CGIAR Research Program on Dryland Systems:

Water Use Efficiency Studies for Double Cropping Winter Wheat/Mung Bean

Odiljon Farrukhbek Sakhovati farm, Komiljon Umarov WUA, Tashlak district, Fergana Province

Irrigated crops in the Fergana Valley can be divided into two main groups: cotton/wheat cropping and other crops, including orchards, vineyards, melons, vegetables and fodders. A complex system of canals supplies irrigation water for the fertile soil of the Fergana Valley to cultivate primarily cotton and wheat, which occupy up to 88% of the irrigated land. The lands designated to produce other crops are very limited. In conditions of limited available space for vegetable and fodder production, farmers cultivate them after harvesting winter wheat from mid-June to October. However, the yield depends on irrigation water availability. In a competitive environment for limited water resources among domestic, industrial, hydropower and environmental uses, agriculture has to adapt to produce more with less water on low productive soil. Mung bean is not only a drought-tolerant crop but also is a very popular crop for food. Furthermore, it has soil fertility improvement characteristics. Profitability of the crop is another key factor for the producers. The objective of this study is to determine water requirements of mung bean sown after winter wheat harvesting. Understanding seed multiplication by farmers is also included in the study.

The field experiment on the mung bean variety 'Durdona' and a local variety is being carried on Odiljon Farrukhbek Sakhovati farm within the boundaries of Komiljon Umarov Water Users Association, Tashlak district of Fergana Province. The farm is located at a latitude of 40°31'59.90"N, longitude of 71°47'4.10"E on the elevation of 461 m. The farmer has 43.8 ha of land and specializes in growing cotton/wheat and vegetables. Water for irrigation comes from a canal and a well. The research activity was implemented immediately after harvesting winter wheat in an area of 0.5 ha. Soil samples were collected to identify soil texture and do chemical analysis (NPK, humus).

Odiljon Farrukhbek Sakhovati farm, Komiljon Umarov WUA

Soil chemical analysis was undertaken at the beginning and at the end of the research to determine the soil fertility improvement. Soil physical analysis was completed and factors were determined, such as bulk density, infiltration rate and water holding capacity of the soil. Soil moisture analysis was conducted by using a gravimetric method. Phenological observations, procedure and norms of irrigation, as well as economic effectiveness are being studied. Farming practices on the field on mung bean are shown in Table 1:

Table 1

Farming practice	Practice date and quantity

Manual labour:	
Sowing of seeds	10-11.07
Making distribution furrows	11.07
Biological Pest Control	27.07
Mechanical work:	
Ploughing	05.07
Leveling	07.07
Making furrows	09.07
Cultivation -1	26.07
-2	06.08
Irrigation: -1	12.07
-2	21.07

The experiment has 3 treatments with 3 replications. The area of each treatment is 240 m2. Each treatment consists of 16 furrows, of which 8 furrows under the mung bean variety 'Durdona' and 8 furrows under the local variety. Furrows are 50 m long and 60 cm wide. According to the methodology, the middle furrows are control furrows, while two rows on both sides respectively are protective ones. The total area of the plot is 0.5 ha.

№	**Mungbean varieties**	**Irrigation treatments**	**Notes**
1	Durdona	Farmer practice (control) (V-1)	Only measuring irrigated water
2	Local variety		
3	Durdona	Furrow irrigation (V-2)	Irrigation number is decreased 20% with respect to farmer practice
4	Local variety		
5	Durdona	Alternate furrow (V-3)	1st crop will be irrigated from one furrow and 2nd time irrigation will be taken from the next furrow
6	Local variety		

Expected results:

1. Determining crop water requirement
2. Collecting data of phenological observations and soil moisture content for crop modeling
3. Data collection on marketable valuable traits and economic effectiveness
4. Farm-based mung bean seed multiplication
5. Recommendation for farmers

Water use efficiency

Kahramon Davlat Sahovati farm, Kodirjon-Azamjon WUA, Kuva district, Fergana Province

The pilot studies are carried out on Kahramon Davlat Sahovati farm, which is located within the boundaries of Kodirjon-Azamjon Water Users Association, Kuva district, Fergana Province. It was selected because it meets the requirements for pilot farms in terms of the availability of necessary natural and socioeconomic conditions. The farm has 65 ha of land.

As the farm is a pilot site, four gauging stations were built there. These gauging stations, located at the demo sites allocated for cultivating cotton and winter wheat, were tested and put into operation:

1. One water measuring unit was set up at the entry into the cotton field - SANIIRI tray (LS-40), and another water measuring device (fixed stream) was set up at the entry into the wheat field. Hydraulic locks were set up before the gauging stations for controlling water flow at the gauging station itself, and controlling water supply to the demo sites allocated for cotton and winter wheat.
2. Two Cipoletti weirs (HF-50) were installed to measure water discharge at the exit of the demo sites, one for the cotton field and the other for the winter wheat field.

Irrigation water mainly comes from the main district canal South-Fergana Main Canal (SFMC). Kukonkishlok is an inter-farm canal. The internal irrigation network is the ditch Hakikat-1.

The main characteristics of the demo site for cotton cultivation

The total area for cotton cultivation is 32 ha, of which 19 ha is for the demo plot. Soil texture is medium loam. Soil on the demo site is not salinized. Irrigation water mainly comes from SFMC. The groundwater level is 1.5 - 2.5 meters. Water is measured at the entry into the demo site by the SANIIRI tray (LS-40), and water discharge on exit is measured by the Cipoletti weir (HF-50).

«Kahramon Davlat Sahovati» farm, Experimental field of the SIC-ICWC, facility for water supply and measurement

On 9 October 2013 an MTZ-80 tractor did fall-ploughing, but the quality of this work was low. Therefore, on 1 November 2013 an MTZ-80 tractor did fall-ploughing again at the depths of 35-40 cm, which was found to be satisfactory. According to the regulations of water zoning, the pilot field is within the 2nd water zoning district.

ET-gage evapotranspiration simulators were also installed to calculate evaporation at the demo field. Based on daily data on evapotranspiration, soil moisture changes and water consumption in the field are being analyzed. Irrometer tensiometers were installed to determine irrigation dates for crops at each demo site.

Adaptation of new varieties to local conditions and identification of irrigation schedule

Akmaljon Matmusaev farm, site for joint studies by AVRDC and SIC-ICWC

Akmaljon Matmusaev farm was established in 2006. The total area is 85 ha, of which 42 ha for cotton and 43 ha for wheat. The demo site for mung bean is 1 ha. Soil texture is medium loam. Soil on the demo site is not salinized. Irrigation water mainly comes from SFMC. The groundwater level is 3-5 meters. Water flow is measured at the entry into the demo site by a Cipoletti weir (HF-50). According to the regulations of water zoning, the pilot field is within the 2nd water zoning district.

New varieties of mung bean were planted in an area of 1 ha at the end of June after winter wheat was harvested. The purpose is to study adaptation of new varieties to local conditions and identification of irrigation schedule.

Each demo site is being monitored:

- for growth and development of crops (phenological observations every 5 days);
- for irrigation water supply to the field and irrigation water discharge from the field;
- for soil moisture after irrigation;
- for evapotranspiration from the field;
- for management and collection of data on agricultural activities: use of fertilizers, soil tillage, pests;
- for management and collection of financial indicators – expenses, yields, gross and net revenues.

Akmaljon Matmusaev farm, site for joint studies by AVRDC and SIC-ICWC; Maraimjon Mirzaliev - water supply specialist at Kodirjon Azamjon WUA