Food and Agriculture Organization of the United Nations

Regional Workshop
17-22 May 2015 - Cordoba, Spain
GCP/INT/231/SWI Output 1

Strengthening Agricultural Water Efficiency and Productivity on the African and Global level

Theme 1: Water Accounting

Theme 2: Water Productivity

Theme 3: Water Harvesting

Theme 4: Agricultural Water Policy

Theme 5: Water Use Efficiency

CORDOBA WORKSHOP REPORT

Capacity development for farm management strategies to improve crop-water productivity using Aquacrop

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Cordoba, 2015

1. Background and justifications

The project "CP/INT/231/SWI: Strengthening Agricultural Water Efficiency and Productivity on the African and Global Level" aims at reducing hunger and poverty in three African countries (Burkina Faso, Morocco and Uganda) by focusing on the improvement of Agriculture Water Management (AWM) and mainstreaming AWM in national frameworks and processes. The objectives of this project are in line with the Comprehensive Africa Agriculture Development Programme (CAADP), which provides a common framework for stimulating and guiding national, regional and continental initiatives for enhanced agriculture productivity in Africa.

The ultimate beneficiaries of the project are the small-scale and family farmers, but the overall approach of the project is a combination of bottom up and top down activities and different levels (micro, meso and macro levels). For this reason, the project will be working with extension agents and farmers' representatives (micro level), research institutes and regional governance structures (meso level), and national governments (macro level).

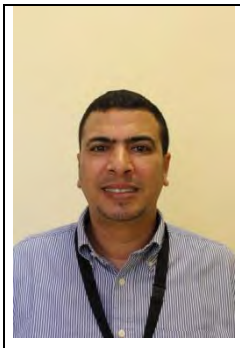
One of the main outputs of the project is to enhance capacity for improved crop water productivity in small-scale agriculture in Burkina Faso, Morocco and Uganda (Output 1). The workshop "Capacity Development for Farm Management Strategies to Improve Crop-Water Productivity Using AquaCrop" was one of the activities of this output. The workshop was organized by FAO/AgWA and the University of Cordoba as part of the Capacity Building for improved crop water productivity in small-agriculture in Burkina Faso, Morocco and Uganda. The workshop ran from Monday 18 to Friday 22 May 2015 at the Headquarters of the University of Cordoba, Cordoba, Spain. The last day, the workshop was held at the Institute for Sustainable Agriculture (IAS-CSIC) with the aim of carrying out a visit of the irrigation experimental fields.

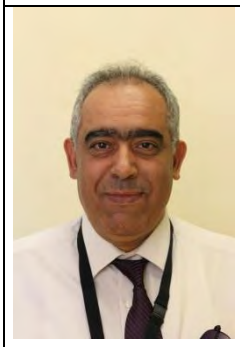
In January 2009, the Water Development and Management Service (NRLW) of FAO released AquaCrop, a crop model to simulate yield response to water under multiple scenarios. This model can be a useful tool to identify and assess strategies for improving crop water productivity.

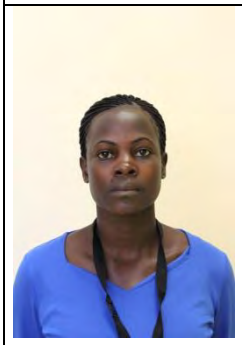
The objective of the workshops was to train participants from the three countries of the project on the practical applications of AquaCrop, in order to improve their skills in strategic management towards increasing crop water productivity in rain-fed and irrigated production systems, and to establish national core teams acquainted to AquaCrop and be able to service project's future activities concerned with Crop Water Productivity theme.

2. Participants

The participants came from governmental and non-governmental agencies dealing with agricultural water resources management, from extension services formulating practical advices to farmers, and from relevant research or higher education institutions.

	**Mahjoub Lahrache** Ingénieur en Chef.Coordonnateur National Direction de l'Irrigation et de l'Aménagement de l'Espace Agricole, Maroc

	**Hamid Chababi** Directeur Régional l'Office National du Conseil Agricole de l'Oriental, Maroc
	**Bassou Bouazzama** Chercheur Institut National de la Recherche Agricole, Maroc
	**Ali Bekraoui** Ingénieur chercheur au Service des Expérimentations des Essais et de la Normalisation Direction de l''Irrigation et de l''Aménagement de l''Espace Agricole Ministère de l''Agriculture et de la Pêche Maritime, Maroc
	**Hassan Bellouch** Marocco
	**Aziz Abouabdellah** Enseignant Chercheur l'Ecole National d'Agriculture de Meknès, Maroc

	**Ronald Kato Kayizzi** National Project Coordinator Deputy Commissioner MAAIF, Uganda
	**Angella Namyenya** Agricultural Officer MAAIF/Extension, Uganda
	**Rajab Namakhola** Agriculture Officer Mbale District/PISD Project District Support Officer, Uganda
	**Charles Mutumba** Research Officer AETREC, Uganda
	**Joshua Wanyama** Lecturer Makerere University, Uganda

	**Martin Ameu** FAO Uganda
	**Kima Etienne** Technicien supérieur en Pédologie Chef de Service Gestion Durable des Terres (MARHASA), BurkinaFaso
	**Nikiema Patarbtalé Joseph** Ingénieur Agronome Chargé des Aménagements Hydro-Agricoles (MARHASA), Burkina Faso
	**Amadou Kinda** Agro-économiste, Enseignant CAP Matourkou, Burkina Faso
	**Illa Moussa** Ingénieur en Vulgarisation MARHASA, Burkina Faso

	**Kambou Donkora** Agronome/ Coordonnateur National du projet MARHASA, Burkina Faso

2. Resource Persons

The resource persons came from the KU Leuven University, Belgium; the University of Cordoba, Spain, FAO-AgWA Secretariat; and FAO-NRL.

