Technical Report

on

Supplemental Irrigation

1 – 5 May, 2016

Amman, Jordan

Organized by

International Center for Agricultural Research in the Dry Areas (ICARDA)

In collaboration with

National Center for Agricultural Research and Extension (NCARE)

Under the support of

Japan International Cooperation Agency (JICA)

Arab Fund for Economic and Social Development (AFESD)

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Executive Summary

Name of the project

Capacity Development for Agriculture and Water Management for Iraq and Regional countries

Partners

Japan International Cooperation Agency (JICA)
Arab Fund for Economic and Social Development (AFESD)
International Center for Agricultural Research in the Dry Areas (ICARDA)
National Center for Agricultural Research and Extension (NCARE)

Purpose

To enhance capacity development of government officials and researchers who are engaged in agricultural development in Iraq and other countries.

Specific objectives of the training course on Seed Health Testing

To present up-to-date knowledge and enhanced capacity on best practice for supplemental irrigation.

Specific outputs

Nine professionally-trained NARS partners from Iraq, 2 from Jordan and 5 from other countries: 1 from Algeria, 1 from Lebanon, 1 from Palestine, 1 from Tunisia, and 1 from Morocco on improving skills for supplemental irrigation with an emphasis on dry land agriculture. While 9 Iraqi, 1 Lebanese, 1 Algerian and 2 Jordanian are funded by JICA, the remaining participants were sponsored by Arab Fund for Economic and Social Development (AFESD).

Specific outcomes

Design, implement, manage, analyze and report on research and development in supplemental irrigation and acquire up-to-date information on research and practical activities in supplemental irrigation in each participating country.

General Overview

Water is the major limiting factor for agricultural production in the dry areas of Central and West Asia and North Africa (CWANA). Agriculture accounts for around 80% of diverted water consumption in the region. However, the rapidly growing population, industrialization, and urbanization will lead to reallocation of water increasingly away from agriculture to other sectors of the economy. Contrasting this, high population growth rates will require a continuous increase in agricultural production to meet demand if regional governments are to reduce their exposure to imports.

There are few opportunities for the capture of new water resources, and there is a tendency toward non-sustainable, over-exploitation of existing sources. Therefore, sustainability of agricultural production depends on conservation and appropriate allocation and management of the scarce water resources in the region. Improving the efficiency of water use through improved crop selection, cropping patterns, cultural practices, and improved management techniques is essential to boost on-farm productivity either under rainfed or irrigated conditions. Further an important approach towards improving water use efficiency is to link on-farm issue with the watershed/landscape level through the application of integrated natural resource management methods.

ICARDA's mission is to improve the welfare of people through agricultural research and training to increase the production, productivity, and quality of food, while preserving or improving the resource base. ICARDA's training courses are designed to improve the capabilities of scientists and technicians in national agricultural research systems (NARS) in developing countries to conduct research independently, and to foster the transfer of technology and address issues related to farmers' decisions in adopting new technologies. To this end, ICARDA organized and presented this course.

Course objectives

Water scarcity is usually the biggest yield-limiting factor in the dry areas. Supplemental irrigation is an important technique to overcome water stress in rainfed croplands of West Asia and North Africa and become climate-resilient. Supplemental irrigation – providing small quantities of water at crucial growth stages, to supplement rainfall – can increase both yield and water productivity, which is the quantity of grain produced per unit of water used.

The course trained participants from CWANA rainfed countries with the expectation that they will serve as trainers upon return to their respective countries and train another 20-25 technicians. Accordingly, this training program utilized a train-the-trainer approach.

Organization of the Course

With financial support from the Japan International Cooperation Agency (JICA), through its overseas office in Jordan and Arab Fund for Economic and Social Development (AFESD) in collaboration with the Jordan's National Center for Agricultural Research and Extension (NCARE), the International Center for Agricultural Research in the Dry Areas (ICARDA) conducted the course at ICARDA's offices in Amman, Jordan. The course included classroom lectures and discussions, as well as practical field and laboratory exercises. The lectures were presented in English, and all course material was provided as hardcopies as well as softcopies in the form of individual flash drives to the trainees. A certificate of attendance was awarded at the end of the course to each trainee.

