SIXTH FRAMEWORK PROGRAMME
FP6-2005-Global-4, Priority II.3.5
Water in Agriculture: New systems and technologies for irrigation and drainage

Farm Level Optimal Water management: Assistant for Irrigation under Deficit

Contract no.: **036958**

Executive Summary 2

Period 2: **Oct 1st, 2007 – Oct 1st, 2008**

Start date of project: **Oct 1st, 2006** Duration: **3 years**

Date: **November 30th, 2008**

Project coordinator name:
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Project coordinator organisation name:
Wageningen University and Research Center
Plant Research International

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SUMMARY

FLOW-AID is a 6th Framework European project which started in autumn 2006. Its objective is to contribute to sustainability of irrigated agriculture by developing, testing in relevant conditions, and then optimizing an irrigation management system that can be used at farm level. The system will be used in situations where there is a limited water supply and water quality. The project integrates innovative sensor technologies into a decision support system for irrigation management, taking into consideration relevant factors in a number of Mediterranean countries. Its specific objectives are to develop and test new and innovative, but simple and affordable, technical hardware and software concepts for irrigation under deficit, at farms in a large variety of set-ups and constraints. It focuses on a maintenance free tensiometer; wireless, low-power sensor networks; an expert system to assist farm zoning and crop planning, in view of expected water availability, amount and quality; and a short-term irrigation scheduling module that allocates available water among several plots and schedules irrigation for each one. The developed concepts will be evaluated in four test-sites, located in Italy, Turkey, Lebanon and Jordan, where the large future market for deficit irrigation systems will be. The test-sites are chosen in such a way that they differ in the type of constraints, irrigation structures, crop types, local water supplies, availability of water and water sources in amount and quality, the local goals, and their complexity.

OBJECTIVES

The general objective of this project is to contribute to sustainability of irrigated agriculture by developing, testing in relevant conditions, and fine-tuning through feed-back, an irrigation management system that can be used at farm level in those situations where there is a limited water supply and water quality. The system can also serve as an assistant for communication with higher level water management systems at basin scale for long and short term water use planning and prediction. This project integrates innovative sensor technologies into a decision support system for irrigation management, taking into consideration relevant factors in a number of third country partners. The involvement of SME`s in the development ensures a fast application of the results.

CONTRACTORS

Participant organisation name	Short name	Country
Wageningen University & Research Center Plant Research International	PRI	NL
Rothamsted Research	RRES	UK
Lebanese Agricultural Research Institute Department of Irrigation and Agro-Meteorology	LARI	LB
University of Castilla La Mancha Regional Center of Water Research	UCLM	ES
Ege University Faculty of Agriculture Dept. of Agric. Structure and Irrigation	EUFA	TR
University of Pisa Dipartimento di Biologia delle Piante Agrarie	UNIPI	IT
Delta-T Devices Ltd.	DELTA T	UK
Geomations S.A.	GEOMATIONS	GR
Spagnol Srl	SPAGNOL	IT
Jordan University of Science and Technology	JUST	JO

CO-ORDINATOR CONTACT DETAILS

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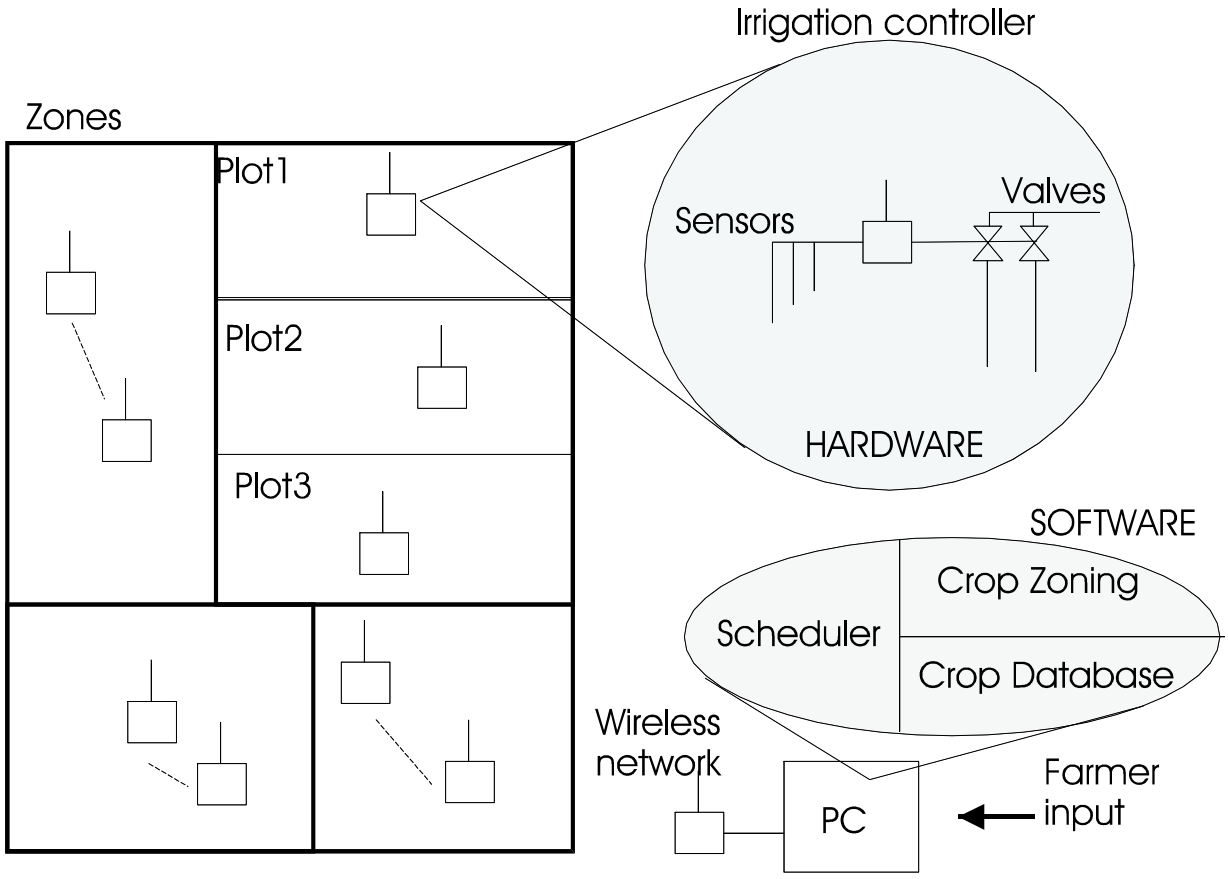
EXPECTED RESULTS
The project is expected to yield the following three major results, to be achieved within nine specific work packages.