	**Dirk Raes** KU Leuven University Faculty of Bioscience Engineering Department of Earth and Environmental Sciences Celestijnenlaan 200E - PostBox 02411 B-3001 Leuven, Belgium
	**Elias Fereres** University of Cordoba Soil-Plant-Water Relations Group Department of Agronomy Campus Rabanales, Edificio C4 Cordoba, Spain
	**Margarita Garcia-Vila** University of Cordoba Soil-Plant-Water Relations Group Department of Agronomy Campus Rabanales, Edificio C4 Cordoba, Spain

	**Lebdi Fethi** AgWA Coordinator FAO, Addis Ababa, Ethiopia
	**Maher Salman** Technical Adviser NRL-FAO-Rome

3. Programme

The first four days were organized in 4 sessions: two in the morning, of 1.5 h each, dedicated to understanding the conceptual background and calculation procedures of the AquaCrop software; and two sessions in the afternoon, of 1.5 h each, devoted to exercises at the PC. The last day, the workshop finalized at mid-day with a lunch in the gardens of the Institute for Sustainable Agriculture (IAS-CSIC).

The opening ceremony took place on Monday 18 May 2015 at 9 am with representatives from FAO and University of Cordoba. Addresses were given by:

- Enrique Quesada Moraga (Vice-Rector of Innovation, Transfer and Excellence Campus, University of Cordoba)
- Lebdi Fethi (AgWA Coordinator, FAO)
- Elias Fereres and Dirk Raes (Conductors of the workshop).

The training, which was conducted in English (with explanations performed in French), consisted of theoretical sessions (conducted by Elias Fereres and Dirk Raes) and practical sessions at the computer (conducted by Dirk Raes and Margarita Garcia-Vila). The theoretical and practical sessions took place in an equipped room of the Headquarters of the University of Cordoba. A memory stick with the training material (see Annex II) was distributed to all the participants at the beginning of the workshop.

The workshop was also taken as an opportunity to discuss, in the framework of the GCP/INT/231/SWI project, the applications of AquaCrop to enhance crop water productivity in the three countries. Three discussion groups (Burkina Faso, Marocco and Uganda) guided by the facilitators were organized on Thursday afternoon (see Annex III for the synthesis of the discussion groups).

The last day, a visit of an experimental almond orchard at the Institute of Sustainable Agriculture

(IAS-CSIC) was performed. The purpose of the visit was to provide participants with a general view of an irrigation experimental field and its usual equipment (lysimiter, neutron probe, porometer, dendrometer, scholander pressure chamber, etc.).

At the closing ceremony, Maher Salman (Land and Water Division, FAO), Elias Fereres and Dirk Raes gave an overview of the workshop, and addresses of thanks and appreciation. Subsequently the participants fill in the evaluation forms of the workshop. At the end of the ceremony, the certificates of attendance were distributed to all the participants.

	Day 1	**Day 2**	**Day 3**
	Introduction to AquaCrop	***Soil characteristics***	***Yield response to water***
Morning Session 1 **(9:00-10:30)**	**Opening ceremony** Introduction to the course Presentation of AquaCrop user-interface	Soil characteristics: – Soil Physical Characteristics – Soil Water content – Soil Water balance – Soil water movement – Specification of soil characteristics in AquaCrop	Crop characteristics: – Crop Transpiration – Biomass production – Yield response to water Rainfed farming: – Initial soil water content – Start of growing cycle
			Coffee/tea break
Morning Session 2 **(11:00-12:30)**	***Climate***	***Crop characteristics and Projects***	***Irrigation management***
	Reference ET (ETo) Agroclimatic data collection and processing Required weather data for AquaCrop	Crop characteristics: – Canopy development – Tuning of canopy development to local environmental conditions – Crop canopy response to water Creating and updating projects	Water Productivity Irrigated farming – Net irrigation requiremen – Irrigation schedule – Generation of Irrigation schedule – Deficit irrigation

	Day 1	Day 2	Day 3	Day 4	Day 5
	Climatic data processing	***Simulations with AquaCrop***	***Simulations with AquaCrop***	***Simulations with AquaCrop***	***Simulations with AquaCrop***
Afternoon Session 1 **(14:00-15:30)**	Practical Exercise on PC: – ETo calculator – Input of climatic data and calculation of ETo	Practical Exercise on PC: – Database management (Soil) – Database management (Crop) – Canopy development	Practical Exercise on PC: – Database management (Crop) – Response to water stresses	Practical Exercise on PC: – Database management (Irrigation) – Irrigation scheduling – Discussion groups	
Coffee/Tea break					

