Consultation Meeting on

CRP Dryland Systems Activity

Improving Water-use Efficiency through Innovative Technologies in Irrigation and Farming

Meeting Proceedings

January 26, 2015

Tashkent, Uzbekistan

A Introduction

The consultation meeting of the project titled: "Improving Water-use Efficiency through Innovative Technologies in Irrigation and Farming" under framework of CRP Dryland Systems Activity (CRP 1.1) was organized in the conference room of Ramada hotel, Tashkent, on January 26, 2015 and was attended by around 30 participants. The participants comprised experts from the International Center for Agricultural Research in the Dry Areas (ICARDA-HQ, Amman, Jordan), United State Department of Agriculture (USDA-ARS Conservation and Production Research Laboratory), the regional office ICARDA for Central Asia and the Caucasus (ICARDA-CAC, Tashkent, Uzbekistan), agricultural research programs (Research Institute of Irrigation and Water Problems, TIIM) and Scientific-Information Centre of the Interstate Commission for Water Coordination of Central Asia (SIC ICWC), and Non-government organization KRASS (Khorezm Rural Advisory Support) as well as representatives of regional water management Units (Water User Associations) from Fergana valley (Uzbekistan and Tajikistan). The list of the participants is attached in Annex I.

The purposes of the consultation workshop were i) to summarize the project's research activities and its results in the abovementioned countries, ii) to familiarize NARES researchers with principles and practices involved in designing, managing and data collection of field crop experiments, and iii) to link the CRP-DS WUE activity with the needs of the stakeholders, inform them of ICARDA methodologies, the purpose, the timeline and expected outputs and outcomes

B Agenda

The agenda of the final workshop envisaged i) presentations by key policy and decision makers on problems farmers in irrigated areas of Uzbekistan and Tajikistan are facing and how irrigated agriculture is conducted in the area, ii) reporting on the project response to these problems and how research activities are planned to be conducted (presentations and discussions of overall project research activities in Fergana Valley and Khorezm areas), and iii) a roundtable discussion and planning session for 2015 in which each team member had been assigned a responsibility, asked their needs and problems and given a target to deliver by the due date. The detailed program is attached in Annex II.

C January 26, 2015: Session 1 - Opening

The Deputy Head of Representative Office of International Center for Agricultural Research in the Dry Areas (ICARDA), **Mr. Rustam Ibragimov**, welcomed all participants on behalf of the ICARDA, gave a short summary about the main achievements of the CRP 1.1 WUE Project, and expressed hope for successful work of the workshop.

Dr. Victor Dukhovny, Director of Scientific-Information Centre of the Interstate Commission for Water Coordination of Central Asia (SIC ICWC), welcomed all the participants, thanked ICARDA for organizing such an important workshop. He added that local scientists have been worked successfully in the region for many years to address water management issues and their knowledge and experience could be used during the project implementation. He highly appreciated ICARDA for flourishing collaboration with national partners.

Dr. Halimjon Hodjiev, Deputy Head of Regional Water Management Unit at Sogd province, Tajikistan, welcomed all the participants, thanked ICARDA-CAC for organizing such an important workshop and remarked that reforms in agricultural sectors in Tajikistan has lead to breaking up big farms into smaller ones (up to 5-10 ha). Farmers do not have much experience in proper water and fertilizers applications. So realization of the project will create instruments and mechanisms for proper use of water resources in Tajikistan.

Mr. Jurabek Saimatov, Deputy Head of Syrdarya Sokh Basin Management of Irrigation System, welcomed all the participants. He said that deficit of water resources has become main obstacle in achieving higher crop yields and highlighted importance of development of the water saving technologies for Uzbekistan and other Central Asian countries, which highly rely on agriculture and crop production. He highly appreciated CRP WUE project activities which lead to higher wheat productivity in Kuva district, where farmers got 6.2 t/ha wheat yield and 4.2 t/ha cotton yields at their pilot fields.

