RESEARCH PROGRAM ON Dryland Systems

CGIAR

ICARDA

# CRP 1.1 – DryLand Systems Integrated Agricultural production System for Poor and Vulnerable in Dry Areas

## Policy brief
## of conducted research

**Tashkent - 2015**

## 1. Introduction.

Within a CGIAR Research program on Dry Land systems 1.1 there was research conducted within ICARDA and SIC ICWC in order to improve water use efficiency through innovative technologies in irrigation and agriculture in cereals, potatoes, vegetables, horticultural and forage crops" in the Fergana Valley.

At this project, there was created a network of weather stations to predict the crop water requirements and to improve the management of land and water at the level of WUA and farms. The real-time weather conditions-based modeling of crop growth which can predict whether the soil is drying and the plant is water-stressed or notand informing farmers to irrigate their crop or not.

### 1.2 Objective.

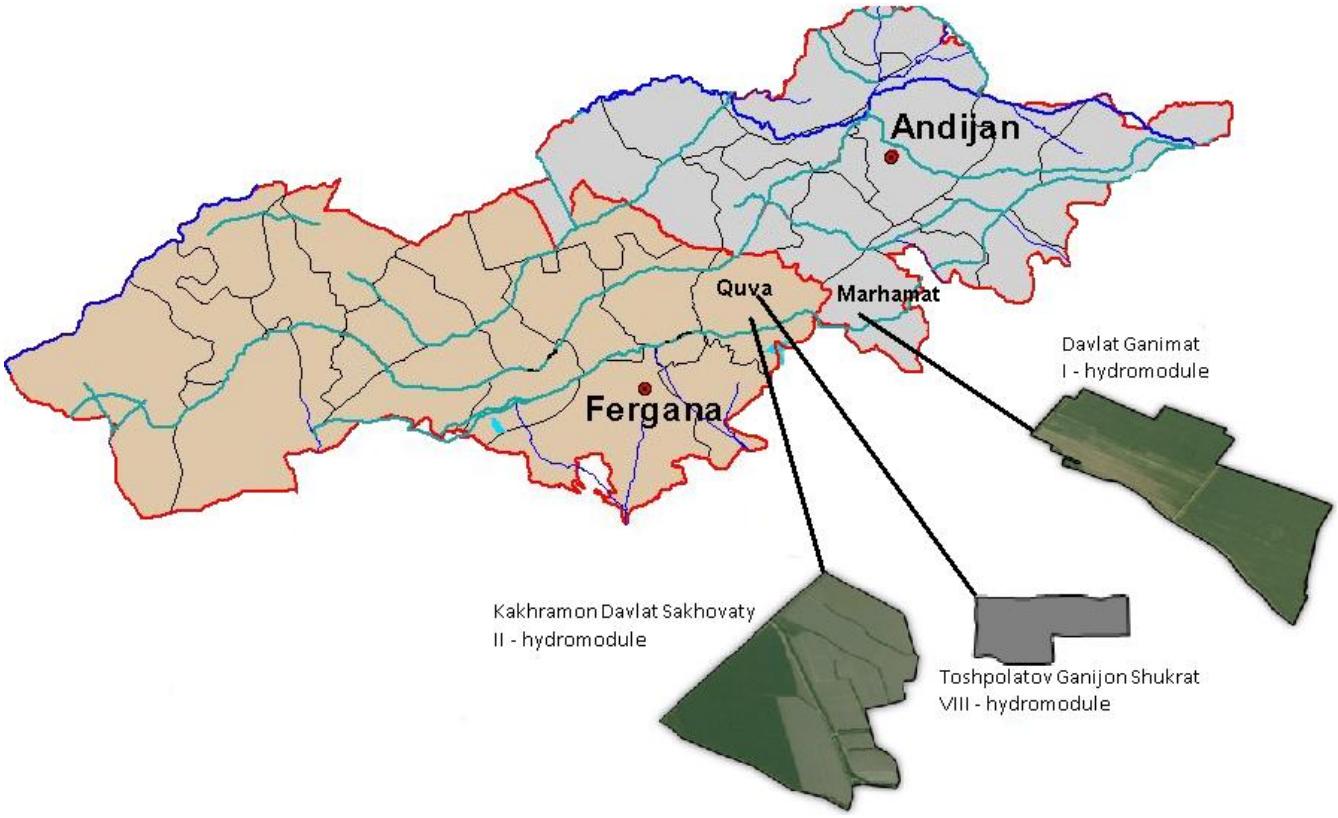
The main objective of this part of work is to show an advantage of the irrigation management method, which is based on accurate calculations using the climate data, over the commonly used methods where irrigation planning is based on indirect indicators showing soil and plant conditions and average data.

### 1.3 Organization of demonstration sites.

Organization of demonstration sites within the framework of this project provides a practical demonstration (with the opportunity to study at these sites) of the efficiency of irrigation water use, water use management and agricultural operations at the field level in a timely manner.