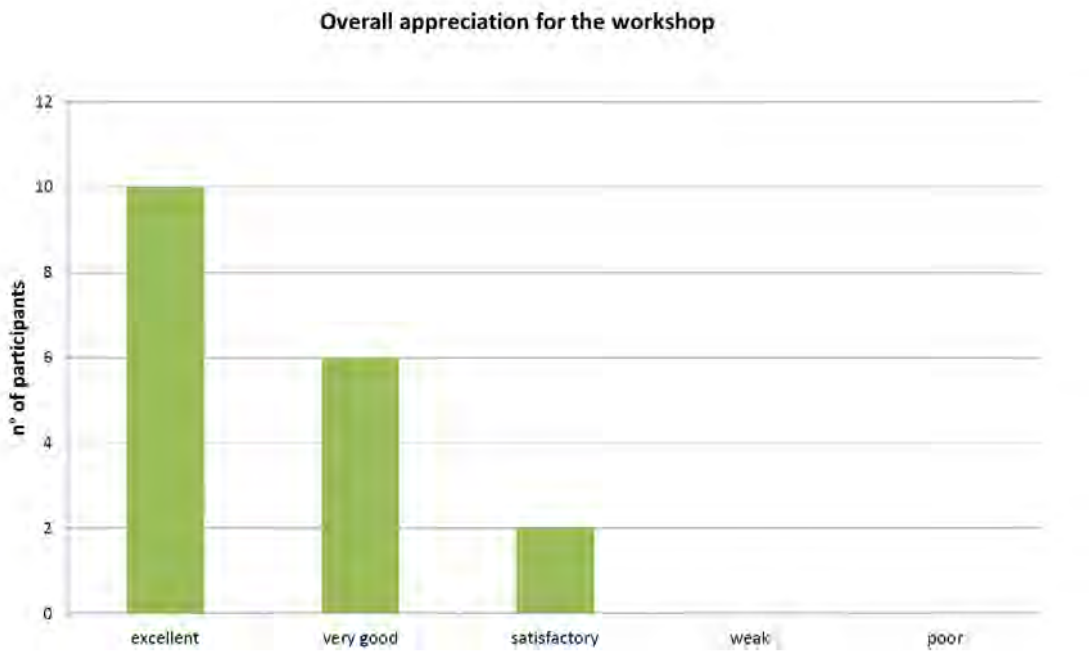
	Day 1	Day 2	Day 3	Day 4	Day 5
	Climatic data processing	***Simulations with AquaCrop***	***Simulations with AquaCrop***	***Simulations with AquaCrop***	***Simulations with AquaCrop***
Afternoon Session 2 **(16:00-17:30)**	Practical Exercise on PC: – ETo calculator – Import of climatic data – AquaCrop: Database management (Climate)	Practical Exercise on PC: – Database management (Crop) – Canopy development	Practical Exercise on PC: – Initial soil water content – Start of the growing cycle (rainfed agriculture) – Net irrigation requirement	Practical Exercise on PC: – Database management (Field Management) – Limited soil fertility	

4. Evaluation

An evaluation form (Annex 1) was distributed to the participants on the last day of the training course and anonymously completed.

4.1 General aspects of the AquaCrop workshop

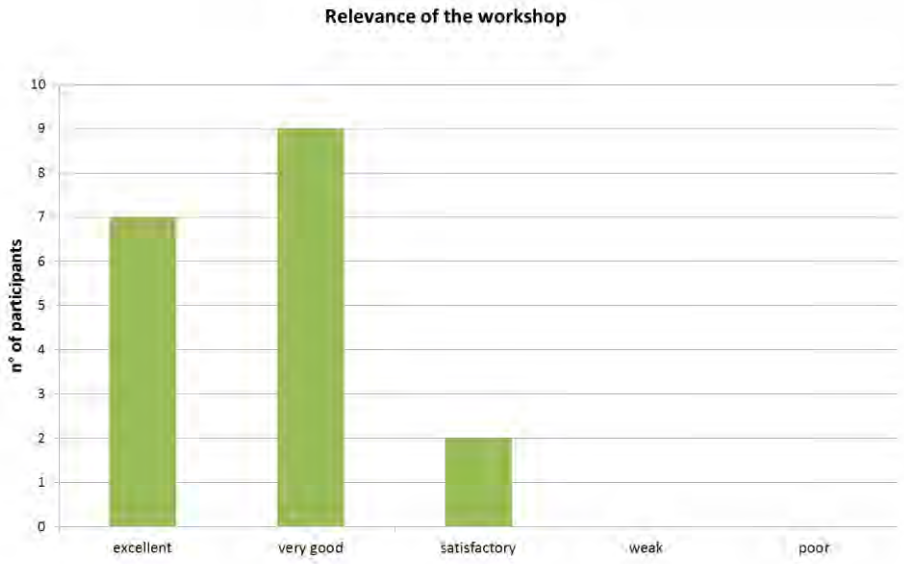
Overall appreciation of the workshop



Comments:

- The course was well presented and it is relevant.
- It is very useful.
- The training is really very nice. The AquaCrop tool can be used in planning to make decisions for productivity.
- Very important, the contribution is appreciated.
- The instructors were very excellent.
- The material included in the stick memory and PPT were impressive.
- It provided an introduction to AquaCrop as a tool.