Mr. Shuhrat Ergashev, Deputy Head of WUA Tomchi Kuli, informed that water storage in Toktogul and Andijan water reservoirs is much lower due to relatively low precipitation in 2014-2015 winter seasons. This clearly shows that there is a risk of crop failure during drought years and he highlighted the importance of developing water saving technologies and best farming practices. He said that Uzbekistan Government developed strategic plans to implement and upscale the water saving technologies (decree # 82, 171, 176). So, the objectives of this project are in line with the Uzbek State program.

Dr. Vinay Nangia, Agricultural Hydrologist, Project Manager, ICARDA HQ, presented CRP 1.1 Dry Land System activities where he specifically discussed six intermediate development outcomes (IDO), seven CRP 1.1 sub activities (Increase livestock productivity, B. Richkovsky, Establish Innovation Platform, B. Dosov, Knowledge management CACILM Phase, A. Akramkhanov, Strategic gender research, N. Mukhamedova and Improving water use efficiency through innovative technologies in irrigation and farming, V. Nangia) and their leaders, CRP requirements and approaches during the meeting.

D January 26, 2015: Session 2 – Presentations on agricultural water management issues in Central Asia

The session started with a presentation by **Dr. Rahimjan Ikramov**, Head of the Department, Technologies for Management of Amelioration Processes in the Irrigated Lands, Research Institute of Irrigation and Water Problems. In his presentation titled: "Adjustment of crop irrigation scheduling and hydro-module zoning of irrigated lands", he explained that mainly two approaches are being used in hydromodule zoning (HMZ) of irrigated lands in Central Asia (SredazHydrovodhlopk, 1969& Uzbek Cotton RI, 1987) and the Uzbek Ministry of Agriculture and Water Resources recommends irrigation rates based on HMZs. The HMZs are delineated by taking into account the soil types, soil depths and groundwater levels. But these recommendations were outdated since they were prepared during Soviet time and they don't take into account the salinity, sowing methods (laser leveled, open area), crop varieties (drought tolerance and soil salinity resistance) and irrigation techniques (furrow length, water discharges). However, FAO methods prescribing irrigation scheduling on the base of estimating of ET using Penman Monteith approach could be well accepted by the local

community in Uzbekistan and it needs calibration of crop coefficients and other parameters for the local weather, soil conditions.

Mr. **Kurban Sharipov,** Agronomist, WUA Qodirjon Agzamjon**,** Kuva district, Fergana province, made a statement on "Issues and options in irrigation water distribution at the level of WUA in Fergana valley". In his statement, he stressed the following issues: farmers don't follow the prescribed irrigation rates, wheat is a new crop and not all farmers have agricultural background so they apply usually 7-8 (up to 10) irrigations for wheat crop in Fergana valley. He said that in 2014 WUA Project staff had achieved the highest wheat yield of 6.0 t/ha by applying just 6 irrigations for early maturity wheat varieties. Although cotton irrigation regime is well studied in Uzbekistan, farmers often stop irrigation in August which lead to higher soil dryness and difficulties during tillage operation to plant winter wheat into standing cotton. Planting of wheat into standing cotton has become traditional practice of wheat planting in Uzbekistan. So there is need to study irrigation regimes of wheat and cotton crop for the current farming practices and the soil climatic conditions.

E January 26, 2015: Session 3 – Presentations on CRP 1.1 WUE Dryland Systems WUE activity in Central Asia

Dr. Vinay Nangia, Agricultural Hydrologist and Project Manager, ICARDA-HQ thanked workshop organizers and expressed warm gratitude to national partners for their support for project implementation and made a presentation titled "Overview of CRP-DS WUE activity". In his presentations Dr. Nangia highlighted objectives, justified the pilot sites selection and soil characterization in 2 focus areas (Fergana valley - Uzbekistan & Tajikistan side and Aral Sea Basin-Khorezm area), project's scientific methods/approaches and progress achieved so far (soil sampling for physical and chemical properties, crop modeling training, stakeholder awareness building) and plans for the future.