The demonstration sites were selected in two provinces of the Ferghana Valley (Ferghana and Andijan Provinces of Uzbekistan) where both wheat and cotton crops were sown. Demonstration fields were selected according to hydromodule zones, as in Central Asia and the CIS the irrigation rates for different crops are set considering both climatic zones and soil-reclamation conditions, with their division into the so-called hydromodule zones.

**Fig 1.Location of Demonstration fields.**




In the Fergana province, two farms “Qakhramon Davlat Sakhovati” and “Tashpulatov Ganijon Shukhrat” were choosen in the territory of WUA QodirjonAzamjon. In the Andizhan province one farm “Davlat Ganimat” was choosen in the territory of WUA “Tomchikuli”.

**Table.1 Characteristics of the selected demonstration sites in the Fergana Valley**

| Farm | HMZ | Soil texture | GWT |
|---|---|---|---|
| Davlat Ganimat | I | Fine-textured (0.2 ... 0.5 m) loamy and clayey on sandy gravel deposits and strong sandy loam and light loamy | ≤ 3m |
| QahramonDavlat Sakhovati | II | Medium (0.5 ... 1.0 m) loamy and clayey on sandy gravel deposits and strong sandy loam and light loamy | ≤ 3m |
| Toshpulatov Ganijon Shukhrat | VIII | Light - and medium loam, homogeneous, heavy loam | 1-2m |

## 2. Equipmentof experimental sites, and technique of project work

Small experimental sites were organized in each of the selected and described above farms. Two fields were selected in each of the farms Davlat Ganimat (Andijan province) and Tashpulatov Ganijon Shukhrat (Fergana province) - one field with winter wheat, and the second one with cotton. In the farm Qakhramon Davlat Sakhovati (Fergana province), one field with cotton is chosen only. In each farm, one site was organized to show traditional method of irrigation management (traditional irrigation) and the other site was set for irrigation management on the basis of daily meteorological information and soil moisture.

As irrigation management on the basis of climatic data was made through the usage of total evaporation values, this site was called for convenience as an experimental site with Meteo based irrigation. Thus, we selected five fields with 10 small experimental sites organized within their boundaries.

### 2.1. Installation of small meteorological stations

For organization of irrigation management on the basis of climatic data in farms of Tashpulatov Ganijon Shukhrat in the Fergana province and Davlat Ganimat in the Andijan province small meteorological stations were installed for collection of data on all meteorological parameters (air temperature, humidity, solar radiation, precipitation, and wind speed).

**Fig. 2 Small meteorological station installed in demonstration sites**

### 2.2. Installation of water weirs

All of the experimental sites were equipped with weirs to keep records of water delivery to and outflow from the fields. In the sites with Meteo based irrigation, weirs were built only at the inlet (one weir for cotton and one weir for wheat), and in these sites irrigation was planned through furrows without outflow. In the traditional irrigation sites, weirs were built at the inlet to keep record of water delivery (one weir for cotton and one weir for wheat) and at the outlet to measure outflow from the fields (one weir for cotton and one weir for wheat).

**Fig.3 Irrigation with water weirs in demonstration site, Davlat Ganimat farm.**

## 2.3 Technique of project work

Field operations of the project were based on monitoring of all necessary parameters related to irrigation, climate and growth of crops. Time and frequency of measurements were set for data acquisition from the devices established in every experimental site. Each captured and measured value was recorded in a log for further assessments and calculations. Following monitoring of data's were obtained:

- Monitoring of soil moisture;
- Monitoring of water table;
- Phenological observations.

## 3. Results and assessments.

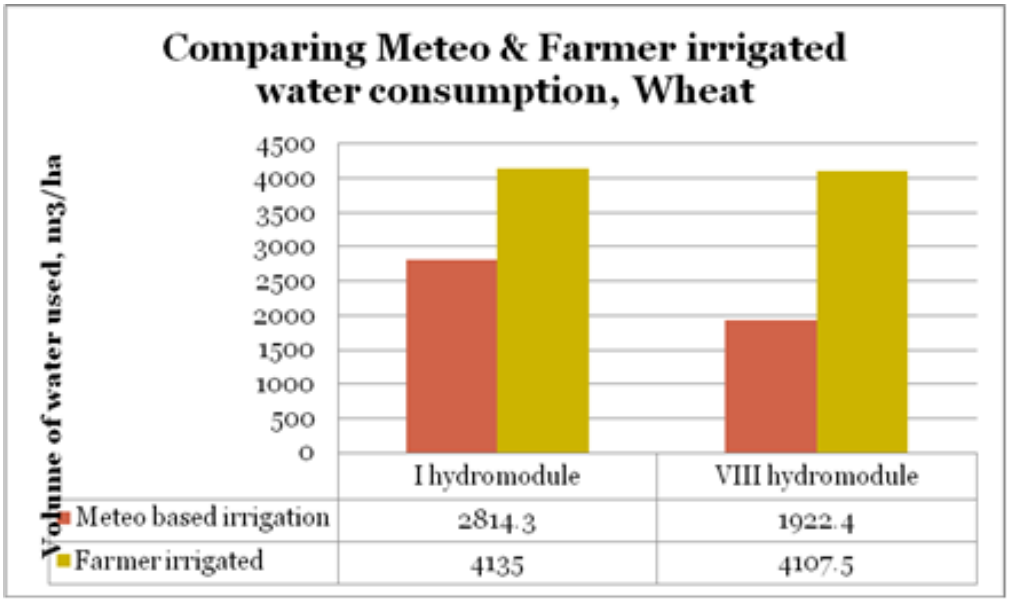
As already noted above, irrigation in the experimental sites were performed in two ways, i.e. traditional irrigation and irrigation based on the data from a small meteorological station and the soil moisture measurements.