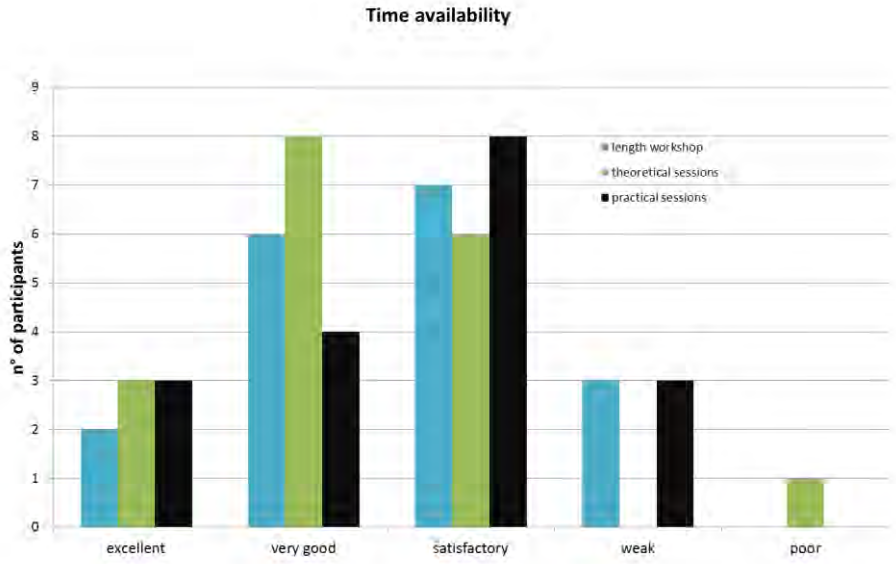
Relevance



Comments:

- Very relevant.
- I will use it in the future for sure.
- It gives me an added value.
- I directly work with farmers in an irrigation scheme but there are still issues of water productivity, so this tool will help me to plan how to improve farmer productivity.
- A lot of interest for work.
- I am involved in research on agricultural water productivity.
- For technical capacity.

Length of workshop, time availability for theoretical and practical sessions



Comments:

Length of the workshop

- Enough to make a good idea on how the model works.
- The duration in the day is very long (it must not exceed 6 hours).
- Not sufficient but it was most the appropriate.
- It is necessary a day for the theoretical and practical module.
- This workshop needs 2 weeks.
- The time is good for us to get familiar with the AquaCrop tool but not enough time to internalise it.
- More time is necessary.
- The time is satisfactory for learning.
- The law of diminishing return sets in on day 5.
- This training needed two weeks for better understanding.
- This would be appropriate for a follow up training.
- Sessions were too short.

