Climate Changing Agriculture

International Conference

29 August – 2 September, 2017

CHANIA GREECE

Book of Abstracts

Editor: Dr. Georgios Koubouris

With the contribution of the LIFE + financial instrument of the European Union to the project "OLIVECLIMA-Introduction of new olive crop management practices focused on climate change mitigation and adaptation"

Dear Colleagues,

During the past year, a group of devoted people worked hard and with great enthusiasm to prepare this event and welcome you in Chania, Greece for the International Conference "Climate Changing Agriculture". On behalf of all involved team mates I would like to express my pleasure for meeting you, having the chance to be informed of your research achievements and exchange views for climate change mitigation and adaptation.

This international conference is one of the final deliverables of oLIVE-CLIMA project. The oLIVE-CLIMA project (LIFE 11 ENV/GR/942), "Introduction of new oLIVE crop management practices focused on CLIMAte change mitigation and adaptation" (oLIVE-CLIMA) is funded by 50% by the financial instrument Life + of the European Union and has a total budget of 3.649.373 € (EU contribution 1.822.436 €). It was launched in October 2012 and will be completed in September 2017. The project partners are the following: Development Agency of Eastern Thessaloniki's Local Authorities-ANATOLIKI S.A., Institute for Olive Tree, Subtropical Crops and Viticulture HAO DEMETER, Department of Soil Science of Athens HAO DEMETER, Soil and Water Resources Institute Former Land Reclamation Institute HAO DEMETER, University of Basilicata, Rodax Agro E.P.E., AGROTYPOS S.A., NILEAS Farmers Group, Agricultural Cooperatives of Peza, Agricultural Cooperatives of Mirabello.

This edition contains abstracts of papers presented in the conference following peer review and selection between a larger pool of submitted research works. Colleagues who are interested in publishing their work in the conference proceedings are invited to submit a four-page manuscript according to the instructions available in the website due 30th September 2017. Also, authors of selected papers will be invited to submit their full paper to be considered for publication in peer reviewed journals to be announced soon.

Many thanks to the LIFE programme for funding as well as all the involved institutions for co-funding and hard work. We wish you all a fruitful participation in the conference and a pleasant stay in Chania.

Kind regards,

Dr. Georgios Koubouris

Conference Organizers

Hellenic Agricultural Organization DEMETER, Institute for Olive, Subtropical Crops & Viticulture, http://www.nagref-cha.gr/
CIHEAM, MAI Chania, http://www.maich.gr/en
Technical University of Crete, School of Environmental Engineering (ENVENG), http://www.enveng.tuc.gr/
Technological Educational Institute of Crete, Department of Environmental and Natural Resources Engineering, https://www.teicrete.gr/en/tmfp/13754
With the contribution of the LIFE + financial instrument of the European Union to the project "OLIVECLIMA-Introduction of new olive crop management practices focused on climate change mitigation and adaptation"

Convener:

Dr Georgios Koubouris, Hellenic Agricultural Organization DEMETER, Institute for Olive Tree, Subtropical Crops and Viticulture (IOSV), GR.

Vice-chair and keynote speakers:

Prof Cristos Xiloyannis, University of Basilicata, Italy
Prof Luuk Fleskens, Soil Physics and Land Management Group of Wageningen University and School of Earth and Environment at the University of Leeds, UK.
Prof Mauro Centritto, Consiglio Nazionale delle Ricerche - National Research Council, Italy.
A. Kavadia; M. Omirou; I.M.Ioannides -Agricultural Research Institute, Department of Agrobiotechnology, Cyprus.
Michalopoulos George - RodaxAgro Ltd, Greece.

Organizing Committee

Dr Georgios Koubouris, ELGO DEMETER, Institute for Olive Tree, Subtropical Crops and Viticulture (IOSV), GR
Dr Georgios Psarras, ELGO DEMETER, IOSV, GR
Prof. George Karatzas, Technical University of Crete
Dr Ioannis Livieratos, Mediterranean Agronomic Institute of Chania, GR
Dr George Arampatzis, ELGO DEMETER, Soil and Water Resources Institute (SWRI), GR
Dr Victor Kavvadias, ELGO DEMETER, SWRI), GR
Prof. Nikos Lydakis-Simantiris, TEI of Crete, GR
Mrs Eftichia Kivrakidou, Economist, Project manager OliveClima. "ANATOLIKI" DEVELOP. AGENCY OF EASTERN THESSALONIKI 'S LOCAL AUTHORITIES, GR
Mr Iakovos Sarigiannis, Mechanical Engineer, General Manager, ANATOLIKI, GR
Mrs Konstantia-Anastasia Kasapi, Msc Geologist Ecol. Water Quality, ANATOLIKI, GR
Mr. Christos Karkanias, MSc Environmental Scientist, ANATOLIKI, GR

Scientific Committee

Arampatzis, George, ELGO DEMETER, Soil and Water Resources Institute, GR
Boussadia Olfa, Institut de l'Olivier - Unité spécialisée de Sousse. TUN
Cantini Claudio, IVALSA-CNR, IT
Centritto Mauro, Trees and Timber Institute, National Research Council, IT
Chartzoulakis Kostas, ELGO DEMETER, Institute for Olive Tree, Subtropical Crops and Viticulture (IOSV), GR
Doulis Andreas, ELGO DEMETER, IOSV, GR
Evangelides Chris, Aristotle University of Thessaloniki, Rural and Surveying Engineering, GR
Fleskens Luuk, Soil Physics and Land Management Group of Wageningen University and School of Earth and Environment at the University of Leeds, UK.
Hatzigiannakis Evangelos, ELGO DEMETER, Soil and Water Resources Institute, GR
Kabourakis Emmanouil, ELGO DEMETER, IOSV, GR
Kalaitzaki Argyro, ELGO DEMETER, IOSV, GR
Kalaitzidis Chariton, Mediterranean Agronomic Institute of Chania, GR
Kavroulakis Nektarios, ELGO DEMETER, IOSV, GR
Kavvadias Victor, ELGO DEMETER, Soil and Water Resources Institute, GR
Kouli Maria, TEI of Crete, GR
Kourgialas Nektarios, ELGO DEMETER, IOSV, GR
Mehdi Hosseini Mazinani, NIGEB, Iran
Michalopoulos Georgios, RodaxAgro LTD, GR
Montanaro Giuseppe, University of Basilicata, IT
Omirou Michalis, Agricultural Research Institute, CY
Psarras Georgios, ELGO DEMETER, IOSV, GR
Stavroulakis Georgios, TEI of Crete, GR
Tzerakis Kostandinos, ELGO DEMETER, IOSV, GR
Tzortzakis Nikolaos, Cyprus University of Technology, CY
Varikou Kiki, ELGO DEMETER, IOSV, GR
Xiloyannis Cristos, University of Basilicata, IT