1. Sensor technology (hardware)
Develop and test new and innovative, but simple and affordable, technical concepts for irrigation under deficit conditions, that can be used at farm level in a large variety of set-ups and constraints, particularly:

WP1: Innovative monitoring tools (a dielectric solid-state tensiometer).
WP2: Wireless, low-power sensor networks.

2. Decision support (software)
Develop a water management decision support system (DSS) that contains:

WP3: An expert system (off-line/long-term) to assist in farm zoning and crop plan, in view of expected water availability (amount and quality), with link to Basin Management.
WP4: A crop response module that can be incorporated into the irrigation scheduler.
WP5: An irrigation scheduling (on-line/short-term) module that allocates available water(s) among several plots and schedules irrigation for each one, with link to Basin Management.



3. Calibrate modules in view of relevant factors
Set-up four test-sites in various market conditions, with different irrigation structures, crop types, local water supplies and constraints. Adapt the general concept of water management to the local situation by using appropriate parts of it, and integrate and test this hard- and software at the test-sites in:

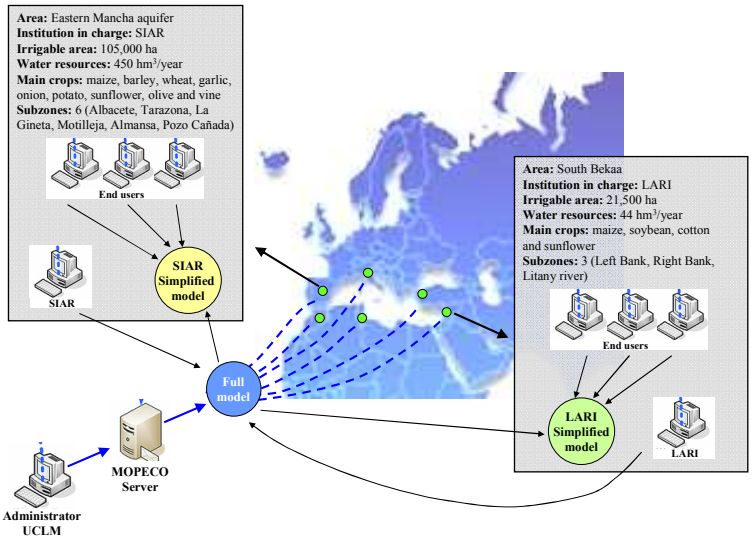
WP6: Pressurized versus surface irrigation (Lebanon);
WP7: Dual water quality irrigation (Jordan);
WP8: Own wells with leaching limitations (Turkey);
WP9: Container crops with limited and dual water supply (Italy).

RESULTS ACHIEVED (1st year)

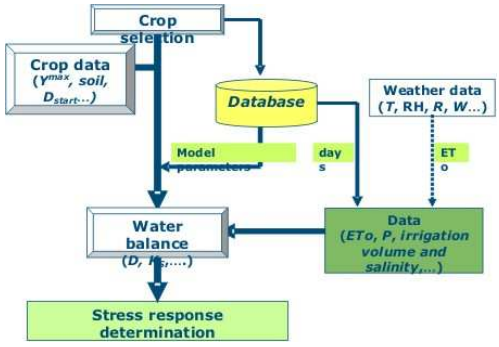
WP1: Dielectric Tensiometer. Prototypes of dielectric tensiometer sensors have been produced and tested both in the lab and in a greenhouse (cucumber) at the Turkey test site (Izmir). Good results have been achieved with a sensor prototype produced that is able to measure soil tension over a measurement range far wider than achieved with a water-filled tensiometer (typically 0 to -85kPa). Field data showed, in an irrigation environment, that the soil conditions at the Turkey test site regularly exceeded the measurement range of a water-filled tensiometer, with the water-filled tensiometers requiring maintenance. The dielectric tensiometer prototype sensors exhibited no such issues.