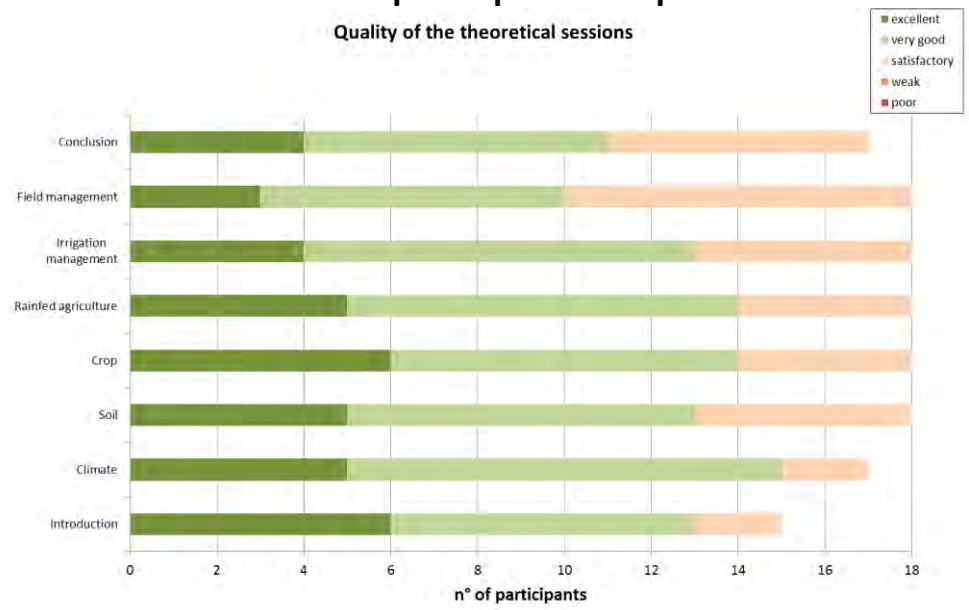
Time for theory

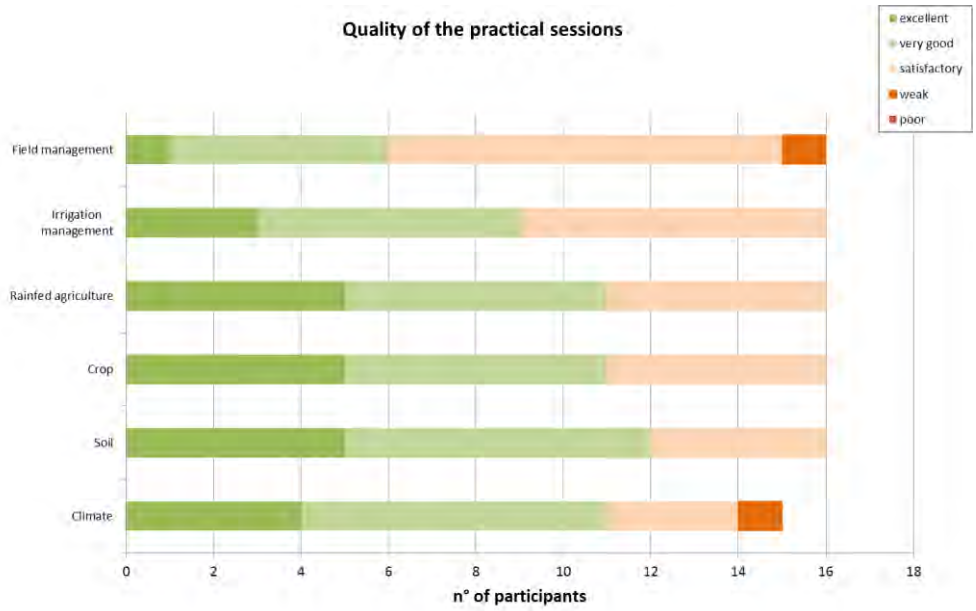
- The time was sufficient but for people with prior understanding of water productivity.
- Good sufficient.
- All the concepts were carefully explained. I think the time was perfect.
- It is necessary to increase the time in theoretical session.
- We should take more time.
- Time was not enough.
- The theory time was good.
- It was short for the first time user.
- More discussions were needed.

Time for practical sessions

- The time for practical was very sufficient.
- Sufficient but more time needed at individual level.
- The language barrier made it necessary to move forward more slowly to ensure that everyone understood.
- Never enough! But perfect as a start point to play with the model.
- Time was not enough
- There is need for more time to be allocated to individual practical sessions.
- Generally satisfactory.
- The time for the practical session wasn't sufficient.
- It was short for the first time user.
- A bit more time should be allowed for hands on.
- We needed more time for practical work with facilitator.
- There was not enough time to link the theory to the practical session.

4.2 Individual sessions of the AquaCrop workshop





Comments:

Introduction:

- It was elaborate.
- All sessions call for more practice when we go back to our home country.

Climate:

- Creation of the climatic files was lengthy.
- Needs more exercises.
- I understood the steps of creating .CLI files.
- The part of ETo calculator was slow.
- I think that the creation of the climate is the most important thing. Therefore, it would be necessary to make more exercises for this module.

Soil:

- Well presented.
- Session understood but not enough practice.

Crop:

- Well presented.
- Session was good but time of understanding crop files on computer.

Rainfed agriculture:

- Well presented.
- This calls for a lot of information and experience at farmer field level.

- Session understood but little practice.

Irrigation management:

- Well presented.
- The link with water use efficiency is critical and should be emphasized.
- Need more individual practical sessions.
- Session good.
- The simulation of the water balance by the model should be well detailed.

Field management

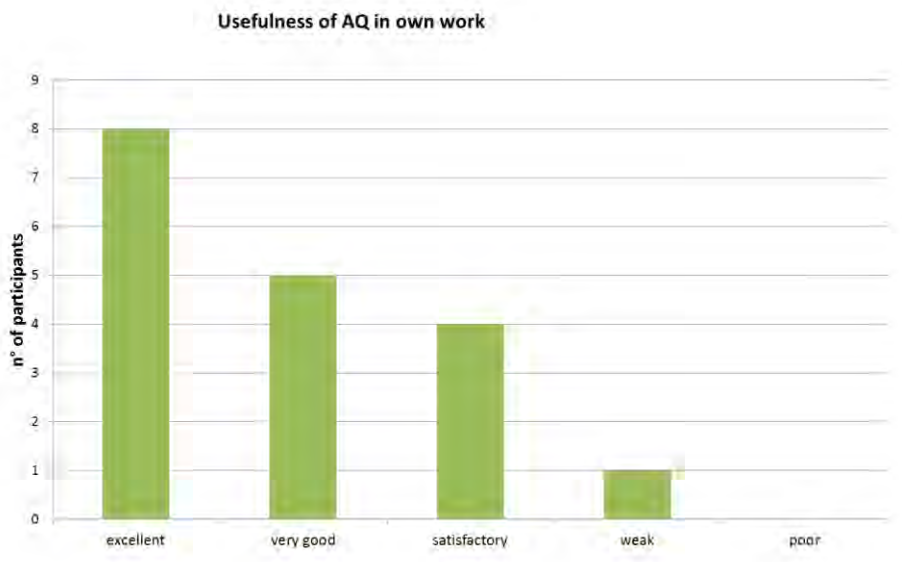
- Well presented.
- Exercise
- Need more individual practical sessions.
- Session not well covered due to time. Other parameter in the model not explained.

Field data, applications and conclusions:

- Field data is quite important and in the course I learned how to use it within the model.
- Presentations of case-studies should be given more emphasis since they illustrate clearly how AquaCrop can be deployed.
- We are going to embark on collecting material data and system calibration.
- Session too short.