Secretarial support

Mrs Chrysi Sergendani
Institute of Olive Tree, Subtropical Crops & Viticulture
ELGO DEMETER, (NAGREF)
Agrokipio, 73100, Chania – Greece
Tel: +30 28210 83435, Fax: +30 28210 93963
E-mail: csergen@nagref-cha.gr

Conference Center Bureau

Mrs Argyro Zervou or Mrs Katerina Karapataki
Conference Center Bureau of the Mediterranean Agronomic Institute of Chania
Tel: +30 28210 35080, E-mail: confer@maich.gr

Table of Contents

ORAL PRESENTATIONS

Management options contributing to climate change mitigation and resilience improvement in olive groves

Authors
Xiloyannis Cristos (cristos.xiloyannis@unibas.it) presenting author (Università degli Studi della Basilicata - DICEM)
Tuzio Angelo C. (angelocarminetuzio@gmail.com) (Università degli Studi della Basilicata - DICEM)
Fausto Catia (catiafausto@gmail.com) (Università degli Studi della Basilicata - DICEM)
Montanaro Giuseppe (giuseppe.montanaro@unibas.it) corresponding author (Università degli Studi della Basilicata - DICEM)

Summary
Agriculture is a key socio-economic sector and a driving force of sustainable development as it is related to a series of crucial conditions of sustainability and ecosystem services delivery including conservation of natural capital. Agriculture is pivotal to face climate changes because it contributes to greenhouse gases by sources as well as removals, through photosynthesis, followed by losses from organic matter decomposition and microbial processes, and from human management/disturbance of the agro-ecosystems. In this regard, olive groves might contribute to climate change mitigation improving the main carbon stock pools (i.e., tree biomass, soil and litter). This contribution will focus the impact of sustainable and conventional management practices on changes of these pools mainly through retention of the pruning residuals, the adoption of cover crops. Soil carbon increased from 0.4 to 0.8% (30 cm depth) and from 1.1 to 1.4% (15 cm depth). Apart from the regulation of the atmospheric CO2 this contribution will highlight the beneficial impact of increasing soil carbon on a number of ecosystem services including soil water holding capacity, reduction of erosion risks, increasing soil biodiversity. Particularly, the application of sustainable management practices increased soil fungi and bacteria by approx. 7-fold and 3-fold, respectively compared to conventionally managed grove. The annual soil CO2 emission and the overall resilience of groves will be also discussed.

A comparative estimate of climate change impacts on cotton and maize in Greece

Authors
VOLOUDAKIS DIMITRIOS (voloudakis.dim@aua.gr) presenting author (Agricultural University of Athens)
KARAMANOS ANDREAS (akaram@aua.gr) (Agricultural University of Athens)
ECONOMOU GARIFALIA (economou@aua.gr) (Agricultural University of Athens)
KAPSOMENAKIS JOHN (johnkaps@geol.uoa.gr) (Research Centre for Atmospheric Physics and Climatology, Academy of Athens)
ZEREFOS CHRISTOS (zerefos@geol.uoa.gr) (Navarino Environmental Observatory)

Summary
The impact of climate change on cotton and maize was estimated on the basis of three IPCC Emission Scenarios (A1B, A2, B2). The study focused on seven locations (Agrinio, Alexandroupolis, Arta, Karditsa, Mikra, Pyrgos, Yliki) belonging to the country's main arable crop zones during three periods, 1961–1990, 2021–2050 and 2071–2100. Eight climatic models (HadRM3, C4I, REMO-MPI, ETHZ, CNRM, DMI-HIRHAM, KNMI, SMHI) were used for the analysis of the A1B Scenario, while the models HadRM3, DMI-HIRHAM and

SMHI were applied for the A2 and B2 scenarios respectively. FAO's AquaCrop model was applied as a crop simulation tool. The model was calibrated using field data. In the case of cotton, Root Mean Square Error for yield and biomass was 0.17 and 0.49 t/ha, respectively, while the Index of Agreement was 0.93 and 0.94. For maize, the Root Mean Square Error for yield and biomass was 0.34 and 0.79 t/ha and the Index of Agreement was 0.70 and 0.81 respectively. The efficiency of the climate models for yield predictions in the two sites was assessed by means of a discriminant function analysis. On the account of their function coefficients, DMI-HIRHAM and C4I models for cotton as well as REMO-MPI and C4I models for maize explained a great proportion of variation among the three periods for the A1B Scenario. In the A2 and B2 Scenarios the model's function coefficients for cotton did not show a significant discriminant ability. Accordingly, all three climate models were used for yield change estimation. As regards maize, the function coefficients of the DMI-HIRHAM and SMHI models played a significant role in the yield discrimination between the seven locations only in the case of the A2 Scenario. The final output of the study was a range of values representing the percentage of cotton and maize yield changes for each scenario and location. According to these findings, climate change could have a positive impact on cotton yields with variations, depending on the adopted climate scenario. For the scenario A1B, the regions of Western Greece (Arta, Agrinio, Pyrgos) exhibited the most favourable results in comparison with the other regions. This tendency became more pronounced towards the end of the century, with the northern (Mikra, Alexandroupolis) and central areas (Karditsa) characterized by a greater uncertainty. No significant differentiation among the areas was observed in the A2 scenario. A positive change for all regions was observed for scenario B2. In maize, the scenario A1B produced small changes in yields, which did not exceed 5% for the period 2021-2050, with the southern areas (Yliki, Pyrgos and Arta) exhibiting a comparative advantage. For the A2 scenario the scale of the change in yields was small, ranging from + 3.7% in Alexandroupoli to -5.7% in Pyrgos. The scenario B2 gave more optimistic estimates of yield changes towards the end of the century in comparison to the scenarios A1B and A2.

