Report 2015

Output-2: Establishing field trials on conjunctive use of canal water, drainage water and groundwater (MS Word) - 2015

Title: Evaluate the effect of conjunctive use of canal and drainage waters, different cropping patterns, and improved irrigation practices on control of salinity and waterlogging and delineate most efficient water management and agronomic practices

CRP-DS Action site:	Aral Sea basin (the Khorezm province, Uzbekistan).
IARC Project Team:	Dr. Usman Khalid Awan, Groundwater Hydrologist Dr. Bogachan Benli (ICARDA) - Senior Irrigation and Water Management Specialist Mr. Tulkun Yuldashev - Soil and Water Specialist
Implementing Country:	Uzbekistan
ICARDA Program:	Integrated Land and Water Productivity Improvement in Aral Sea Basin
Research Team (National):	Khorezm Rural Advisory Support Service (Hereinafter KRASS) Scientific information Center for Interstate Commission for Water Coordination (SIC-ICWC)
Data collection site:	Ara Sea and Fergana valley action sites

Title: Evaluate the effect of conjunctive use of canal and drainage waters, different cropping patterns, and improved irrigation practices on control of salinity and waterlogging and delineate most efficient water management and agronomic practices

Overall Objectives (2015-2016)

- Comprehensive analysis of the dryland system to identify the different levels of canal water, groundwater and drainage water quality and quantity at different temporal and spatial resolution
- Identifying the potential of different crops to grown in the dryland system under waterlogging and salinity situation
- Calibrating and validating model for strategic crops (cotton/wheat) under intensive field trials
- Proposing different water management and agronomic practices simulated by SWAP model under different scenarios e.g., optimum salinity levels of irrigation water (canal water, drainage water), cropping pattern, irrigation practices

Outputs - 2015

- Collecting and analyzing data on the current status of groundwater levels and salinity, canal water use and salinity, irrigation and drainage layout, soil texture and salinity, climatic data (MS-Excel/GIS, MS Word) – 2015
- Establishing field trials on conjunctive use of canal water, drainage water and groundwater (MS Word) - 2015

Outputs – 2016

- Calibrated and validated groundwater model (unsaturated zone) for different scenarios (Model)
- Establishing strategies for optimum salinity levels of irrigation water (canal water, drainage water and shallow groundwater), cropping patterns, irrigation practices (MS Word)

Quantified Outcomes (2016):

- Farmers day for demonstrating the use of conjunctive water management strategies under different options
- Meetings and workshops with irrigation officials on use of different techniques for sustainable management of surface and drainage water

Quantified CD Outputs and Outcomes (2016):

- Training to the university students on state of the art tools (2)
- Training to the farmers to manage surface and drainage water in an optimum way (10)
- Training to the authorities for the management of marginal lands at mesoscale (2)

Quantified Gender Outputs and Outcomes (2016):

- Quantifying the role of women in managing irrigation and drainage systems(doc)
- Identifying the areas where women can participate actively for improving the water productivity under saline environment (doc)

Progress towards achieving outputs (2)-2015

Output-2 Establishing field trials on conjunctive use of canal water, drainage water and groundwater (MS Word) – 2015

Background

An extensive irrigation network exists in irrigated areas of Uzbekistan to convey freshwater mainly from the Syrdarya and Amudarya rivers to farmer fields. Losses from unlined irrigation conveyance infrastructure and over irrigation during field application led to shallow groundwater levels in the region. These shallow groundwater levels are threatening the menace of waterlogging and soil salinity. To control waterlogging and salinity, an extensive network of mainly open surface drains exists in the region. It has been observed during the last decades that the tendency of dry years is increasing in Uzbekistan. Moreover farmers are not getting adequate canal water supplies especially located at tail end reaches of the irrigation network. To combat water scarcity, farmers apply conjunctive use of canal and drainage water to achieve their yield targets. However continuous use of canal water and drainage water can build soil salinity in root zone, degrade the fertile agriculture lands and eventually reduce the crop yields. The hydrological models exists to simulate scenarios for proper management of canal water and drainage water in a more sustainable way. Moreover cropping patterns and improved irrigation practices can reduce the adverse impacts of soil salinity.

Strategy

Several models for simulating soil moisture and soil salinity in vadose zone exists. These models can simulate the impact of conjunctive use of canal water and groundwater, cropping strategies and irrigation practices on soil salinity and root water uptake and eventually crop production. Two spatial scales are selected to conduct this study i.e., field level and water consumer association (WCA) level. The WCA level study is used to delineate the WCA into different irrigation response units so that the characteristics of these IRUs can be used to upscale the field level results to the WCA and region as well as for other same regions. At field level, conjunctive water management experiments were designed where different levels of canal water and groundwater/drainage water mixing was used to analyze the impact of conjunctive water management.