Dr. Prasanna Gowda, Research Agricultural Engineer, USDA-ARS Conservation and Production Research Laboratory, USDA-ARS, Bushland, Texas, made a presentation on "Evapotranspiration-Based Irrigation Scheduling in Uzbekistan". In his presentation, Dr. Gowda described in detail the ET-based irrigation scheduling method which has been successfully used for irrigation scheduling of major crops (winter wheat, cotton, corn, Sorghum) in the Texas High Plains, a part of the Ogallala Aquifer Region, since 1991. He highlighted importance of using the ET-based irrigation scheduling for Uzbekistan conditions and explained how Bushland Reference ET (BET) Calculator could be used for estimating reference ET and how crop coefficients will be developed using the water balance method in order to determine the timing and rates of irrigation applications in the field demonstration experiments in Fergana valley and listed required data to be collected by NARES partners under the close supervision of the ICARDA Coordinator.

Dr. Mariya Glazirina, Crop Modelling and Climate Change Specialist, ICARDA, made a presentation on "Using Crop modeling tools (CROPSYST/DSSAT) for crop yield prediction (Mariya Glazirina, Tulkun Yuldashev)". In her presentation, she explained basic principles of crop simulation models, their application areas, DSSAT (Decision Support System for Agro-technology Transfer) model selected by the Project team, DSSAT model data requirements and described how the model is being calibrated for eight winter wheat

cultivars, which had been tested in 2012-2013 and 2013-2014 to select the facultative wheat varieties for tolerance to heat stress during flowering stages at the experimental site managed by the Kashkadarya Research Institute of Grain Breeding and Seed Production of Cereal Crops (KRIGBSPCC) near Kovchin village of Karshi district, Kashkadarya region, Uzbekistan. These calibrated parameters will help to develop crop coefficients that will be used in ET-based irrigation scheduling in Fergana valley covering both Uzbekistan and Tajikistan.

Dr. Shukrat Mukhamedjanov, National Project Manager, SIC ICWC, made presentation on "Overview of CRP-DS WUE research activities in Fergana valley and Tajikistan (Soil sampling, equipment)". In his presentation, he showed allocation of 7 experimental sites in three Water User Associations (Kodirjon Azamjon; Tomchikuli and Chashma) in seven hydro module zones (I, II, III, IV, VI, VIII, and IX) in Fergana valley of Uzbekistan and Tajikistan. He demonstrated irrigation equipment (ET gauges, tensiometers, etc.) installed at demonstration fields, process of monitoring of soil moisture, irrigation inflow/outflow and ET, phenological observations at the site as well as agro-economic assessments of agriculture production in demonstration sites. Additional he mentioned how soil physical parameters (Field Capacity and infiltration rates) had been determined at the selected 7 sites.

Dr. Yulduz Djumaniyazova, Senior Researcher, KRASS, Urgench made presentation on "Evapotranspiration-based Irrigation Scheduling for Winter Wheat and Cotton in the Aral Sea Basin, Uzbekistan". In her presentation, she mentioned objectives of CRP1.1 WUE Project, Location of Khorezm province on the Aral Sea basin, she stressed that the effects of CC in terms of increase in air temperature (+0.4^{o}C during April-May) on cotton production in time interval from 1970 to 2012 might not be severe but it may be more severe for wheat production where air temperature increase (+2.7^{o}C during November-March) is much higher at the same time interval. She justified selection of the Ostona WCA and described the experimental field site characteristics (soil type, groundwater level and salinity) of Xushnudbek farmer, Ostona WCA, Yangyarik district, Khorezm where the trials had been established. She also provided first calibration results of DSSAT model for wheat cultivar Kupava at this area.