Carbon footprint of rainfed and irrigated arable crops under tillage compared to no till & guide assistance

Authors
Gil-Ribes Jesus A. (gilribes@uco.es) presenting author (University of Córdoba)
Márquez-García Francisco (fmarquez@uco.es) corresponding author (University of Córdoba)
Blanco Gregorio L. (ir3blrog@uco.es) (University of Córdoba)
González-Sánchez Emilio J. (egonzalez@agriculturadeconservacion.org) (Spanish Association of Conservation Agriculture)

Summary
One of the most important key points for agriculture in the next years is to reduce its impact over the climate change (CC). This work try to demonstrate which crops and soil and water management systems are more profitable in order to reduce the contribution of agriculture to CC. This work belongs to the Life + Climagri project. It shows the results of two seasons carried out in the experimental farm of the University of Córdoba. Different arable crops were studied in rainfed (wheat, beans, barley) and irrigated (corn) conditions. Two soil management systems were compared: Tillage (T) versus No Till (NT) and Guide Assistance

(GA). For irrigated crops, two water supplies were studied: 550-750 mm. The parameters on mechanized operations were logged using a remotely data acquisition system. The equivalent Carbon Dioxide (CO2) emitted was calculated by an energy analysis. The CO2 fixed was a transformation of the yield. Two parameters were defined, CO2 Efficiency (CE): CO2 emitted by CO2 fixed. Carbon Productivity (CP): Kg of yield by each kg of CO2 emitted. Irrigated yields in corn doubled the production of cereals and were 10 times bigger than beans, especially for higher irrigation. There were no differences between T and NT & GA, except for wheat. The CO2 emitted in T always were more than a 20 % higher than NT & GA. This situation caused that NT & GA always provided best results of CE and CP. Barley under NT & GA obtained the higher values of CE and CP due to the scarce use of fertilizers. Corn with sustainable techniques produced better results than wheat, the first season, but not the second one. It is possible to reduce the carbon footprint of agriculture by using sustainable techniques. The used of high inputs systems it does not seem to be the answer. The application of rainfed crops with a low application of fertilizers (barley) showed the best results. However, more years of study are needed in order to get robust results. Acknowledgements The authors would like to thank the European Commission's LIFE (Financial Instrument for the Environment) for co-financing the LIFE + Climagri project, Best Agricultural practices for Climate Change, LIFE13ENV/ES/000541. Keywords: Sustainable agriculture, climate change, energy, Efficiency in the use of natural resources.

A tool for adaptation to Climate change Impacts on the Mediterranean islands' Agriculture: LIFE ADAPT2CLIMA

Authors
Giannakopoulos Christos (cgiannak@noa.gr) presenting author (National Observatory of Athens)
Moriondo Marco (marco.moriondo@cnr.it) (CNR-IBIMET)
Papadopoulou Maria (mpapadop@mail.ntua.gr) (National Technical University of Athens)
Karali Anna (akarali@noa.gr) (National Observatory of Athens)
Lemesios Giannis (jlemesios@noa.gr) (National Observatory of Athens)
Papadaskalopoulou Christina (chpapad@chemeng.ntua.gr) (National Technical University of Athens)
Varotsos Konstantinos V. (varotsos@noa.gr) (National Observatory of Athens)
Brilli Lorenzo (lorenzo.brilli@unifi.it) (CNR-IBIMET)
Charchousi Despoina (charchousi@gmail.com) (National Technical University of Athens)

Summary
Agriculture is one of the economic sectors vulnerable to climate change, since it directly depends on climatic factors such as temperature, sunlight, and precipitation. The EU LIFE ADAPT2CLIMA (http://adapt2clima.eu/en/) project aims to facilitate the development of adaptation strategies for agriculture by deploying an innovative decision support tool. The ADAPT2CLIMA tool will make it possible to simulate the impacts of climate change on crop production and the effectiveness of selected adaptation options in decreasing vulnerability to climate change in three Mediterranean islands, namely Crete (Greece), Sicily (Italy), and Cyprus. The islands were selected for two reasons: firstly, they figure among the most important cultivation areas at national level. Secondly, they exhibit similarities in terms of location (climate), size, climate change threats faced (coastal agriculture, own water

resources), agricultural practices, and policy relevance. The project is expected to contribute significantly to increasing climate resilience of agriculture areas in Sicily, Cyprus and Crete as well as at EU and international level by developing, implementing and demonstrating ADAPT2CLIMA decision support tool for adaptation planning in agriculture that estimates future climate change impacts on local water resources, as well as the climate change vulnerability of the studied crops' (olives, vineyards, wheat, barley, tomatoes and potatoes) production in the project areas. The tool construction will be closely monitored by the project steering committee comprising of climate and crop scientists, government policy makers as well as farm association executives who will be interacting to tailor make the final product perfectly suited to their needs. In particular, the tool will provide: i) current climate and future climate projections for the areas under study and for two different IPCC RCP scenarios; ii) water resources projections; iii) vulnerability indicators of selected crops relevant to crops' phenology, physiology, production and quality; (iv) socioeconomic indicators; (v) an adaptation assessment together with an evaluation of the proposed adaptation options.