WP2: Wireless Sensor Network.
A literature review and product search on wireless sensor networks (WSN) with special attention to communication protocols, network topologies and reliability has been carried out by PRI. The Flow-aid system requirements and specifications for a WSN have been outlined. A WSN with 8 nodes and equipped with soil moisture sensors (SM200, Delta-T Devices) was built, installed and tested for 5 months in a container crop field trial in Pistioa (Italy), in collaboration with UNIPI. Remote access to the WSN using internet worked very stable and data transport from Italy to the Netherlands for further analysis worked fluently. The battery lifetime of the sensor nodes was adequate, but the defined requirement of a maximum of 5% data loss could not be fulfilled since to the transmitter/receiver power was preset to a too low power use. Weak points of the overall system, including the packaging, were identified and form the fundamentals of the next generation WSN which is currently designed for the next season.

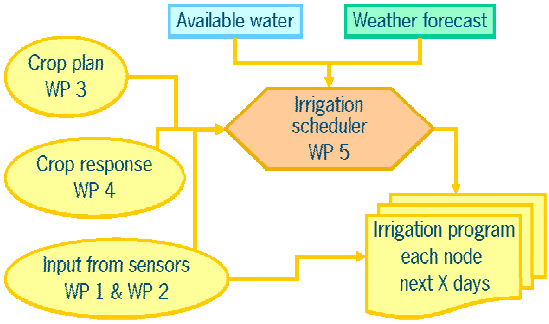
WP3: Crop planning and farm zoning tool. This year UCLM worked on improving the previous MOPECO version (Economic optimization model of irrigation management), in order to adapt it to the requirements of Flow-Aid. This MOPECO-FLOW model, which has been programmed with friendly software design through C++, uses a new optimizer methodology for selecting the distribution of crops that maximizes the Gross Margin of the farm. In addition, it includes a new module to asses the risk related to climatic variations or harvest sale price. In the same way, the model incorporates a procedure to optimize regulated irrigation in order to maximize the Gross Margin of each crop. This model is valid for a wider range of scenarios, and currently it is enhanced by incorporating a module of salinity and another one to determine the daily progression of LAI and Biomass. It has been used to study the Agricultural System Eastern Mancha (Albacete, Spain). Currently the Lebanese test-site is collecting all compulsory data for the model (climatic data series and variable costs of each selected crop), to make it possible to utilize the model for the Lebanese test-site. The new tool can be very useful for improving the income of any irrigated farms of the world. For using it, the user must introduce a set of compulsory data related with his farm, which can be uploaded via the internet (web-based tool).



WP4: Crop response model. UNIPI defined a crop response model and started to gather for all relevant crops model parameters. An experiment was conducted in spring by UNIPI to investigate the response of greenhouse tomato to the degree of salinity oscillation of the recycling nutrient solution in semi-closed systems. The degree of EC variation up to 5.0 dS/m did not affect fruit yield and quality, which was more dependent on the average salinity level in the root zone. Therefore, the choice of the procedure for managing fertigation in semi-closed systems must consider the operational (labour for the renewal of recycling nutrient solution) and environmental implications (water and nutrient runoff).



WP5: Irrigation scheduler DSS. PRI, together with Geomations and UNIPI, has achieved to describe the FLOW-AID system in a more detailed way. Next, the objectives of this work package were redefined and detailed into achievable targets, and a workable methodology was defined. The specific objectives of WP5 for the 1st year of the project can be described as follows:



1. Define the structure of the scheduler in terms of a. knowledge use and b. interfacing with the other modules of the system.
2. Have a prototype of the (web-based) data-base functioning.
3. Use the results of the 1st irrigation tests of the sites to evaluate the feasibility of various [model based] indicators, to supplement the reading of the root-zone sensors within the DSS, in terms of improved water use efficiency or decreased environmental impact.

The first two objectives have been achieved and the analysis of the results of the test-sites is in progress.

WP6: Pressurized versus surface irrigation. LARI defined the experiments. However, due to the local political and economical situation in Lebanon, LARI was not able to set-up the experimental test-site as planned in the experimental farm in the Bekaa valley. Instead, a smaller irrigation experiment with potato at the Tal Amara Station, and benchmarking activities for 30 growers were performed. The planned irrigation nodes from DeltaT will be installed next year, and the full field test at LARI is postponed until the 2nd growing season. The acquired data was made available for PRI to define the irrigation management strategy for the next growing season. Data from previous experiments on three crops (maize, potato and sunflower) will be made available to UCLM for evaluating the Crop Planning module.