F January 26, 2015: Session 4 –Group discussion on planning for 2015

The session started with discussions of proposed research activities mentioned in the detailed work plan for January 2015-December 2015 for experimental sites in Fergana Valley/Aral Sea Basin (the document was provided in folders). Dr. Vinay Nangia familiarized all participants with proposed activity/aims/methods/team/expected outputs/outcomes. He mentioned importance of proper field data collection and need for organizing trainings to NARES on data collection methods by SIC ICWC. Afterwards, participants discussed field measurements of irrigation amount and outflow, measurement of soil water storage, plant characteristics (LAI, groundcover measurements) and yield parameters. Dr. Prasanna Gowda recommended establishing 6 (5 furrows each with 5 m length) experimental plots at 7 selected sites at ET based irrigation plot and at control (WUA proposed irrigation scheduling plots) and put soil moisture measurement devices right in the center of the plots. Three plots each will be managed under ET- and WUA-based irrigation recommendations. This will lead to a total of 42 plots in the Fergana valley. In all 42 plots, all crop data parameters, irrigation

amounts, farming practices etc. will be monitored for winter wheat. The same experimental design was proposed for cotton. Dr. Nangia said that ICARDA will provide NARES additional access tubes and Diviner instrument for soil moisture measurements, LAI meters, and digital cameras for all 3 WUA in Fergana valley (Uzbekistan and Tajikistan). Additionally he mentioned that Specialist will come by end February (when snow melt) to Uzbekistan to establish weather system, demonstrate access tube installations and calibration of Diviner instruments. Dr. Nangia informed that ICARDA launched website where all materials (photos, Soil maps, ET based calculator, training materials, brochures, work plans) developed during the Project will be uploaded and there will be open access to all datasets. He stopped on importance of climate change studies to help planners (policy makers) to change policies on the base of predicted yields developed by DSSAT/other models so there is need required data base for crop modeling activities. NARES partners fully agreed with proposed activities and deliverables as mentioned in work plan.

Closing remarks

Closing remarks were made by the national coordinators of the Fergana valley and Aral Sea basin. Drs. Shuhrat Mukhamedjanov, Halimjon Hodjiev and Liliana Sin emphasized that great work was conducted during the CRP WUE project and there is a need for continuing such research activities at this and following years, as farmers are highly interested in adopting these technologies.

Dr. Nangia Vinay and Dr. Prasanna Gowda thanked all people who was involved in organizing and conducting the workshop and requested to contact ICARDA specialists (Dr. Mariya Glazirina and Tulkun Yuldashev) in case if they have any issues related to implementation of research activities at their corresponding sites.

CGIAR CRP 1.1 Research Program on Dryland Systems

Improving water use efficiency through innovative technologies in irrigation and farming in cereals, potatoes, vegetables, horticultural and fodder crops

Workshop

In collaboration with CGIAR Program Facilitation Unit for Central Asia and Caucuses

26 January, 2015

Tashkent, Uzbekistan

G Annex 1: List of Participants

N	Name	Position	Affiliation	Address	Contacts
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H Annex 2: Workshop Program

Meeting on

CRP Dryland Systems Activity

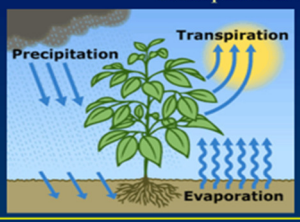
Improving Water-use Efficiency Through Innovative Technologies in Irrigation and Farming