4.3 AquaCrop software

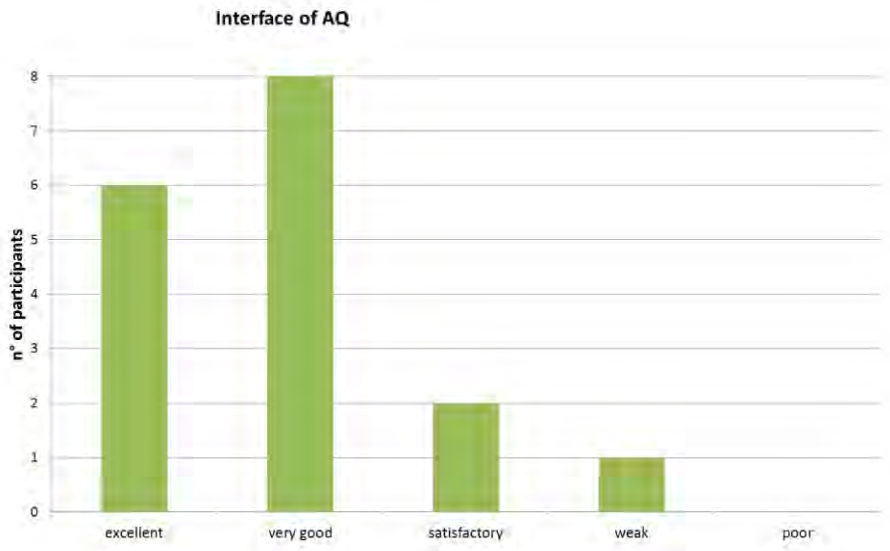
Usefulness



Comments:

- The tool is useful in generating information to guide decision making.
- I am involved in research on agricultural water productivity.
- It will improve our skills.
- Not in this moment as I work in trees but in the future it will be an essential tool.
- In design and management (evaluation) of projects.
- I would not use AquaCrop everyday, but I would use it if I have time and the circumstances for the decision making need a deep analysis.
- Full irrigation

Interface



Comments:

- Very simple, flows well and enough details.
- Integration of AquaCRop and ETo calculator is very timely.
- Not only easy, but also attractive.
- It is clear and helps to understand all variables to be considered and how to quickly locate them.
- With time and more frequent use.
- It is too difficult.
- It is necessary more demonstration.

4.4 Most difficult part of the software to understand/use

- Creation of climatic files.
- Creation of the climate data file, especially the rainfall data.
- The general structure of the model

- In my opinion it is easy to understand
- The interface between the components of the software.
- Application: transformation calendar day to GDD crop?
- Field management.
- Application
- The last day
- None
- Calibration.
- Calibration.
- Generating scenarios with limited data to include field management (pesticides and crop rotation).
- The introduction and the generation of climatic data.
- The plugin, creating files.
- The interface between the components of the software.
- The climate files generation may be problematic.

4.5 What were the best things about the course

- The structuring of the course: The flow of presentations and practical exercises made understanding easy.
- The course combined the practical exercises and demonstration with theory.
- The practical exercises with AquaCrop.
- The course showed many possibilities for future works.
- Finding the original authors (Dirk and Fereres) as facilitators of the workshop. They facilitated so well in the limited time of the workshop. Marga was so supportive on computer and technical guidance in the workshop.
- Generally the course was well organized. The lectures made the tool easy to use and where willing to answer questions and share experiences with the participants. The tool opened my thinking about the need to plan for the productivity before making recommendations to farmers.
- The good conditions of the course and the participation of different countries.
- The reception and the availability of the trainers were excellent.
- The training was interactive and lively.
- Practice
- Exchange
- All things.
- The availability of the trainers and the working atmosphere.
- All the duration
- Everything
- All the steps were interesting
- I discovered many opportunities for collaboration and implementation of applied research under AquaCrop.
- The training room and the organizing committee of the workshop.

4.6 What were the worst things about the course

- Possibly time constraint for practical exercises, but generally the basics were provided.
- None
- Nothing
- I did not like the part of ETo calculator because it was slow.
- None
- The very short time of training in order to avoid the heavy daily training time.
- None
- Nothing
- We came with little or no knowledge on AquaCrop which limited asking practical and non-informed questions.
- Timing
- Time management, a little long, especially in the afternoons.
- Switching between English and French would slow down the workshop progress.
- None.
- The time management.

4.7 Additional comments

- The tool will require individual efforts beyond the time for the course. More practice is needed and where possible national level training with need the participation of the course facilitators.
- In general, the course has been great.
- Reduce the day duration (max. 6 hours/day).
- The course is very excellent. It explains how we can apply the climate data we have to improve the crop water productivity of the farmers. However, I feel the need to allocate another week to the training to practise with the tool under different conditions and make comments.
- Thanks to all.
- Five days is not sufficient to learn correctly.
- The team spirit and the formation (mastery of the trainers) were excellent.
- Thanks to the organizers and the facilitators.
- Thanks
- There are many people who have heard about AquaCrop like me, but they need this kind of introduction.
- It is necessary to address the salinity problem and make practical exercises about this issue.
- Thanks for everything.
- Inclusion of more crops into the tool will enhance its utilisation.
- There is a need for a follow up training to assess the level of uptake and implementation challenges.
- Make the theoretical sessions in the morning and the practical sessions in the afternoon.