WP7: Dual water quality irrigation. Two field experiments on tomato were conducted at JUST in the summer of 2007. Each experiment had four treatments, combined from either “full irrigation” or “deficit irrigation” and “potable water” or “treated water”. The irrigation nodes from Delta-T were installed to control and optimize the irrigation as well as for testing innovative technologies under field conditions and local circumstances in the Jordan test site. The test site was set up and all devices were installed and tested during the growing season. Due to the late availability of all instruments, the field experiment was conducted in the summer time, which is not the appropriate time for the tomato growing season. The acquired data was made available for PRI to define the irrigation management strategy for the next

growing season. During the growing season, local farmers, advisors and governmental agencies were invited at the test-site and the equipment was demonstrated.

WP8: Own wells with leaching limitations. The first step was to build the site (cucumber experiment in a greenhouse) in close co-operation with the SME's and RRES. DELTA-T installed GP1 controllers that can accommodate the sensors and SPAGNOL supplied fertigation equipment. Also first prototypes of the dielectric tensiometers were installed (RRES). Different irrigation programs based on soil moisture levels were tested. Two deficit irrigation treatments in which soil water content was allowed to be depleted to 40 and 60% of available water content of the plant root zone respectively were compared with full irrigation and farmer's practice as well. Representative plants were grown in containers in order to measure the drained water, and yield and quality of the cucumber crop was studied. The highest yield was obtained from the full irrigation treatment. The lowest yield was obtained from the plants that received the lowest amount of water (deficit 1 program). The acquired data was made available for PRI to define the irrigation management strategy for the next growing season.

Results of the field experiment showed that the variations of soil moisture in the plant root zone in farmer's treatment was higher than the treatments controlled by the GP1 controller and sensors. Therefore, it seems that the use of new technology can be easily adapted to the farmer conditions. The environmental impact due to the excess use of water and fertilizers could be decreased with the proper programs including deficit irrigation. Additionally, during the growing season, local farmers, Agric. Engineers, Officials of Min. of Agric. & Municipality, were invited at the test-site and the equipment was demonstrated.

WP9: Container crops with limited and dual water supply. Most of the experimental work for this work package was conducted at the Centro Sperimentale per il Vivaismo (CESPEVI) in Pistoia (Italy), along with some short-term studies at UNIPI on irrigation control strategies (f. i. zero-runoff irrigation). A series of experiments were conducted with WET sensors provided by PRI to calibrate them for the typical substrates used in greenhouses and nurseries for pot plants and to identify the main difficulties for the operational point of view.

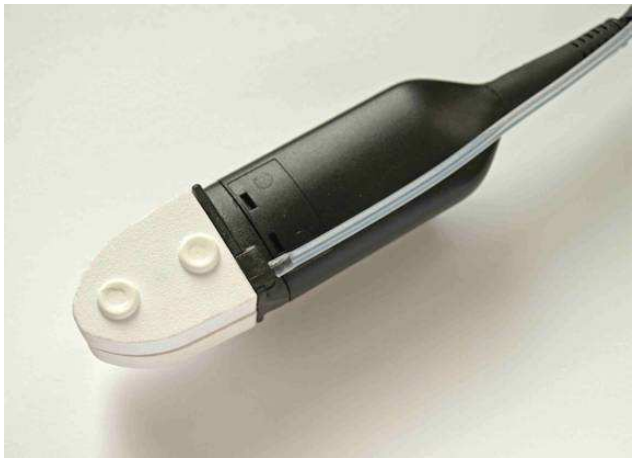
Two experimental nurseries were installed both at UNIPI (Pisa) and at CESPEVI (Pistoia). A customer-made fertigation unit was set up in Pisa, while a commercial device manufactured by SPAGNOL was mounted in Pistoia, and at present the two nurseries work correctly and seem adequate for the planned activities.

The experiment was conducted on four ornamental species (*Photinia x fraseri*, *Viburnum tinus*, *Prunus laurocerasus* and *Forsithia intermedia*) to test the performance of a root zone sensor based control of irrigation as compared to the conventional “timer” approach; and to model the seasonal changes in lead area index and crop coefficient for the selected species. More specifically, it was assessed the inter-pot variability in terms of: daily water balance; EC and pH of drainage water; nutrient leaching; plant growth by means of non-destructive or destructive measurements. The experiment was concluded at the end of October 2007. On the basis of a rough analysis of available data the following conclusions can be drawn: i) irrigation strategies did not affect plant transpiration (ET) and influenced only slightly dry matter accumulation and LAI evolution; ii) the reduction of the overall water application and of the average drain fraction in tensiometer-controlled irrigation treatment was the result of a reduction in the frequency of watering; iii) huge differences in plant daily water demand were observed as a consequence of both inter- and intra-specific variability in ET, the former resulting from different plant size (LAI) and habitus; *Forsithia* was the most water consuming species with an average daily ET over the growing seasons more two times higher than Viburnum;iv) the variability coefficient for the mean daily ET values calculated for each species was as high as 60% and averaged 19%. Figure: The effect of saline water (left) compared to clean water (right).