08:30-09:00	Arrival of participants and registration	
Opening session		
09:00-09:05	ICARDA welcome statement	Dr. Jozef Turok
09:05-09:10	Self-introduction of participants	
09:10-09:15	Welcome by the host country	Kuchkarov Sharifjon
09:15-09:20	SIC-ICWC welcome statement	Dr. Viktor Dukhovniy
09:20-09:30	Objectives and expected outputs from this workshop	Dr. Vinay Nangia
Presentations on agricultural water management issues in Central Asia		
09:30-09:45	Adjustment of crop irrigation scheduling and hydro-module zoning of irrigated lands	Dr. Rahimjan Ikramov
09:45-10:00	Issues and options in irrigation water distribution at the level of WUA in Fergana valley	Mr. Kurban Sharipov
Presentations on CRP 1.1 WUE Dryland Systems WUE activity in Central Asia		
10:00-10:15	Overview of CRP-DS WUE activity	Dr. Vinay Nangia
10:15-10:30	Overview of weather station network-based irrigation scheduling system	Dr. Prasanna Gowda
10:30-11:00	Coffee break and group photo	
11:00-11:20	CRP-DS WUE work plan, deliverables, scientific methods, principles of field plot experimentation, data collection formats, equipment purchased and need for training	Dr. Vinay Nangia
11:30-12:30	Introduction in experimental design and methods of irrigation scheduling using weather system	Dr. Prasanna Gowda
12:30-12:40	Overview of CRP-DS WUE research activities in Fergana valley and Tajikistan (Soil sampling, equipment)	Dr. Shukrat Mukhamedjanov/ Mr. Azamat Mukhamedjanov
12:40-12:50	Overview of CRP-DS WUE research activities in Aral Sea Basin (preliminary results)	Ms. Liliana Sin and KRASS team
12:50-13:00	Using Crop modeling tools (CROPSYST/DSSAT) for crop yield prediction	Dr. Mariya Glazirina/ Mr. Tulkun Yuldashev
13:00-14:00	Lunch	
Group discussion on planning for 2015		
14:00-15:00	Technical session: moderated discussions about CRP-1 WUE expectations and work plan,	Dr. Vinay Nangia/ Dr. Prasanna Gowda

	deliverables, scientific methods, principles of field plot experimentation, data collection formats, equipment installations and need for training	
15:00-15:30	Dividing participants to concurrent working groups (Fergana, Sogd, Khorezm) with Group Moderators to discuss and finalize detailed work plan and time table for 2015	All participants
15:30-16:00	Coffee break	
16:00-17:00	Continuing discussions in working groups. Group presentations of work-plan. Leader of Groups will present planned research activities, anticipated outcomes, issues and logistical problems discussed in 3 working groups	All participants
17:00-18:00	Round table discussion and feedback on how to best respond to the needs of the farmers and report and disseminate results	All participants
18:00	Closing and farewell	

Background

Evapotranspiration (ET) = Evaporation from soil
+
Transpiration by plants



Background

- Reference ET (ET_{ref}):
  - ET_{ref} refers to the amount of water that would be lost to the atmosphere from a hypothetical grass or alfalfa crop when water is not a limiting factor (Allen et al., 1998)
  - Grass or alfalfa reference crop
- ET_{ref} can be calculated using meteorological data:
  - Solar radiation (R_s),
  - Wind speed (U_2),
  - Air temperature (T_a), and
  - Relative humidity (RH).

Reference ET

- Reference ET Calculation
  - ASCE-EWRI Standardized ET Equation

$$ET_{sz} = \frac{0.408\,\Delta\,(R_n - G) + \gamma \frac{C_n}{T + 273}\,u_2\,(e_s - e_a)}{\Delta + \gamma\,(1 + C_d u_2)}$$

ET-based Irrigation Scheduling in Uzbekistan

- Need ET
- ET = Kc x Reference ET

Weather Data

From Field Studies
E.g. from KRASS in this case

Reference ET Input

- Weather data?
  - Minimum and maximum air temperature
  - Solar radiation
  - Wind speed
  - Relative humidity
  - Precipitation
  - Atmospheric pressure

Crop Coefficient (Kc)

- Direct field measurements of Crop ET
  - Lysimeters
  - Eddy covariance systems
  - Soil water balance method
    - KRASS field data
    - DSSAT crop modeling to develop crop efficient
  - Refining the Kc with Fergana Valley field trails that you will be conducting

ET-Based Irrigation Scheduling

▶How do we do it?

➔when soil-water level is less than 50%, irrigate.