Effects of addition of organic materials and irrigation conditions on soil quality in olive groves: A case study of the region of Messinia, South West Peloponnese, Greece

Authors

Kavvadias Victor (vkavvadias.kal@nagref.gr) presenting author (Hellenic Agricultural Association HAO-DEMETER", Institute of Soil and Water resources, Department of Soil Science of Athens,)

Papadopoulou Maria (mashapapoulou@yahoo.gr) (HAO-DEMETER, Institute of Soil and Water resources, Department of Soil Science of Athens)

Vavoulidou Evangelia (evavoul@otenet.gr) (HAO-DEMETER, Institute of Soil and Water resources, Department of Soil Science of Athens)

Theocharopoulos Sideris (sid_theo@otenet.gr) (HAO-DEMETER, Institute of Soil and Water resources, Department of Soil Science of Athens)

Repas Spiros (spirosreppas@gmail.com) (NILEAS-Agricultural Cooperative for Standardized Products - Nestor Messinia (NILEAS))

Kokkinos Georgios (gkokkinos3@gmail.com) (NILEAS-Agricultural Cooperative for Standardized Products - Nestor Messinia (NILEAS))

koubouris Georgios (koubouris@nagref-cha.gr) (Hellenic Agricultural Organization DEMETER, Institute for Olive Tree, Subtropical Crops & Viticulture, Agrokipion, Chania, Greece)

Psaras Georgios (gpsarras@nagref-cha.gr) (Hellenic Agricultural Organization DEMETER, Institute for Olive Tree, Subtropical Crops & Viticulture, Agrokipion, Chania, Greece)

Summary

Intensive cultivation practices are associated to soil degradation mainly due to low soil organic matter content. The application of organic materials to land is a common practice in sustainable agriculture in the last years. However, its implementation in olive groves under different irrigation regimes has not been systematically tested under the prevailing Mediterranean conditions. A LIFE+ project was initiated (oLIVE-CLIMA; LIFE

11/ENV/000942) aiming to introduce alternative management practices in olive tree crops. The aim of this work was to study the effect of alternative carbon input techniques (i.e. wood shredded, pruning residues, returning of olive mill wastes the field with compost) and irrigation conditions (irrigated and rainfed olive orchards) on spatial distribution of soil chemical (pH, EC, total organic carbon, total nitrogen, inorganic nitrogen, humic and fulvic acids, available P, and exchangeable K) and microbial properties (soil basal microbial respiration and microbial biomass carbon) in two soil depths (0-10 cm and 10-40 cm). The study took place in the region of Messinia, South western Peloponnese, Greece during three year soil campaigns. Forty soil plots of olive groves were selected (20 rainfed and 20 irrigated) and carbon input practices were applied on the half of the irrigated and rainfed soil parcels (10 rainfed and 10 irrigated), while the remaining ones were used as controls. In each soil parcel, six composite soil samples were taken from 0-10 cm of depth, at equal intervals, along a straight line joining the trunk of the tree with the middle of the distance from the nearest tree of the next tree series (sample codes: 1, 2, 3, M-1, M, M+1). The first three samples were under the tree canopy. An additional composite sample was taken at the depth of 10-40 cm.The results showed significant changes of chemical and biological properties of soil in olive orchards due to carbon treatments. However, these changes were depended on irrigation conditions. Levels of most of the soil properties were considerable higher under the canopy as compared to outside the canopy. Proper management of alternative soil carbon inputs in olive orchards can positively affect soil fertility.

Climate Change Impacts on the Hydrologic Balance and Irrigation Demands for the Region of Crete

Authors
Nerantzaki Sofia (sofia_ner@hotmail.com) presenting author (Technical University of Crete, Department of Environmental Engineering)
Giannakis George (geogiann@gmail.com) (Technical University of Crete, Department of Environmental Engineering)
Efstathiou Dionissis (dionissis.efstathiou@enveng.tuc.gr) (Technical University of Crete, Department of Environmental Engineering)
Nikolaidis Nikolaos (nikolaos.nikolaidis@enveng.tuc.gr) (Technical University of Crete, Department of Environmental Engineering)
Kritsotakis Marinos (m.kritsotakis@apdkritis.gov.gr) (Decentralized Administration of Crete)
Tsanis Ioannis (tsanis@hydromech.gr) (Technical University of Crete, Department of Environmental Engineering)
Grillakis Manolis (manolis@hydromech.gr) (Technical University of Crete, Department of Environmental Engineering)

Summary
The island of Crete is a semi-arid, karst-dominated region, characterized by long periods of drought and infrequent but high-intensity rainfalls. The main challenge of the area is the irregular water supply and the high seasonal demand, especially during summer, when agricultural and touristic demand rises. Water needs during the summer months are exclusively covered by the karstic springs and the groundwater, distributed among the region. Hydrological modeling of such watersheds, along with the assessment of climate change impacts, is of utmost importance for the quantification of the water balance in the view of the impacts of climate change for the Mediterranean region. The Karst-SWAT Model was used to

calibrate the hydrology of the Crete Island. By calibrating 22 streamflow and 47 springs gauging stations using actual irrigation data from the shallow and deep aquifer were used, the model captured the spatial and temporal variability of the water balance. In order to simulate climate change scenarios, we assumed that only the agricultural needs will change due to changes in the climate. As a result, the historical time series were simulated again using the "auto-irrigation" function of the model, maintaining the same amounts of irrigated water for each sub-basin as in the actual irrigation case. In order to estimate the potential irrigation, the "auto-irrigation" function was used again considering that the irrigated water was derived from an unlimited outside source. The Karst-SWAT Model was run for the Region of Crete under three climate change scenarios in order to account for the variability of climate change using the two irrigation cases described above in order to estimate by difference the water deficit due to climate change. An SQL code was created that incorporated the modeling of the Karstic Springs and was used for the manipulation of large datasets, in order to complete the simulation of the climate change scenarios for the next 100 years. According to the results, a significant decrease in both surface water bodies and karstic springs flows is expected. This is significant especially for the 2060-2100 time period, while for the whole future simulation (2016-2100) a continuous increase in irrigation water demand is observed. The results were used for the estimation of the future water deficit for the three climate change scenarios.