RESULTS ACHIEVED (2nd year)

WP1- Dielectric Tensiometer

Prototypes of dielectric tensiometer sensors (Delta-T) have been produced and tested both in the lab and in a greenhouse (cucumber) at the Turkey test site (Izmir). Good results have been achieved with a sensor prototype produced that is able to measure soil tension over the nominal range -3kPa to -250kPa, a measurement range far wider than achieved with a water-filled tensiometer (typically 0 to -85kPa). Field data showed, in an irrigation environment, that the soil conditions at the Turkey test site regularly exceeded the measurement range of a water-filled tensiometer, with the water-filled tensiometers requiring maintenance. The dielectric tensiometer prototype sensors exhibited no such issues. For the next year a large number of sensors will be produced and these will be further tested in test-sites in Turkey, Italy and the Netherlands.

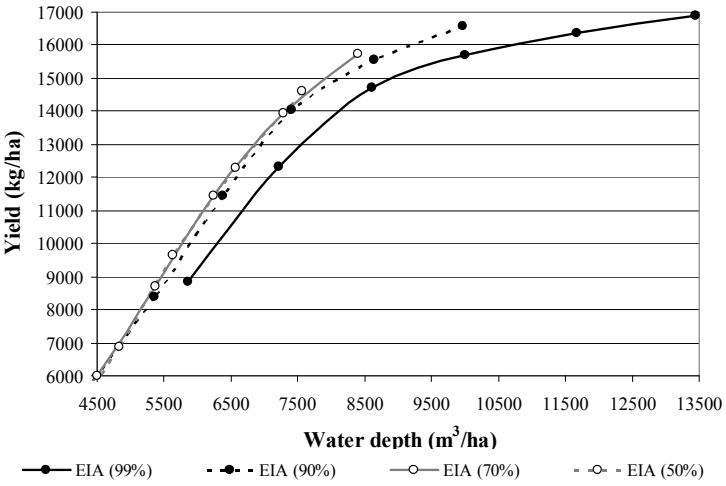


WP2: Wireless Sensor Network

Based upon experience of the 1st year experiment the 8 Wireless Sensor Nodes (Mesh-Star network, SOWNET) with soil moisture sensors were modified to have a higher signal strength and a more robust housing. Another set with a solar power system (Mesh-type) WSN was obtained from Crossbow Systems and equipped with Watermark sensors. Both systems were tested for functionality and next installed for practical evaluation at the Pistoia test-site in Italy. The operation was monitored remotely from the Netherlands using an internet link. Preliminary results showed that the Crossbow system had a larger working range and worked to a nearly 100% satisfaction, and was far favorable above the SOWNET system. Next year this system will be used and it will be adapted to accommodate a combined soil moisture and EC sensor.