Organizing Committee

Mr. Charles Kleinermann, Head, ICARDA Capacity Development Unit (CDU)
Dr. Vinay Nangia, ICARDA Agricultural Hydrologist, Course Coordinator

Course Structure

The course was composed of theoretical lectures and field demonstration visits. The theoretical lectures covered: 1. Basic soil-water-plant-management inter-relations with emphasis on computing crop water needs; 2. Fundamentals of supplemental irrigation practices with emphasis on irrigation scheduling; 3. Methods of water application systems for supplemental irrigation; 4. Optimizing supplemental irrigation systems operation and management; and 5. Economics and sustainability issues of supplemental irrigation. The field visits included showing the trainees cropped fields under supplemental irrigation. The trainees were exposed to different components and function of the supplemental irrigation components (hardware) as well as demonstrations on how to measure soil moisture in the root zone of growing crops and how to determine the amount of supplemental irrigation to be applied.

Course implementation

The duration of the course was 5 working days; four days for lectures and 1 day for demonstration field visits.

On Sunday, Dr. Vinay Nangia introduced the trainees to the course and to each other followed by a zero assessment to test the background knowledge of the participants. In the afternoon, Dr. Ahmed Hachum provided the lectures to introduce the **concept of supplemental irrigation** and **soil water plant relationships, soil texture and water retention.**

The second day was dedicated to **evapotranspiration (ET) of crops and water requirements, and irrigation scheduling** followed by **optimization of supplemental**

irrigation. Tuesday focused on **soil moisture and water measurement and monitoring** and **water application systems** to improve crop water productivity.

On Wednesday, the trainees were taken to **Mushaggar research station** of ICARDA where they visited several experiments on supplemental irrigation and laboratories analyzing soil and water samples for physical and chemical parameters.

The last day of the course was dedicated to case studies **for Best Supplemental Irrigation Practices** and discussion followed by a final assessment test and general course evaluation.

Zero - Final assessment

The course evaluation was carried out using a knowledge gain measurement method through which participants were subjected to a zero assessment test at the beginning and at the end of the course. The difference in scores of the participants between the two tests are reported in Annex IV. The results showed an average of 89% gain in knowledge from the course ranging from 39% to 73% which is significant for a 1 week of training.

General course evaluation by trainees

At the end of the training, the trainers offered to each participant the opportunity to provide feedback on their perception of the effectiveness of training process, format and content. This gives ICARDA valuable information from which to validate or fine-tune each training component (sessions, format, content, tec.), as well as the overall training program.

Through the training evaluation questionnaires, various evaluations were carried out during the course, including a specific evaluation for each part of the course. Here we

present an overview of the final evaluation. Issues considered were the topics and thematic areas of the course, the trainers and the organization, as well as general suggestions (Annex III).

Regarding the overall methodology of the training course, most of participants qualified it as excellent (57%) and 36% of participants expressed very good. Participants expressed their interest in giving more time for discussion, case studies and group work.

With respect to the technical level of the topics covered in the training, 84% of the participants considered that the delivered material was useful and effective. Some of them commented that it's better to have a meeting after two or three years for feedback of how the training affected our work.

Conclusion

The course provided both theoretical and practical guidance to the trainees in supplemental irrigation. The participants nominated for the course were of high quality and appeared eager to participate. The mix between lectures and discussions appeared to work well, and the enthusiasm of the participants over the 1 week course appeared to remain high.

The course evaluations support the approach taken, and the pre and post knowledge assessment tests show an overall improvement in understanding the material.

As per the comments from the trainees and the scientists, trainees would benefit more if the follow up sessions were held after 2 -3 years. The course is evaluated as successful by the lecturers. However, in the view of capacity development to actually improve skills and techniques on water management with its use efficiency for higher agricultural production, more follow-up (ex. such as a mentoring program) for those who received the highest score in the training should be offered as a non-degree training program under the supervision of ICARDA scientists to apply and tailor the knowledge gained to the specification of their research and field activities in their own country.