Modelling of carbon fluxes and pools between soil, vegetation and atmosphere in crop fields under different agricultural practices

Authors
Vavlas Nikolaos, Christos (nikvav@ceh.ac.uk) presenting author (Centre for Ecology & Hydrology / University College London)
Gomez-Dans Jose (j.gomez-dans@ucl.ac.uk) (National Centre for Earth Observation (NCEO) / University College London)
Williams Mathew (mat.williams@ed.ac.uk) (National Centre for Earth Observation (NCEO) University of Edinburgh)

Summary
Climate change caused by accumulation of greenhouse gases (GHG) presents significant challenges to ecosystems. Bio-sequestration of atmospheric carbon (C) in soils and vegetation has been suggested as a way of reducing the atmospheric GHG concentrations. Soil C sequestration has a number of additional benefits, such as increased soil quality and improvement in yield, improved water quality and decreased net GHG emissions from agricultural lands. Modelling of the carbon cycle in croplands can help to understand and assess these claims, as well as open the door to monitoring or prediction capabilities. In this communication, we use the DALECc crop model, a pragmatic simplification of the SPA-crop model. This is a simple model that assumes C circulates between a fixed number of pools, the pools representing different crop organs (root, stem, live and dead leaves, labile C and storage), but also the litter and soil organic C (SOC). The model calculates solar radiation interception by the crop and provides an estimate of GPP, which is then allocated to the different C pools using a set of allocation strategies controlled by a phenology model. DALECc thus allows the calculation of the different C fluxes in a typical crop. DALECc is very simple in comparison to similar models, and it is designed to be used in conjunction with observations that allow to correct for the errors arising from the simplifying assumptions

made in developing the model. We concentrate on studying the performance of DALECc for identifying different fluxes and the evolution of C pools, SOC specifically on well studied sites in the US. The three Mead sites are part of the FLUXNET network of flux towers, and are currently undergoing a long term experiment to assess the C storage potential of croplands. As such, they are ideal to investigate the performance of a model, as well as to identify what observations are required to make the application of the model to large areas feasible. We have performed a Bayesian calibration of the model using ground measurements and a variational scheme, and show that the model is able to reproduce C fluxes on a daily scale, as well as showing a general trend to the decrease of SOC. We have also investigated the use of satellite-derived leaf area index (LAI) products, a widely available measure globally available, as a way to assess the ability of DALECc operation to be applied to other areas where detailed ground measurements might not be available. We found that using only LAI as a calibration input resulted in poor predictions of the development stages, so other data streams or prior information are required to fully calibrate the model phenology. Additionally, soil respiration was overestimated, suggesting that an investigation of more complex soil respiration models might be beneficial.

Impacts of climate change on reservoir management in Crete: the case of Potamon-Amariou Reservoir

Authors
Papadaki Sofia (s.kef@hotmail.com) presenting author (Technical University of Crete, Department of Environmental Engineering)
Nerantzaki Sofia (sofia_ner@hotmail.com) corresponding author (Technical University of Crete, Department of Environmental Engineering)
Nikolaidis Nikolaos (nikolaos.nikolaidis@enveng.tuc.gr) (Technical University of Crete, Department of Environmental Engineering)

Summary
It is estimated that 85% of the total amount of water supply in Crete is used in order to satisfy the needs for agriculture and livestock, making reservoirs created by dams, in a semi-arid watershed like Crete, necessary, especially during dry periods. However it is estimated that from the total 129 Mm3 capacity of the reservoirs in Crete, only 40 Mm3 are exploited on average. The Potamon-Amariou Reservoir is located in the province of Amari in Rethymno prefecture, and has a total storage of approximately 22.5 Mm3. The objective of this study is to assess the reservoir management under present and future climate conditions and suggest improvement measures. Field data from river measurements along with data taken from the reservoir during the period it was filling up (water level vs time), in combination with the SWAT model (Soil and Water Assessment Tool) and a reservoir model were used for calibration and validation. Various management scenarios for the present case were applied. For the future projections, a moderate climate scenario was selected. The management scenario under the present conditions suggested that the system failure is significantly low when 15 Mm3 are derived on average. As far as the future scenario is concerned, a 12-month SPI index revealed that there will be a period of 10 consecutive years of drought, during which only 1/3 of the capacity of the reservoir can be utilized. Overall, the climate change impact on the hydrologic cycle of Crete is going to be significant. It is important to rethink the way of the reservoirs operation and consider diverting water from other basins in order to increase the water storage and alleviate the impacts of dry spells.

Effect of different sustainable orchard management strategies on soil properties, nutrient uptake and soil microbiological aspects in an olive orchard

Authors
Bechara Elias (koubouris@nagref-cha.gr) (Mediterranean Agronomic Institute of Chania)
Doupis Georgios (gdoupis@gmail.com) (HAO "Demeter" - Institute of Olive Tree, Subtropical Crops & Viticulture)
Sofo Adriano (adriano.sofo@unibas.it) (Università degli Studi della Basilicata - School of Agricultural, Forestry, Food and Environmental Sciences)
Psarras Georgios (gpsarras@nagref-cha.gr) presenting author (HAO "Demeter" - Institute of Olive Tree, Subtropical Crops & Viticulture)
Papafilippaki Androniki HAO "Demeter" - Institute of Olive Tree, Subtropical Crops & Viticulture)
Koubouris Georgios (koubouris@nagref-cha.gr) corresponding author (HAO "Demeter" - Institute of Olive Tree, Subtropical Crops & Viticulture)

Summary
The short-term (three years) effects of four sustainable orchard management schemes were evaluated in an experimental olive orchard in Crete, Greece, in terms of mineral content of soil and trees, soil microbial populations and mycorrhizal colonization. The study was performed between 2013 and 2015 in a forty-year-old olive plantation (Olea europaea L., cv. Kalamata). The orchard management schemes included: a) compost application (COMP), b) recycling of pruning material (PRUN), c) a mixed (legumes and Avena sativa) cover crop (COVER), d) combination of a, b and c (ALL), and e) control (CON), with no application of organic material and maintenance of weed-free orchard. Although alteration of basic soil properties including increase of organic matter and water and nutrient holding capacity are slow processes that require several years to be achieved, some positive effects were recorded during the first 3 years of application. Soil organic matter, was significantly increased in ALL treatment as compared to single-factor treatments, where differentiation from control was still not clear. Nitrate-N availability was higher in COMP and ALL treatments, while sole application of PRUN treatment seemed to act negatively in N availability as compared to control. Phosphorus availability was also increased in COMP and ALL treatments, while ALL treatment resulted in higher N and P content in olive tree leaves. A positive effect on mycorrhizal colonization was recorded in ALL treatment, while all sustainable schemes seemed to favor the populations of azotobacters and actinomycetes, as compared to the control. The adoption of the sustainable management schemes applied during this study, is in complete agreement with the European policy on the transition from a linear to a circular economy and could provide significant benefits for rural stakeholders and ecosystems in the long term.