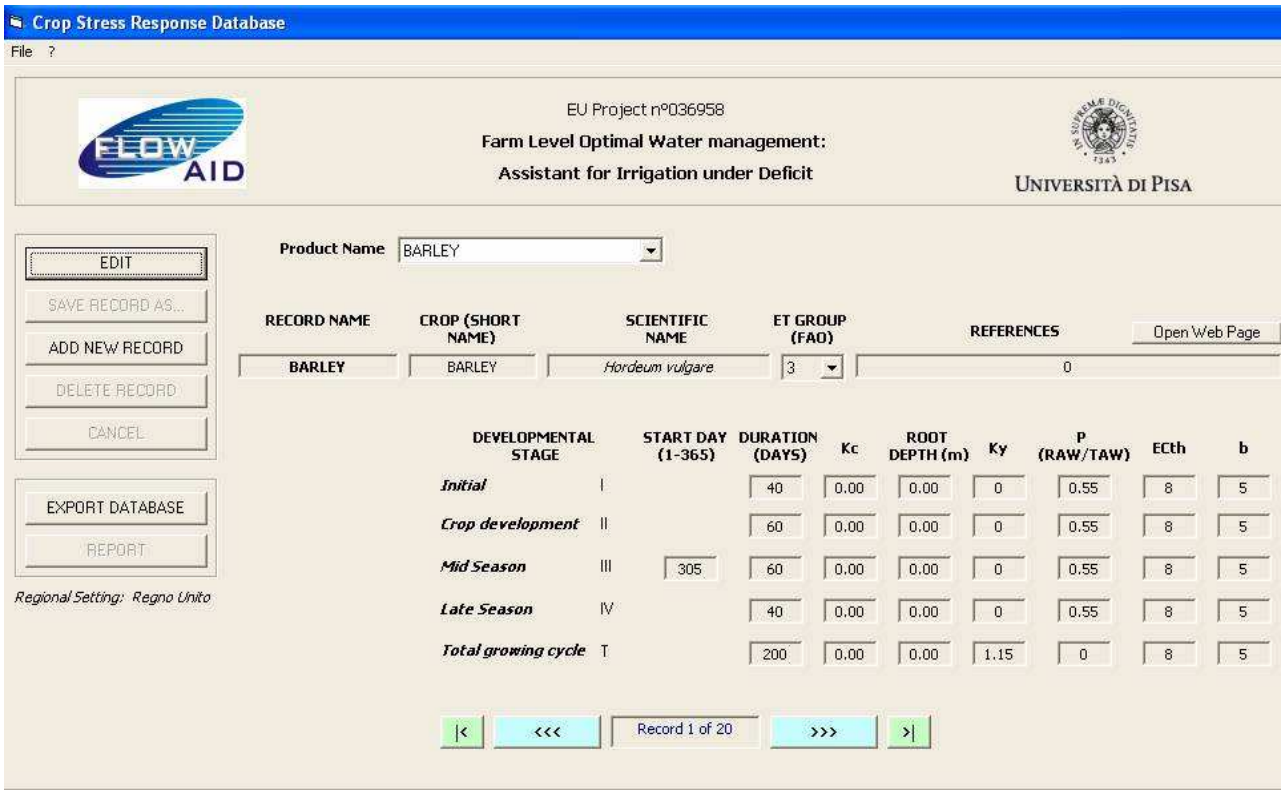
WP3: Crop planning and farm zoning tool

The first version of the web-based tool of MOPECO-FLOW was developed. Two new modules were added ensuring a wider range of scenarios that can be simulated. Now the model can simulate effects on water use and crop yield due to non-uniformity of the irrigation systems as well as the use of salt irrigation water. The model was developed and tested, based upon data obtained from the Mancha Oriental region in Spain. This year no practical data could be obtained from the Lebanese test-site. Alternatively, the functionality of the model was further improved through an end-user β-test performed at the Research Institute for Knowledge Systems (RIKS) in the Netherlands. The new model will be tested and validated next year using practical data from the Jordan test-site.

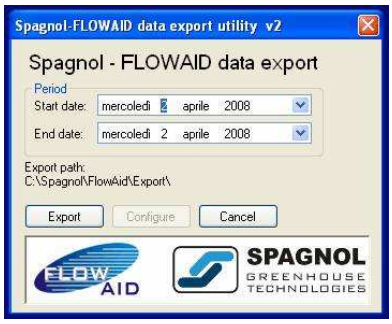


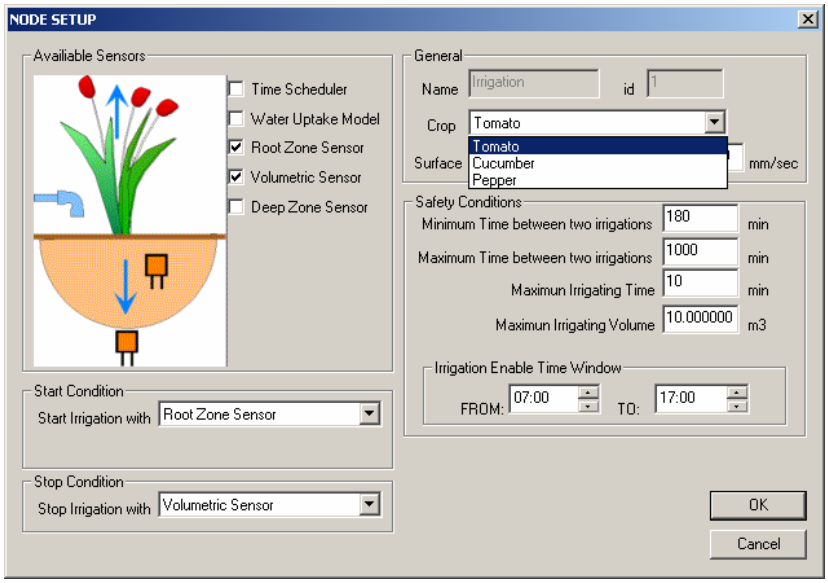
WP4: Crop response model

A draft version of the database (EXCEL based) was presented before the growing season. Based upon this, a first version executable database was developed using Microsoft Visual Basic with ActiveX Objects. The crop response database now contains quantitative information on the response to water and/or salinity stress for 20 selected crops. A user may retrieve, edit, extend and export data from the database with the new program. Next year the database will be calibrated and extended with additional information on the basis of the field tests and finalizing the reference manual and the final version of the database.



WP5: Irrigation scheduler DSS
A central database, accessible through internet, has been established. This database, hosting actual and local measured soil and climate data, is up and running and has been successfully used by all partners using a “Data Upload Facility”.





For the Irrigation Scheduler, which will run either remotely on a central computer or locally at the farmer-site, a common Glossary and Ontology has been prepared as reference for all partners. An off-line version of the scheduler is ready and was demonstrated at the 2nd annual meeting by Geomations. An instruction manual is being circulated among the partners for comments. Early next year, and based upon the results from the 2nd year experiments at the test-sites, an “Irrigation Knowledge Database” containing “Best Practice Rules for Deficit Irrigation” will be made. This database will then be incorporated into the final version FLOW-AID Irrigation Scheduler DSS.

WP6: Pressurized versus surface irrigation
During the 2008 growing season a test was performed with two irrigation controllers and soil water content sensors (GP1 and SM200, Delta-T Devices) in a greenhouse using micro-sprayers for pot-grown ornamental plants in the winter season, and with field-grown egg-plants using drip-irrigation in the summer season. The tests showed a “proof of concept” and viability of a low-cost simplified automated irrigation system. The next year a calibration of this irrigation controller concept will be performed again in a greenhouse and in a field-trial on other drip-irrigated vegetable crops. The DSS-irrigation scheduler will be tested in full with drip-irrigated lettuce under rain-fed as well as simulated semi-arid conditions in a field experiment conducted in the Netherlands.