Annex I: Course Program

Date	Lecture	Time	Lecturers
Sat, 30 April	Arrival in Amman		
Sun, 1 May	Registration	8:30-9:00	CDU, ICARDA
	Opening session	9:00-09:30	ICARDA
	Zero Assessment test	9:30-10:00	
	Coffee Break	10:00-10:15	
	Irrigated versus rainfed agriculture: *the concept of supplemental irrigation*	10:15-12:00	Dr. Ahmed Hachum and Dr. Vinay Nangia
	Lunch	12:00-13:00	
	The soil-water-plant relationships, soil texture and water retention	13:00-15:00	
Mon, 2 May	ET of crops and water needs	9:00-10:30	Dr. Ahmed Hachum and Dr. Vinay Nangia
	Coffee Break	10:30-10:45	
	ET of crops and irrigation scheduling	10:45-12:00	
	Lunch	12:00-13:00	
	Optimization of supplemental irrigation: *supplemental irrigation comes at cost*	13:00-15:00	
Tues, 3 May	Field soil moisture measurement and monitoring: techniques and procedures	9:00-10:30	Dr. Ahmed Hachum
	Coffee Break	10:30-10:45	
	Methods of water application systems for supplemental irrigation	10:45-12:00	Dr. Ahmed Hachum
	Lunch	12:00-13:00	
	Irrigation water measurement and improving crop water productivity*: if you do not measure it, you cannot manage it*	13:00-15:00	Dr. Ahmed Hachum and Dr. Vinay Nangia
Wed, 4 May	Field visit – Mushaggar Research Station	9:00-15:00	ICARDA
Thurs, 5 May	Examples and case studies for Best Supplemental Irrigation Practices (BSIP)	9:00-10:30	Dr. Ahmed Hachum
	Coffee break	10:30-10:45	ICARDA
	Final assessment and course Evaluation	10:45-11:45	
	Closing ceremony	11:45-12:30	
	Lunch	12:30	
Friday, 6 May	Departure from Amman to return home		

Annex II: Trainers

Dr. Ahmed Y. Hachum is a Professor of Farm Irrigation and Water Management at the College of Engineering, University of Mosul (MU), Mosul, Iraq. He earned his B.Sc. in civil and irrigation engineering from University of Baghdad (1967) and M.Sc. (1973) and Ph.D. (1976) in Agricultural and Irrigation Engineering from Utah State University, Logan, Utah, USA. He joined Utah State University staff for one year as Postdoctoral appointee and worked for one year as consultant in Keller-*Bliesner Engineering*, USA**.** Head of the Irrigation and Drainage Engineering Department, MU during 1992 to 1997; Editor in Chief for the *Al-Rafidain* Engineering Journal (MU) for several years; consultant for the Ministries of Irrigation and Agriculture in Baghdad for many years. His main field of interest includes: farm irrigation systems design and management, water harvesting, supplemental irrigation, deficit irrigation, and improvement and optimization of agricultural water productivity. Dr. Hachum is the author of more than 80 technical publications, including 74 refereed publications, book chapters and technical reports, and two textbooks on irrigation principles, planning, Design, and management. His current research is focusing on the improvement of water productivity for rainfed and irrigated agriculture through improved farm water management and better production input. He is privileged for being visiting scientist and consultant at ICARDA several times during the last 17 years. He supervised numerous graduate students and teaches different graduate courses in mechanized and modern irrigation systems, farm irrigation water management, drainage engineering, simulation and mathematical modeling, optimization and system analysis.