Comments by the conductors of the workshop

The overall impression was very good. There was an effort to interact with all of the participants and to discuss their specific interests and the different applications of the

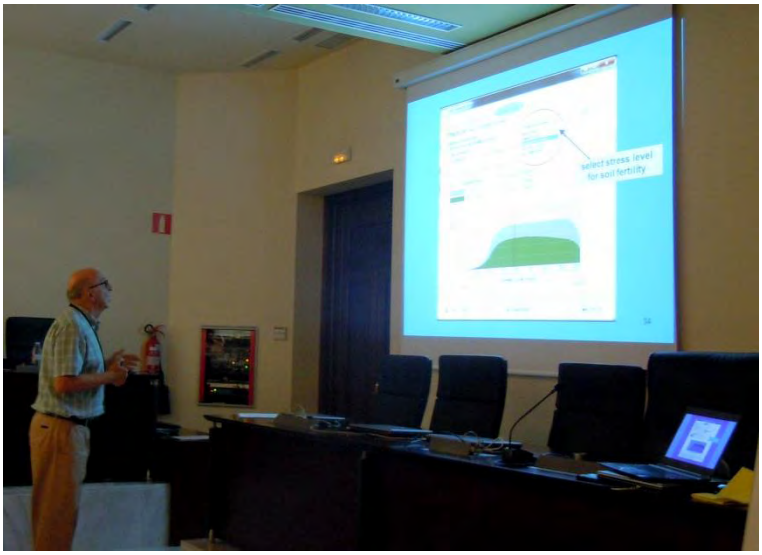
model. All of the participants exhibited significant interest and motivation to learn AquaCrop and to apply it to their specific conditions. The Workshop went very well in an amiable atmosphere and with substantial exchanges among all participants.

56. Pictures

Group picture of participants, organizers and trainers (Headquarters of the University of Cordoba)

Opening ceremony. From right to left: Enrique Quesada Moraga (Vice-Rector of Innovation, Transfer and Excellence Campus, University of Cordoba), Elias Fereres and Dirk Raes

(conductors of the workshop).

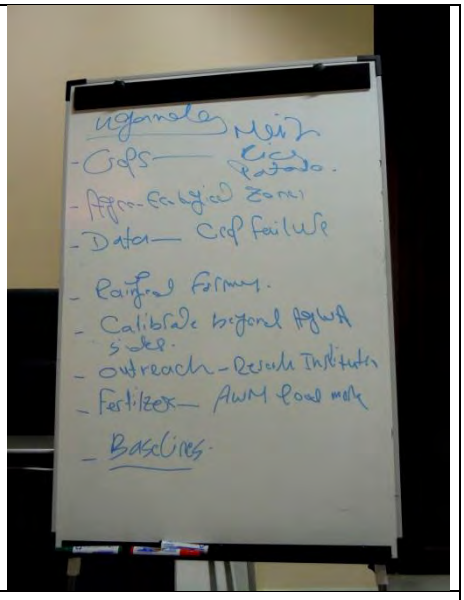


Theoretical session conducted by Elias Fereres (Headquarters of the University of Cordoba)

Practical session conducted by Dirk Raes (Headquarters of the University of Cordoba)

Practical session (Headquarters of the University of Cordoba)

Practical session (Headquarters of the University of Cordoba)



Pooling of the discussion groups (Synthesis from Uganda participants)

Theoretical session conducted by Elias Fereres (Institute for Sustainable Agriculture, CSIC)

Field visit of an experimental irrigated almond orchard (Institute for Sustainable Agriculture, CSIC)

Group picture of participants, organizers and trainers during the field visit (Institute for Sustainable Agriculture, CSIC)

Closing ceremony – distribution of the certificates

From left to right: Charles Mutumba (participant), Dirk Raes (facilitator) and Maher Salman (Land and Water Division, FAO)

ANNEX I. Evaluation form

	**Capacity development for farm management strategies** **to improve crop-water productivity using AquaCrop** **AquaCrop Workshop** **Cordoba, Spain** **18 – 22 May 2015**

Evaluation form

Rating key

1-Poor / 2-Weak / 3- Satisfactory / 4-Very good / 5-Excellent

1. General aspects of the AquaCrop workshop

Question	Rating 1 to 5	Comments
Overall appreciation of the AquaCrop workshop		
How relevant was the workshop to your job?		
How was the length of the workshop (5 days)?		
How was the time availability for theoretical		

sessions?		
How was the time availability for practical sessions on the computer?		

2. Individual sessions of the AquaCrop workshop

Session	Quality of the sessions		Comments
	Theory	Exercises on PC	
Introduction to AquaCrop			
Climate			
Soil			
Crop			
Rainfed agriculture (Initial soil water content and onset)			
Irrigation management			
Field management			

Field data, Applications, Conclusions, way ahead			

3. AquaCrop software

Question	Rating 1 to 5	Comments
Will AquaCrop be useful in your everyday work?		
Is the AquaCrop interface easy to understand?		

4. Which is the most difficult part of the software to understand/use?

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5. What were the best things about the course?

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6. What were the worst things about the course?