WP7: Dual water quality irrigation
Two field experiments with a drip-irrigated tomato crop were conducted at the Jordan test-site in spring/summer 2008. In each experiment four treatments with four replicas were performed by making combinations from “fresh or treated water” and “full or deficit irrigation”. Soil moisture status (WET-sensor), climate conditions as well as all relevant crop parameters were monitored (yield). The treatments were controlled by using the sensor activated (SM200) irrigation controllers (GP1). A reasonable effect was observed for both full versus deficit irrigation strategies as well as fresh versus treated water on plant growth development and yield productivity. It showed that using innovative technology to control irrigation scheduling resulted in higher Water Use Efficiency (WUE) for most of the treatments evaluated. Some sensor inconsistencies were observed. The WET-sensors performed well in comparison with the Neutron Probe, which encourages the further use of these sensors. Next year the experiment will be repeated to evaluate it together with the DSS-irrigation scheduler and to obtain further best practice rules for irrigation under local conditions.


WP8: Own wells with leaching limitations
In a polyethylene greenhouse with cucumber, two irrigation experiments were conducted in spring/summer at a farmer site in Yeniköy-Menderes near Izmir (Turkey). The main goal was to prevent leaching and reduce the use of water. The greenhouse was equipped with fertigation equipment (Spagnol), and irrigation controllers (GP1, Delta-T), as well as the new dielectric tensiometers (SM160) and other soil moisture sensors. Three treatments: one “Full” (20% depletion) and two “Deficit” (40 and 60% depletion) were compared with standard farmer practice, by monitoring water consumption and crop yield and quality. It showed that the farmer treatment had the highest crop yield, but he used the largest amount of water of which a large portion drained to deeper layers. The automated controlled treatments showed higher water use efficiencies with slightly smaller crop yields. It seems that excess use of water and fertilizers and their possible environmental impact by leaching can be easily decreased by the use of sensor activated irrigation technologies. Next year the experiment will be repeated to evaluate it together with the DSS-irrigation scheduler and to obtain further best practice rules for irrigation under local conditions.


WP9: Container crops with limited and dual water supply
Analyses of data from the first year experiment at Cespevi (Pistoia, Italy) was concluded including a simulation of water use efficiency of container cultivations irrigated with a timer, a crop ET model or with soil moisture sensors. During summer an irrigation/fertigation experiment was conducted with the use of two water sources: ground water with low salinity and waste water with high salinity. WET-sensors, placed in sentinel pots (Prunus), were used to control soil moisture as well as EC, by applying a “stress index” based control strategy which was implemented by Spagnol. It showed that the sensor-activated controller fairly well maintained a given salinity level in the pots, and reduced the water consumption while using the dual water

source. Although the overall system worked well, one treatment received markedly less water due to a bad working sensor/sentinel pot. Visual observations of plant heights suggest that the use of saline water could reduce plant growth in some species. During summertime more than 50 growers and consultants attended an Open Day at the test-site. Next year the experiment will be repeated to evaluate it together with the DSS-irrigation scheduler and to obtain further best practice rules for irrigation under local conditions.

INTENTIONS FOR USE AND IMPACT

The central role of the SME's will ensure that the most promising and relevant project results will find a fast way to the irrigation market. The participation of Mediterranean Partner Countries (where most field tests will be located) ensures that the final products will be fine-tuned to the [economic and physical] conditions of non European markets, where the largest growth in irrigation requirement is expected. SPAGNOL will focus on the off-line DSS system for their fertigation unit, using crop models, irrigation scheduling and new sensor technologies. Their software will be available to mostly horticulture growers (greenhouses and container crops). DELTA-T Devices will focus on the global market for hardware and the irrigation scheduling programs (irrigation nodes) including new sensors, wireless interfacing, and will use the results from all three test sites in Turkey, Lebanon and Jordan. GEOMATIONS will develop the FLOW-AID overall software system including the irrigation DSS, interfacing with several hardware platform through an open interfacing structure, an internet facility for remote data uploading and reporting as well as the Crop Planning module. They will incorporate these tools into their irrigation and management software for the horticultural market, especially in the Mediterranean but as well on a global market. The developers of hardware and software will make sure to take actions for protecting their rights (IPR actions) and for contract agreements to ensure further industrialization and commercialization of the developments of the project, as agreed upon with in the management board.

PLAN FOR USING AND DISSEMINATING KNOWLEDGE

The role for the test-sites will be the organisation of all kinds of dissemination actions such as conferences, workshops and seminars for farmers (by each site partner together with the SME particularly involved at the site). All scientific partners will focus on the publication of their research results through papers for periodicals, conferences and local farmer magazines.
The coordinator maintains a web-site for the project (www.flow-aid.eu).

In the Annexes a list of dissemination activities and publications can be found.