Study site

The research field is located in the "Nauhas" water consumers' association of the Khorezm province (Figure 1). The field is geographically situated between latitudes 41º48´N and longitudes 60º66´E. The Khorezm province is located in northwestern Uzbekistan, on the left bank of the Amudarya River within the transition zone of the Karakum and Kyzylkum deserts. The area is characterized by arid continental climate. During vegetation season, the weather is hot and dry, while winter is cold. Precipitation around 100 mm on average occurs from October to May, but its share in satisfying crop water demands is not significant. At the same time, evapotranspiration in the range of 1170 mm (Conrad 2007) by far prevails over the precipitation, which creates the strong need for artificial irrigation. Cropping pattern is mostly cotton, wheat and rice, while the share of other crops is negligible.

The 9 ha irrigation field is equipped with the three subsurface tile drains discharging into the open collector drain. The water is supplied through the open canal in the north of the field.

Figure 1. Study site

Data collection

Data regarding soil moisture, soil salinity, soil texture, soil organic matter, hydraulic conductivity, pF curves, irrigation depths, irrigation water salinity, groundwater depth and salinity, crop height

and rooting depth, yield, fertilizer, pesticides and other inputs etc is being collected at high spatial and temporal resolution. These data sets will be used to calibrate and validate the groundwater model to simulate scenarios for conjunctive water management for long run.

Table-1 Data collection

Sr. No.	Description of parameters	Frequency of data collection period season
1	Soil moisture contents at 30, 60, 90 and 120 cm depths	5-days basis
2	Soil salinity at 30, 60, 90 and 120 cm depths	5-days basis
3	Soil texture (sand, silt and clay content) at 30, 60, 90 and 120 cm using pipette method	Only once
4	Soil organic matter at 30, 60, 90 and 120 cm using titration method	Only once
5	Hydraulic conductivity at 30, 60, 90 and 120 cm by field experiments	Only once
6	pF Curves	Only once
7	Rainfall and other metrological measurements	Daily basis
8	Irrigation depths	Same day
9	Irrigation water salinity	Same day
10	Groundwater depth and groundwater salinity	daily basis
11	Crop height and rooting depth	15-days basis
12	Yield	Only once
13	Fertilizer, pesticides and other inputs	When applied

Five divers for automatic recording of the groundwater table were installed in the field. After a week, one of the divers stopped working. Two divers also recorded electrical conductivity. The divers were set to record values once in every 3 hour. The average groundwater table was 1.3 (±0.3) cm below surface. The other parameters are being analyzed.

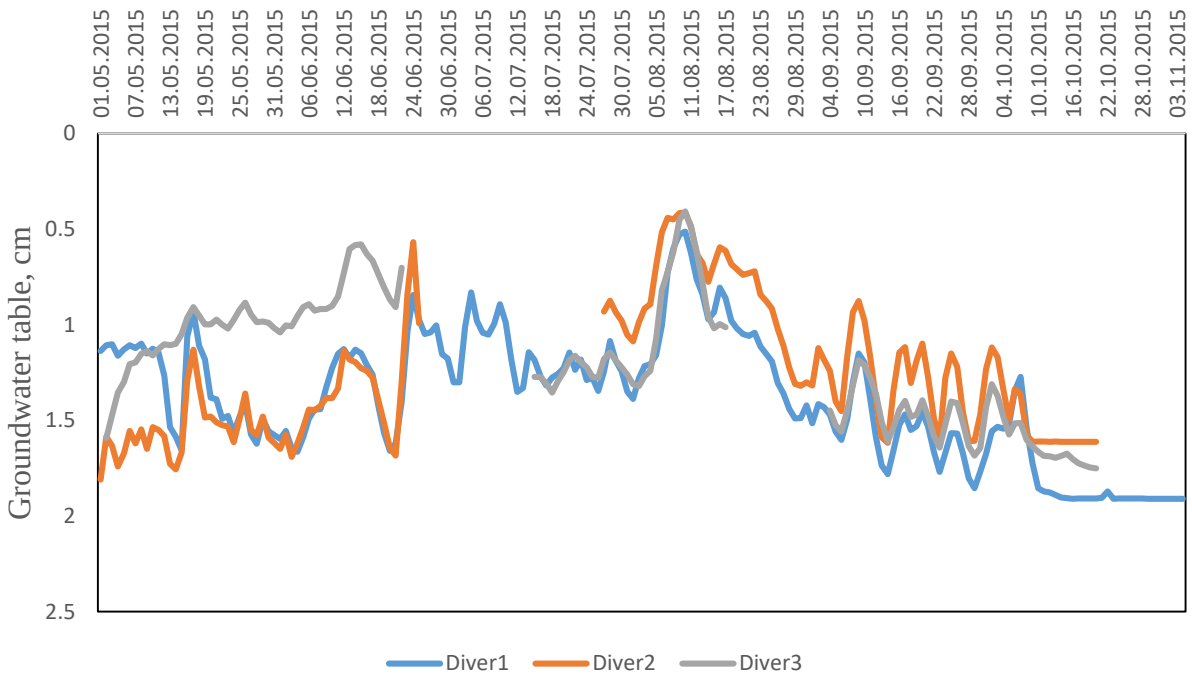

Figure 2: Variation in groundwater levels

Plans for 2016

The data described in Table-1 is collected and the samples are being analyzed. The experiments will continue for the next year as well. The results of the data collection for cotton 2015 will be ready by the end of January. These results will be used to setup the hydrological model (HYDRUS-1D) in an unsaturated zone.