Crop coefficients and water use efficiency in an apple orchard assessed by eddy covariance measurements

Authors
Damiano Zanotelli (damiano.zanotelli@unibz.it) presenting author (Free University of Bolzano-Bozen)
Montagnani Leonardo (leonardo.montagnani@unibz.it) (Free University of Bolzano-Bozen)
Andreotti Carlo (carlo.andreotti@unibz.it) (Free University of Bolzano-Bozen)
Tagliavini Massimo (massimo.tagliavini@unibz.it) (Free University of Bolzano-Bozen)

Summary
The undergoing climate change is expected to severely affect the agriculture in mountain areas, as a consequence of a predicted increase in temperature and changes in the amount and distribution of precipitations. Apple is an irrigated crop in in the Trentino Alto-Adige (Italy) district, and there is an impelling need to improve water management based on the precise knowledge of its water requirements so to increase the efficiency in the use of the resources. Objectives of this work were: i) to determine experimentally crop coefficients (Kc) capable to predict with accuracy crop evapotranspiration (ETc); ii) to compare them with the reference standard Kc for the apple tabled in FAO Quad56, and to test their correlation with environmental drivers; iii) to assess the water use efficiency (WUE). The experimental work was conducted for three consecutive years (2013-2015) in a mature commercial apple orchard (cv. Fuji on M9 rootstock) located near Bolzano (South Tyrol, Italy). Actual evapotranspiration (ETa) was measured continuously with the eddy covariance methodology, and then corrected by forcing the closure of the surface energy balance following the bowen ratio method. Reference evapotranspiration (ETo) was modelled with the standard FAO-PM equation. Empiric Kc was obtained at daily time scale from the ratio ETa/ETo, and the correlation with vapour pressure deficit (VPD) and global radiation (Rg) was analysed for each phase of the growing season (initial, development, mid and end stage). WUE was assessed as the ratio between gross primary productivity (GPP, derived from net ecosystem carbon fluxes measured by eddy covariance) and ETa. Results showed that empiric Kc were substantially lower than that proposed by FAO starting from the development phase until the end of the season. In the mid-phase, the Kc averaged 0.90, approximately 25% less than the 1.20 tabled in FAO Quad56 (1.18 after correction for the local climatic conditions). A positive correlation of Kc with both VPD and Rg was found during the development and mid-season stage, with a delta-Kc of approximately 0.20 observed from days with low and high VPD. When we used the linear model of Kc as a function of VPD, the ability to predict crop evapotranspiration (ETc= ETo*Kc) in the central part of the season was higher than when we used the fixed, empirically assessed Kc. The average (± se) WUE of the apple orchard in the three growing seasons was 2.53±0.06 gC kg-1 H2O. In the summer period, higher values were recorded in 2014 when the weather was wet and relatively cold (2.73±0.13, mean ± se) as compared to 2013 and 2015 (2.13 ±0.09 and 2.19±0.08 respectively), when it was dry and warmer. Our findings indicate that site-specific and VPD-adjusted Kc may allow to better predict ET in the apple orchard; excessive air temperatures have an adverse effect on water use efficiency a fact that must be taken into account in the context of global warming.

Effects of addition of organic materials and irrigation conditions on soil quality in olive groves: A case study of in the region of Merambello, island of Crete, Greece

Authors
Kavvadias Victor (vkavvadias.kal@nagref.gr) presenting author (Hellenic Agricultural Association HAO-DEMETER", Institute of Soil and Water resources, Department of Soil Science of Athens)
Papadopoulou Maria (mashapapoulou@yahoo.gr) (Hellenic Agricultural Association HAO-DEMETER", Institute of Soil and Water resources, Department of Soil Science of Athens)
Theocharopoulos Sideris (sid_theo@otenet.gr) (Hellenic Agricultural Association HAO-DEMETER", Institute of Soil and Water resources, Department of Soil Science of Athens)
Vavoulidou Evangelia (evavoul@otent.gr) (Hellenic Agricultural Association HAO-DEMETER", Institute of Soil and Water resources, Department of Soil Science of Athens)
Malliaraki Stella (stellamalli@yahoo.gr) (Union of Agricultural Cooperatives of Mirabello, Sergaki 2, Neapoli, Lasithi, 72400, Crete, Greece)
Agelaki Katerina (stellamalli@yahoo.gr) (Union of Agricultural Cooperatives of Mirabello, Sergaki 2, Neapoli, Lasithi, 72400, Crete, Greece)
koubouris Georgios (koubouris@cha-nagref.gr) (Hellenic Agricultural Organization DEMETER, Institute for Olive Tree, Subtropical Crops & Viticulture, Agrokipion, Chania, Greece)
Psarras Georgios (gpsarras@cha-nagref.gr) (Hellenic Agricultural Organization DEMETER, Institute for Olive Tree, Subtropical Crops & Viticulture, Agrokipion, Chania, Greece)