Annex 1: Overview table of dissemination activities

Date	Type	Type of audience	Countries	Size of audience	Partners involved
16/11/2006	Conference, publication	General public	Italy (Bologna)	100	UNIPI
01/12/2006	Seminar at Pistoia test-site	Attended by local actors both agriculture and politics	Italy (Pistoia)	50	PRI, UNIPI, CESPEVI
18/01/2007	Conference, publication	General public	Italy (Milan)	100	UNIPI
19/01/2007	FLOW-AID: Een assistent voor deficit irrigatie.	Article in: Tuinbouw Onder Glas, Februari 2007 (NL)	NL	>1000	PRI
01/02/2007	Leaflet on FLOW-AID	Public domain handout	NL, International	100	PRI
01/02/2007	Journal article EJSS, Febr. 2007,58,18-25	Public	International	>1000	RRES
14/02/2007	Conference presentation	Public	Italy	150	PRI
22/06/2007	Conference	General public	Italy (Mola di Bari)	50	UNIPI
02/08/2007	Farmer meeting	Turkish farmers, Agric. Engineers, Officials of Min. of Agric. & Municipality	Izmir, Turkey	20	EUFA, RRES
3-5/09/2007	Training days	Technicians, farmers, and WUAs	Lebanon	25	LARI
3-5/09/2007	Training	Agricultural and Bio system engineering students	Jordan	12	JUST
4-6/09/2007	Conference	Local scientific researchers	Spain(Albacete)	50	UCLM
13/09/2007	Conference	General public	Italy (Padova)	50	UNIPI
01/10/2007	Growers magazine: Tuinbouw Onder Glas	Growers	NL	>1000	PRI
05/10/2007	Scientific conference (Greensys2007)	Scientists in the area of horticulture engineering	International	350	PRI
2007	Press release(press/radio/TV)	General public	Jordan Mass Media	About 1.5 Million	JUST
2007	Media briefing	Graduate and Under graduate Students at JUST,	North part of Jordan	75	JUST
2007	Demonstrations	Farmers Leaders	North Jordan	8	JUST
01/02/2008	Article, growers magazine: Tuinbouw Onder Glas, Februari 2008 (NL)	Growers	Netherlands	1000	PRI
05/04/2008	Poster at conference ISHS SPCMWC2008	Agricultural scientists	Antalya, Turkey	200	UNIPI
7-10 April 2008	International Symposium	Research	35 countries	135	EUFA
6-11/04/2008	Special session on FLOW-AID project at the Conference in Antalya (Turkey), 4 presentations	Scientists in the area of hortucultureal engineering	International, Antalya, Turkey	200	PRI, EUFA, Geomations, UNIPI,
29/05/2008	Farmer meeting	Farmers and local authorities	Turkey	50	EUFA
03/06/2008	Seminar	Academic staff and students	Turkey	25	EUFA
05/06/2008	Presentation at Open Day on irrigation technology	Local farmers and technicians, general public	Pistoia, Cespevi, Italy	50	UNIPI
25/06/2008	Scientific conference (AgEng 2008)	Scientists in the area of agricultural engineering	International	150	PRI, UNIPI, RRES, EUFA, DELTA-T
26/06/2008	Presentation at Conference: XXVI CONGRESO NACIONAL DE RIEGOS	Scientists	Huesca, Spain	100	UCLM
07/08/2008	Flow-Aid article in: RRA Newsletter - December 2008	General public	UK		RRES
22-24/08/2008	Conference	General public	Lima (Peru)	130	UNIPI
01/09/2008	Symposium presentation	Scientists	Lima, Peru	>100	UNIPI
04/09/2008	Conference presentation	Scientists	Brazil	>100	UCLM
07/10/2008	Scientific meeting	Experts in soil watermeasurement	US	40	RRES, DELTAT,PRI

14/09/2008	International ISHS Symposium, paper	General public	Italy (Bologna)	50	UNIPI
10/10/2008	Seminar Presentation	General public	Italy (Pisa)	30	Cespevi
21/10/2008	Poster presentation at Research Station Bleiswijk	Agricultural Attachees	Netherlands	60	PRI
23/10/2008	Seminar	General public	Italy (Battipaglia, Salerno)	50	UNIPI
2008	Press release(press/radio/TV)	General public	Jordan Mass Media	About 2.0 Million	JUST
2008	Media briefing	Graduate and Under graduate Students at JUST,	North part of Jordan	125	JUST
2008	Training	Agricultural and Bio system engineering students	Jordan	8	JUST
2008	Demonstrations	Farmers Leaders	North Jordan	10	JUST
07/11/2008	Irrigation workshop with 6 presentations	Farmers and local authorities and water board	Ierapetra, Crete	100	GEOMATIONS, RRES, PRI, EUFA

Annex 2: LIST OF PUBLICATIONS

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Domínguez, A., López-Mata, E., De Juan, J.A., Artigao, A., Tarjuelo, J.M., 2008. DEFICIT IRRIGATION UNDER WATER STRESS AND SALINITY CONDITIONS. THE USE OF MOPECO MODEL. CIGR - International Conference of Agricultural Engineering. August 31 – September 4 2008. Iguazu (Brazil).

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