The tables and graphs show that irrigation performed on the basis of meteorological parameters showed high efficiency for both wheat and cotton.

**Table.3. Water consumption of winter wheat in experimental sites**

| I-hydromodule - Andijan province, farm Davlat Ganimat | | | VIII-hydromodule, Fergana province, Tashpolatov Ganijon Shukhrat | | | |
|---|---|---|---|---|---|---|
| **Date** | Traditional irrigation | Meteo based irrigation | **Date** | Traditional irrigation | **Date** | Meteo based irrigation |
| | $m^3$/ha | $m^3$/ha | | $m^3$/ha | | $m^3$/ha |
| 17-Mar | 970 | 753 | 14-Mar | 935 | | |
| 20-Apr | 1090 | 565 | 16-Apr | 910 | 25-Apr | 909 |
| 11-May | 990 | 708 | 18-May | 1075 | | |
| 30-May | 1085 | 788 | 30-May | 1188 | 30-May | 1013 |
| | **4135** | **2814** | | **4108** | | **1922** |

**Fig. 4 Water consumption of winter wheat in experimental sites of I and VIII hydromodule zone within traditional and meteo-based irrigation**

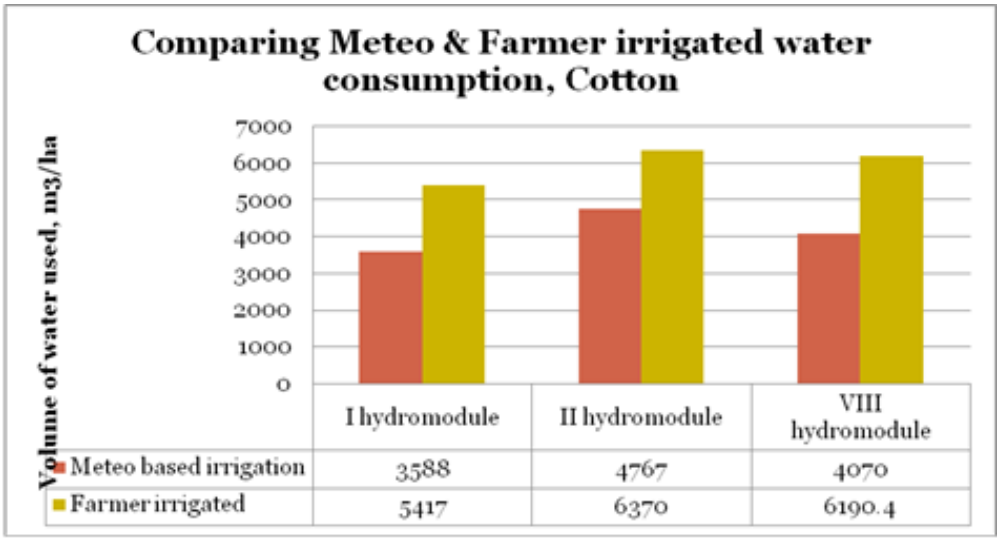



For the experimental site of winter wheat in VIII-hydromodule zone, the quantity of irrigation events is two times less in case of meteorological parameters based method than under the traditional method of irrigation. As a result, the irrigation rate of winter wheat in the first case is 2186 $m^3$/ha less than that in the traditional irrigation method.

As to irrigation of cotton, there is also a significant decrease in irrigation rates in all experimental sites. This was mainly due to the difference in watering depths between the traditional irrigation method and the meteorological parameters based irrigation method.

When performing irrigation in the traditional way, the irrigation rate is higher in all sites as compared to the new approach and this difference is from 1829 $m^3$/ha to 2130 $m^3$/ha.