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7. Additional comments

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ANNEX II. Structure of the memory stick

The memory stick contains the following folders:

- **Handbook_I_UnderstandingAquaCrop (concepts)**
  - Handbook: folder containing the PDF of training handbook I. (concepts)
  - PowerPoints: folder containing the PowerPoints of the different training modules
  - Scripts: folder containing the scripts of the different PowerPoints

- **Handbook_II_RunningAquaCrop (exercises)**
  - Handbook: folder containing the PDF of training handbook II. (exercises)
  - Ch7Tunis
    - AquaCropFiles: folder containing files, specific created for the exercises
    - Data: folder containing input data, required for the exercises
    - Solutions: folder containing an excel file with the solutions in worksheets
  - Ch8Hyderabad
    - AquaCropFiles: folder containing files, specific created for the exercises
    - Data: folder containing input data, required for the exercises
    - Solutions: folder containing an excel file with the solutions in worksheets
  - Ch9Brussels
    - AquaCropFiles: folder containing files, specific created for the exercises
    - Data: folder containing input data, required for the exercises
    - Solutions: folder containing an excel file with the solutions in worksheets

- **Information**
  - AquaCropPapers: folder containing a list of research papers published in peer reviewed journals
  - FAO_IrrigationDrainagePapers
    - FAO33: folder containing the PDF of Nr. 33 'Yield response to water'
    - FAO56: folder containing the PDF of Nr. 56 'Crop evapotranspiration'
    - FAO66: folder containing the PDF of Nr. 66 'Crop yield response to water'
  - FAO_IrrigationManual: folder containing reference to Irrigation Manual

- **ReferenceManuals**
  - AquaCrop: folder containing the PDF of AquaCrop's reference manual
  - AquaCropPlugIn: folder containing the PDF of the PlugIn reference manual
  - EToCalculator: folder containing the PDF of reference manual of the EToCalculator

- **Software**
  - AquaCrop: containing folders with the installation guidelines and the software for AquaCrop (32 and 64 bit PC) and AquaCrop Plug-In (32 and 64 bit PC)
  - EToCalculator: containing folders with the installation guidelines and the software for EToCalculator (32 and 64 bit PC)

- **TimeTable:** folder containing the structure of the 5-day workshop

ANNEX III. Synthesis of the discussion groups

1. Synthesis from Uganda participants

This training is timely and appropriate to address the challenges of agricultural water management to enhance productivity in the agriculture sector in Uganda. The scope and capabilities of the Aquacrop tool have revealed that much can be achieved in terms of planning, implementation of crop subsector projects, agricultural water management, extension and evaluation of sector project performance, all towards enhanced agricultural water productivity at both farmer field and scheme level in general. The team appreciates that the tool can be utilized beyond the current scope of the Agwa project to address the challenges/gaps for planned and on-going projects with in the crop-subsector, namely: the agriculture cluster development project (Maize, Beans, Cassava, Rice) funded by the World Bank, the Enhancement of Lowland Rice Development Project and the Project on irrigation scheme design and development (Rice) by JICA.

Critical Issues for Immediate Action

1. To constitute and consolidate a multi-disciplinary and multi-sectoral team for effective implementation of the AgWA project.
2. To popularize the utilization of the Acquacrop tool amongst extension staff, farmers and other stakeholders.
3. Active engagement of academia, research and extension in the calibration, application and improvement of the tool.
4. To identify potential candidate sites based on agro-ecological zones to guide the establishment of demonstration sites and target farmers/groups.
5. Conduct a baseline survey to support the customization of the model to selected agricultural production zones.
6. Explore avenues for collaborative engagement in research between the governments of Uganda in AgWA with International Universities like University of Cordoba.

2. Synthesis from Morocco participants

The following issues were discussed:

- Interest of using AquaCrop in the agriculture of Morocco, particularly for irrigated agriculture.
- Use for managing large irrigation projects as one application that was envisaged by the Group.

- The need for calibration and validation of the model under the specific conditions of Morocco. In that regard, site selection for calibration must consider the ample variations in climate that exist within the agriculture of Morocco.
- Regarding its use in the Project, there has to be an effort to gather the appropriate soils and climatic data
- The elaboration of protocols for calibration and use of the model is highly desirable.
- It would be important to work at different scales, from the farm up to the irrigation district and the regions. Relevant data at the various scales must be collected for its use in model validation.

Training efforts:

- Technicians and extension personnel must be trained in four domains:
  a) Irrigation management
  b) Use of soil and weather data/information
  c) Interactions between crops and farming techniques (modern agronomy)
  d) Applications of AquaCrop as a simulation model

Awareness by stakeholders:

- Local managers and representatives must be made aware of the advantages of improved water management via AquaCrop for enhanced water productivity.
- There is a need for organizing workshops and demonstration sessions at the local level to show applications that may be meaningful to local farmers.

3. Synthesis from Burkina Faso participants

Sites should be selected in the 3 climatic zones (Sahelien, Sud soudanines, Soudaniens).

It may be desirable that some crops might be calibrated for AquaCrop: for example: millet, ground nut, and onions, which are missing in AquaCrop's data base and are relevant in Burkina.

Rainfed agriculture:

- What is the best type of crop (traditional variety or improved variety);
- What are the best planting dates;
- What are the appropriate lengths of the crop cycle;
- What is a good equilibrium between the applications of fertilizers and rainfall amounts;
- By how much can water harvesting (of surface runoff) improve crop yield. Or how much water should be harvested to get reasonable good and stable yields

Irrigated agriculture:

- Determine irrigation calendar for various crops by considering planting date, cultivar, soil type and climatic zone;
- What is the correct amount for the irrigation requirement

Extension: Dissemination of the results to farmers.

Climatic data (from 11 stations): Quality check is needed before they can be used.

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