Dr. Vinay Nangia is an Agricultural Hydrologist at ICARDA and an Adjunct Professor at the Texas A&M University (USA). He received his Ph.D. in Water Resources Science and two M.S. degrees - one in Biosystems & Agricultural Engineering and another in Geographic Information Science - all from the University of Minnesota, USA. Throughout his career, he has applied skills in hydrologic and crop modeling, and GIS and remote sensing to research issues relating to climate change, climatic variability, conservation agriculture, water quality, water productivity, land degradation and sustainable crop production. During a 9-year research career, he has served as a PI or co-PI on research projects worth about $5.75 million, authored or co-authored 59 technical publications that include 22 refereed journal articles in national or international journals. Dr. Nangia is an internationally-recognized authority in hydrologic and water quality modeling and GIS applications in water resources management. He has offered more than 20 trainings (covering a total of 400 participants) on hydrologic modeling in 10 countries. Dr. Nangia serves on the editorial board of professional society journals. He has served as research advisor/committee member to M.S. and Ph.D. students and was a visiting assistant professor (2007-2011) at the Institute of Soil and Water Conservation of the Chinese Academy of Science where he co-advised graduate students. Previously, Dr Nangia was a NSERC Visiting Fellow at Agriculture and Agri-Food Canada conducting research on GHG emissions from sub-surface tile-drained croplands of Eastern Ontario prior to which he was a post-doctoral fellow at the International Water Management Institute (IWMI), where he started his career in 2005.

Annex III: General Course Evaluation

I. Contents of the course:

Item/rating/percentage	1	2	3	4	5
Relevance of the course to your job			4.4		
Accomplishment of subject matter			4.2		
Clarity of course objectives			4.3		
Level of lectures			3.9		
Time allocated for discussions			3.5		
Interaction with participants enrolled in the course			4.2		
Overall, how would you rate this course			4.6		

II. Schedule and time allocation:

Item/rating/percentage	1	2	3	4	5
Percentage of Time allocated to lectures 1=Too short 5=Too long			3.8		
Usefulness of Lectures 1=not useful 5=useful			4.5		

III. Teaching aids:

Item/rating/percentage	1	2	3	4	5
Effectiveness of teaching aids in general 1=Not effective 5=Very effective			4.2		
Clarity of slides/overheads/PowerPoint 1=Not clear 5=Very clear			3.4		
Handouts and material 1=Not useful 5=Very useful			4.2		

IV. Administrative arrangements:

Item/rating/percentage 1=NI 5=Excellent	1	2	3	4	5
Pre-course communication			4.4		
Travel arrangements			4.8		
Quality of the accommodation			4.9		
Payment of allowance on time			4.6		
Transportation			4.6		
Lecture rooms			4.1		

Your comments and suggestions on the course:

1. Please state the three most important ideas/concepts that you learned from this course
   - Management water resources and soil
   - Water harvesting technique and supplemental irrigation
   - The important of water productivity to improve water use
   - Exchange knowledge with different countries
   - How to measure water productivity
   - Seeing the fields on site
   - Water economic
   - New irrigation methods
   - Water shed modeling-range land
   - Climate change
2. Suggestions for future improvement of the courses
   - Field visits and lab visit are very useful, if possible visit more sites
   - Tell the trainees about the case study topics earlier. Exams can be in a separate day from the presentation day, give notice to trainees before attending the course about the assessment exam.
   - Lectures should be based on excises and case studies
   - The presentations subjects that the trainees had to do at the end should have been given since the first week so they could have more time prepare

3. Do you recommend this course to be repeated in the future?

   Yes ☐ No ☐

   100%

Annex IV: Zero and Final assessment scores

A/ Trainees funded though JICA

#	Name of trainee	Zero assessment test/45	Final assessment test/45
1	Ms. Hala Hashim Dahad	14	22
2	Mr. Hussain Ali Hussain	7	26
3	Ms. Noor Adeeb Mansoor	10	28
4	Mr. Ali Fakhri Kadhim	17	24
5	Ms. Ghadah Salah Shawqi	17	34
6	Mr. Mohammed Zuhair Hassan Sharif	13	24
7	Mr. Wafi Mohammed Kadhim	9	21
8	Mr. Anas Mohammed Mahdi	16	30
9	Mr. Basim Tuama Naser	12	33
10	Mr. Abderrahmane Taib	13	22
11	Mr. Salim Fahed	24	36
12	Mr. Ibrahim Mohammed Al-Amad	22	34
13	Ms. Doaa Ismail Abuhamoor	14	34
	Highest	**24**	**36**
	Lowest	**7**	**22**
	Avarage	**14.46**	**28.30**

