- The tripling of the valuation of irrigation water
- The tripling of the average income of farmers.
- Significant improvement of the water service, due to the modernization of the irrigation networks and the transition to the water supply mode on demand.

### New impetus to development of drip irrigation system

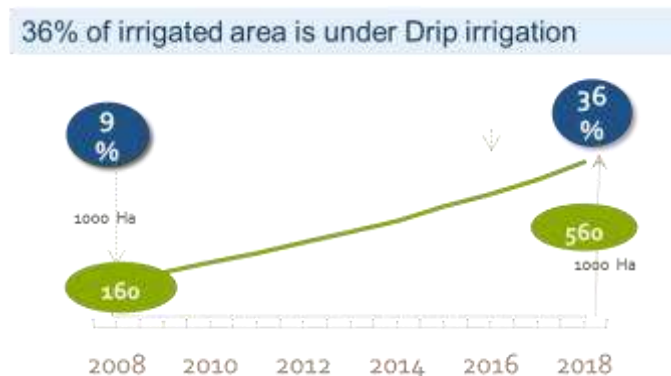


Figure 6. Area under drip irrigation in Morocco

### Saving and valorization of irrigation water



## Significant improvement of water service



**Figure 7.** Main results and impacts of the program

## 5. CONCLUSION

With the adoption of the Green Morocco Plan, irrigated agriculture in Morocco has entered a new era "the era of promoting more sustainable use of irrigation water". This program, which has given small farmers access to more efficient irrigation technologies, is a response to the challenges of water scarcity, increasing productivity and enhance resilience of agriculture to cope with the effects of climate change, which particularly threatens the entire region.