**Fig. 5 Water consumption of cotton in experimental sites of I; II and VIII hydromodule zones within traditional and meteo-based irrigation**




Thus, by comparing the traditional method of irrigation scheduling with the new method based on use of meteorological parameters and soil moisture, one can conclude that the new approach helps to irrigate crops in optimal for plants dates and with optimal rates and significantly reduce the amounts of irrigation water used and increase water productivity.

**Fig. 6 Water productivity of cotton in experimental sites**

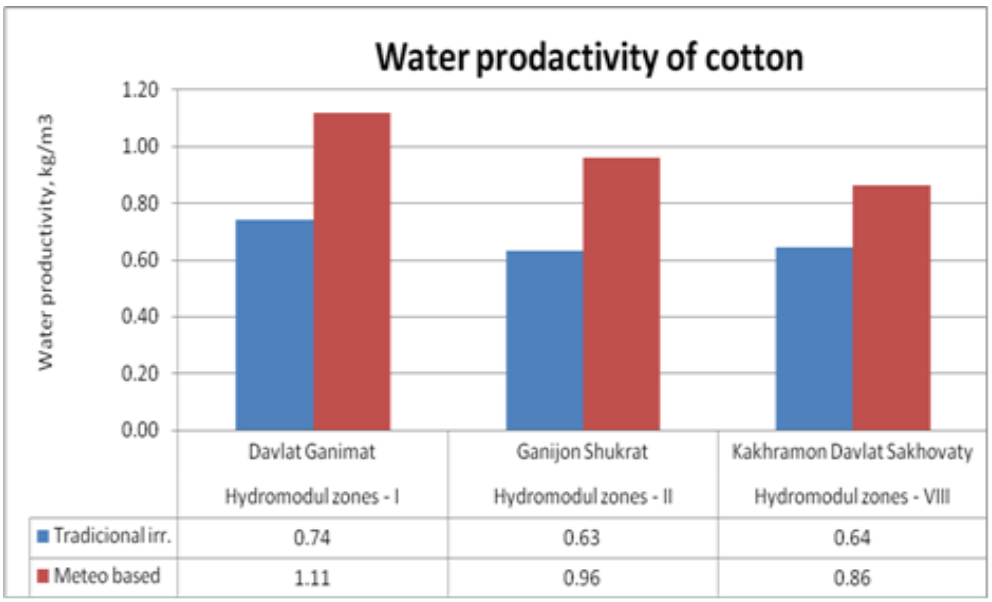
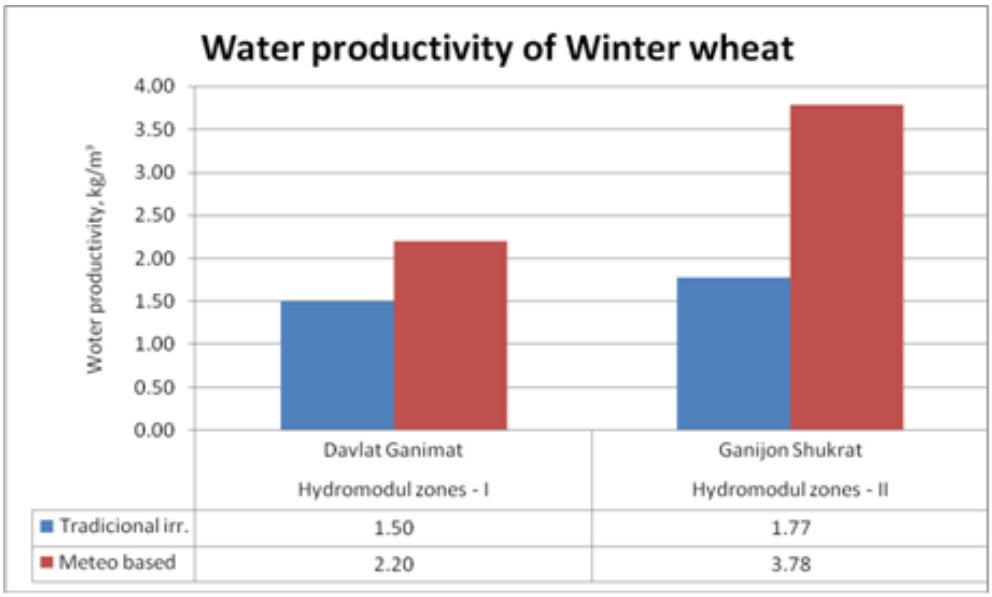


**Fig. 7 Water productivity of winter wheat in experimental sites**




As irrigation norms reduced with the help of this new approach, the water productivity increased in considerable extent. There is evidence that with the help of small meteo-station and soil moisture data it is possible to monitoring the soil water balance and let us to know how much and when to apply amount of water required for given crop.

Thereby, this method also provides adaptation to climate change in irrigated agriculture, managing irrigation and agronomic operations taking into account unexpected precipitations or water scarcity due to unexpected dry conditions.