B/ Trainees funded through AFESD

#	Name of trainee	Zero assessment test/45	Final assessment test/45
14	Mr. Tarik Benabdelouahab	31	36
15	Ms. Faten Ahmad Abu Rajab Al Tamimi	13	40
16	Ms. Hiba Kharabsheh	22	42
17	Ms. Olfa Boussadia	16	34
	Highest	**31**	**42**
	Lowest	**13**	**34**
	Avarage	**20.5**	**38**

C/ Group Average Score : Zero and Final Assessment Test

	Name of trainee	Zero assessment test/45	Final assessment test/45
	Highest	**31**	**42**
	Lowest	**7**	**22**
	Average	**17.48**	**33.15**

Annex V: List of participants

A/ Trainees funded through JICA

#	Name of nominee	Country	Gender	Current position/Institutions	Telephone number	E-mail address
1	Ms. Hala Hashim Dahad Lafta	Iraq	F	Engineer/ General Commission for Irrigation and Reclamation project	00964-7700624009	lolohashim30@gmail
2	Mr. Hussain Ali Hussain	Iraq	M	Agricultural engineer/ Ministry of Water Resources (MoWR)	00964-7805795675	hsen_82@yahoo.com
3	Ms. Noor Adeeb Mansoor	Iraq	F	Assitant engineer/National Center for Water Recourses, MoWR	00964-7721403436	noor_198912@yahoo.com
4	Mr. Ali Fakhri Kadhim	Iraq	M	Civil engineer/MoWR	00964-7801655681	ali_fk87@yahoo.com
5	Ms. Ghadah Salah Shawqi	Iraq	F	Civil engineer/MoWR	00964-7902736087	ghadakhatone@yahoo.com
6	Mr. Mohammed Zuhair Hassan Sharif	Iraq	M	Senior engineer/ MoWR	00964-7901418131	mohammed_sharif56@yahoo.com
7	Mr. Wafi Mohammed Kadhim	Iraq	M	Engineer/ MoWR	00964-7808434234	wafi_1979@yahoo.com
8	Mr. Anas Mohammed Mahdi	Iraq	M	Engineer/ MoWR	N/A	anas1990anas1m@gmail.com
9	Mr. Basim Tuama Naser	Iraq	M	Assistant chief Agricultural Engineer/ MoWR	N/A	basimtuama@gmail.com
10	Mr. Taib Abderrahmane	Algeria	M	Agricultural engineer /technical institute of field crops, Ministry of Agriculture	00213-664176312	walidkhaled54@yahoo.fr
11	Mr. SALIM FAHED	Lebanon	M	Research assistant / Irrigation and Agro-meteorology Department, LARI	00961-71634455	salimfahed@hotmail.com
12	Ms. Doaa Ismail Abuhamoor	Jordan	F	Research Assistant /National Center for Agricultural Research and Extension (NCARE)	00962-799209535	eng.doaa_abuhamoor@yahoo.com
13	Mr. Hiba Mashhour Al-Kharabsheh	Jordan	M	Research Assistant/National Center for Agricultural Research and Extension (NCARE)	00962-799209535	hibamsus@gmail.com

B/ Trainees funded through AFESD

#	Name of nominee	Country	Gender	Current postion/Institutions	Telephone number	E-mail address
14	Ms. Olfa Boussadia	Tunisia	F	Assistant Professor, Olive Tree Institute (Sousse station)	216 22546275	boussadio@yahoo.fr
15	Ms. Faten Ahmad Aburajab Al Tamimi	Palestine	F	Assistant Professor, Olive Tree Institute (Sousse station)	599926503	Faten_aburajab@yahoo.com
16	Mr. Tarik BENABDELOUAHAB	Mococco	M	Researcher/INRA	212 523440006	tarik.benabdelouahab@gmail.com
17	Ms. Hiba Kharabsheh	Jordan	F	Jordan University	-	hibamsus@gmail.com