Summary
Olive tree pruning residue and olive waste represent a great amount of organic materials which are produced during a short period. The application of organic materials to land is a common practice in sustainable agriculture in the last years. However, its implementation in olive groves under different irrigation regimes has not been systematically tested. A LIFE+ project was initiated (oLIVE-CLIMA; LIFE 11/ENV/000942) aiming to introduce alternative management practices in olive tree crops. The aim of this work was to study the effect of alternative carbon input techniques (wood shredded, pruning residues, returning of olive mill wastes the field with compost) on soil chemical (pH, EC, total organic carbon, total nitrogen, inorganic nitrogen, humic and fulvic acids, available P, and exchangeable K), and microbial properties (soil basal microbial respiration and microbial biomass carbon) in relation to irrigation conditions (irrigated and rainfed olive orchards). The results showed that changes of soil quality in olive orchards due to carbon inputs depend on irrigation conditions. Soil carbon content remarkably reduced by addition of organic material in irrigated plots compared to control whereas they were substantially increased in rainfed plots. Microbial parameters appeared to be reliable indicators of changes in soil management over the short period of this study. Nutrient contents and microbial properties were declined with the distance from the tree regardless, the irrigation regime and carbon input treatment. This fact indicated the influence of tree canopy area and root density on the soil surface properties. Soil depth significantly influenced soil attributes. Significant decreases were recorded for SOC, inorganic nitrogen and microbial properties indicating the high potential of surface soil in olive groves to sequester carbon. Conversely, addition of organic matter and irrigation conditions did not contribute to subsoil C content. Proper management of alternative carbon inputs in soil can positively affect soil productivity in Mediterranean olive groves.

Crop production versus applied water

Authors
Evangelides Chris (evan@vergina.eng.auth.gr) presenting author (AUTh)
Arampatzis George (arampgeo@gmail.com) (ELGO DEMETER)
Zormpa Dimitra (dzormpa@yahoo.gr) (AUTh)

Summary
Agriculture consumes about 70% of the available freshwater worldwide. Specifically in Greece, the agricultural sector is consuming about 80% of the available water resources. Most of the organized collective irrigation networks in Greece were built mainly during the decade of 1960. Total irrigated land in Greece exceeded 1.200.000 ha in 1998, and currently is almost 1.600.000 ha, whilst collective irrigation networks in 1998 sufficed about 600.000 ha (source: webpage of the Hellenic Ministry for Agricultural Development and Food) Rational irrigation aims at providing the root zone with the required water quantity to sufficiently cover crop needs, while in parallel achieving minimization of water losses at field level. It is well known that due to climatic change and overexploitation, there is significant pressure on the available water resources. According to many researchers climatic change will effect the worldwide available freshwater and it is mandatory to apply a better management scheme for the preservation of the available water resources. Previous studies show that there is between 30-50% excessive water used for irrigation compared to the actual crop water requirements. In this article an attempt is carried out to estimate how the sum of the applied irrigation water and the effective precipitation affects crop production. The investigation was carried out at two open collective irrigation networks operated by Local Land Reclamation Organizations (L.L.R.O.), namely Agios Athanasios and Chalastra in the area of Thessaloniki plain. These networks receive their water supply from Axios River. Irrigation water quantities were recorded and also effective precipitation was calculated for the period 2002 to 2010. The production of cotton, rice and maize were accounted for, since they occupied about 80% of the area under examination. The cultivations were selected due to the fact that have high water needs. The area was selected since the dominant cultivation in the area is rice, which has the highest water needs compared to the remaining cultivations of Thessaloniki plain. Results show that production of rice and cotton are not affected from total water volume applied, contrary to maize that follows the distribution. The variations of yearly irrigation water quantities follow quite closely the variations of the effective precipitation.

Climate change and olive farming. The case of olive growing in different agroecological zones and under different management systems in Crete, Greece

Authors
Kabourakis Emmanouil (ekab@nagref-her.gr) presenting author (Ecological Production Systems, Institute of Olive Tree, Subtropical Plants and Viticulture, Directorate of Agricultural Research (NAGREF), Hellenic Agricultural Organisation (ELGO))
Gkisakis Vasileios (gisakis@gmail.com) (Agroecologiki SP)
Volakakis Nikolaos (nvolakakis@gmail.com) presenting author (Geokomi)

Summary
Olive yields and quality are linked to the weather conditions that vary from one location to the other. The severity of climate change in olive farming depends among others on the farming methods applied. The greenhouse gases (GHG) emissions were calculated in olive

orchards located in hilly and plain agroecological zones and under organic, integrated and conventional farming systems, for two years in Messara plain, Crete, Greece. The GHG emissions were calculated in terms of CO2-equivalents, following IPCC methodology, and included several farming methods, farming inputs, and equipment use. GHG emissions (CO2-eq/kg of olive oil produced) were not significantly different between agroecological zones and were significantly higher in the conventional farming system, especially due to burning of pruning residuals. Use of fertilizers were the main source of emissions for both hilly and plain olive orchards. Based on the findings farming methods for adaptation to climate change, minimising negative effects and increasing resilience are discussed.

How can agriculture adapt to changing climate conditions? Social perceptions and new practices of farmers, a case study in Southern France

Authors
ASPE Chantal (chantal.aspe@univ-amu.fr) (Aix Marseille Université / LPED UMR 151)
JACQUE Marie (marie.jacque@univ-amu.fr) (Aix Marseille Université / LPED UMR 151)

Summary
This paper presents a sociological analysis on the link between farmer's social perceptions of climate change and the effects on their behaviours and their agricultural technical choices. Our analysis is based upon first results of a qualitative research in southern France. Semi-directed interviews were conducted with farmers. The farmer sample for the case study was constructed to ensure that the general characteristics of agriculture are represented. Case study farms are categorized according to the type of production: vegetables, fruit trees, vine, and livestock. We try to understand how farmers take decisions when they adapt to changing conditions. Are they affected by the scientific knowledge? Are they utilizing or creating networks contacts?, Are they researching information by professional technicians ? Are they mobilized by financial support? Are they affecting by the social pressure? Or, and that is our main hypothesis, are they trust in their inner guidance and perception of climate change to act: less component crops yield, high severity drought and flooding more frequently. The emphasis in the fieldwork is on the farmer's perspective, by studying how the farmers explain their own goals regarding to their representation of reality, and analyzing what factors are involved according to their explanation. Besides the analysis of the farmers perceptions, we will take account of their practices to show that they can adapt in different ways: water savings by drip or spray irrigation systems, by testing different heat resistant crop types (for the vine for example) or by changing cultivation techniques. These changes could lead to an unintended consequence: more ecological practices. These practices are supported by european and french policies. In public policy, agriculture represents a key sector for a local and territorial adaptation to climate change and, the transformation of agricultural practices the main lever through which agricultural system will become more sustainable. In that way, propose a climate smart agriculture model which could be able to ensure food security, adaptation and mitigation, notably by the promote of innovative practices and technics in agriculture. It's seems that agro-ecological transition which combine economic and environmental performance is a major issue to maintain agricultural activity and a priority for the European and regional politics.