If WC = 50% of FC, Irrigate

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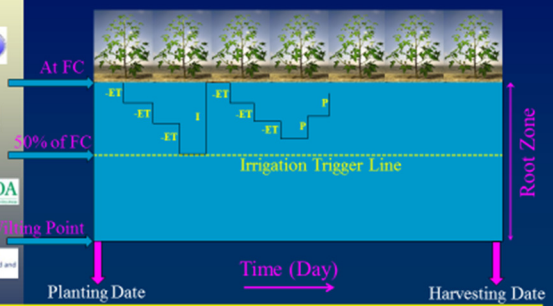
ET-Based Irrigation Scheduling

▶How do we do it?



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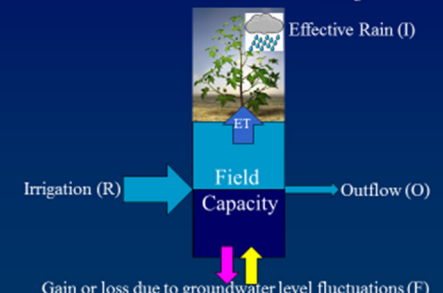
ET-Based Irrigation Scheduling

▶Field Demonstration Experiment

➔when soil-water level is less than 50%, irrigate.



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ET-Based Irrigation Scheduling

▶What do we need?

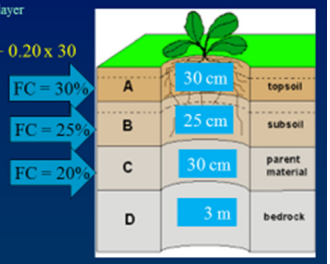
➔ Effective precipitation, Water storage at FC, and ET

➔Determine water storage in the root zone (WHC) at FC

▶ Field capacity of each layer

WHC = 0.3 x 30 + 0.25 x 25 + 0.20 x 30

WHC = 21.25 cm of water



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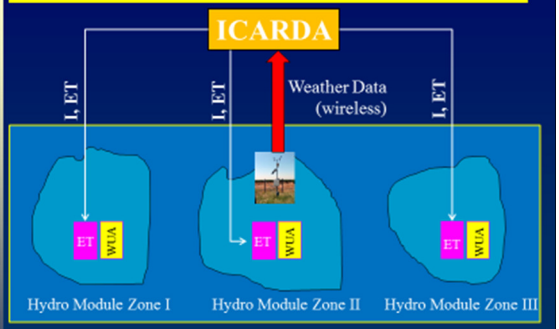
ET-Based Irrigation Scheduling in Uzbekistan



Water User Association 1

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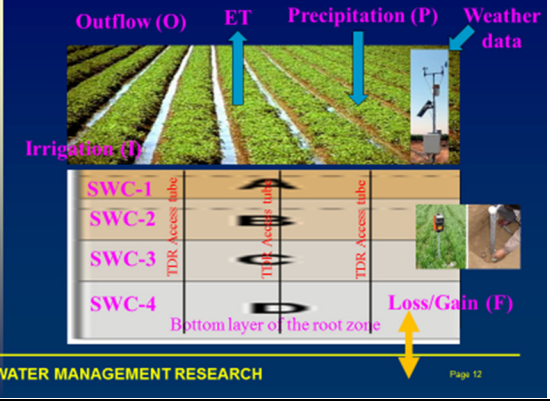
Field Set Up



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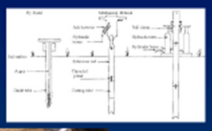
Field Setup

- Access tube for TDR measurements
  - Soil water content

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ET By Water Balance Method

$$ET = P + I + F - O - \Delta S$$

ET - Crop water use
P - is Precipitation
I – Irrigation
F - Flux across the lower boundary of the root zone,
O - Sum of runoff and run-on
ΔS is the change in soil water content in the soil profile.

ET from this method will be used to refine Kc for Fergana Valley

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