Carbon and nutrient distribution across soil profiles in Mediterranean olive forests

Authors
Theocharopoulos Sideris (sid_theo@otenet.gr) presenting author (Hellenic Agricultural Association HAO-DEMETER", Institute of Soil and Water resources, Department of Soil Science of Athens)
Vavoulidou Evangelia (evavoul@otenet.gr) presenting author (Hellenic Agricultural Association HAO-DEMETER", Institute of Soil and Water resources, Department of Soil Science of Athens)
Kavvadias Victor (vkavvadias.kal@nagref.gr) corresponding author (Hellenic Agricultural Association HAO-DEMETER", Institute of Soil and Water resources, Department of Soil Science of Athens)
Papadopoulou Maria (mashapapoulou@yahoo.gr) (Hellenic Agricultural Association HAO-DEMETER", Institute of Soil and Water resources, Department of Soil Science of Athens)
Michalopoulos Georgios (parabem@hol.gr) (RodaxAgro Ltd)

Summary
Carbon sequestration into soils is one of the most important ecosystem services because of its role in climate change impacts. Intensification of agriculture practices causes high losses of soil organic carbon, thus inducing soil degradation. The application of organic materials to olive groves is a common practice in sustainable agriculture in the last years. A LIFE+ project was initiated (oLIVE-CLIMA; LIFE 11/ENV/000942) aiming to introduce alternative management practices (wood shredded, pruning residues, returning of olive mill wastes to the field with or without composting) in olive tree groves. The olive groves were located in three pilot regions, where two of them were in the regions of Peza and Merrambello, island of Crete, and the third one in the region of Messinia, South west Peloponnese. The aim of this work was to study the effect of carbon practices on distribution of soil organic carbon and nutrients across the soil profiles which were mechanically excavated in the pilots areas. In each soil profile, soil samples were selected at 10 cm intervals until parent material. Moreover soil samples were also collected from the identified morphogenetic soil horizons. The samples were analyzed for soil physical, chemical and microbiological properties. The results showed that the levels of most soil chemical constituents were decreased with soil depth. The significant accumulation of soil organic carbon in the superficial layers of olive groves indicated high potential of surface soil to store carbon and nutrients. This effect was more evident in soil receiving organic materials and in irrigated olive fields.

"Diversify & minimize": Agroecological approaches for reducing greenhouse gases emissions and increasing resilience of Mediterranean agroecosystems and rural societies

Authors

Gkisakis Vasileios (gisakis@maich.gr) presenting author (Researcher, Sustainable Agriculture dpt, Mediterranean Agronomic Institute of Chania)

Summary

Climate change is expected to have a pronounced effect on food production systems of the Mediterranean region, due to combination of adverse agroclimatic and socio-economic conditions. Without an adaptation strategy to be implemented soon, the performance of modern, high input, cropping systems is estimated to be at stake, while rural communities appear as highly vulnerable. On the other hand, agroecological approaches can serve as the basis to increase resilience of Mediterranean agriculture and rural society. Agroecology is defined as a multidisciplinary science, as well as practice and movement, which provides a holistic approach for the design and management of truly sustainable food production systems. It incorporates integrated and robust paths to increase climate resilience and performance, with successful international examples. This is mostly achieved through high field diversity and landscape heterogeneity (Diversify) to resist extreme climate effects and low-input management (Minimize) for greenhouse gases mitigation purposes. The agroecological concept incorporates also traditional agricultural knowledge, as developed in conditions of scarce resources of the Greek islands and for cropping systems like olive, vine and vegetables, combining several agroecological methods; adjusted and diversified farming techniques, use of locally adapted, stress-tolerant crops, sustainable management of resources and soil. Eventually, a paradigm shift towards agroecological strategies requires gradual transition procedures, addressing additional social and economic issues; localized production & consumption networks, community supported agriculture and diffused agricultural knowledge by facilitating innovative research & extension services, both institutional and among farmers. The above can set the conceptual framework to achieve climate mitigation and resiliency of the Mediterranean agroecosystems, as well as food sovereignty and security for rural societies. Therefore, policies and actions which address and support the development and adaptation of such agroecological mechanisms should be pursued.

Climate change and water resources management in Arab countries

Authors

El Gayar Attia (attiaelgayar@yahoo.com) (Professor of SOIL-WATER MANAGEMENT. Soils, Water & Environment Research Institute)

Summary

In the face of limited water resources, the Arab has to be re-structuring and managing of water resources to match what was expected to increase pressure on those resources due to the direct impact of climate change, where you must activate the principle of integrated management of all water resources up to reduce water losses and maximize the return from a unit of irrigation water concept of national security and economic demonstrating that harnessing the political relations to serve this purpose. Should also review the policy of distribution and consumption of water and change the crop structure commensurate with its economic feasibility from the standpoint of water, in addition to the establishment of a regional numerical model to modify the structures to control the crop in the effectiveness of the exploitation of water resources. In general, Arab countries are developing ones countries, which are highly vulnerable to the effects of climate change because climate is dry. If the temperature rose or fell in the area of rain, intensified pressure on natural systems and physical. According to studies of climate models that the Arab region will increase by 5.5

degrees Celsius in the surface temperature at the end of the twentieth century and the atheist. And this increase will be associated with an expected drop in rainfall from zero to 20 per cent, these changes will make the expected shorter winters and drier summers, warmer, and raise the heat waves and increase the frequency and occurrence of volatile weather events and extremes. These effects are an increase in evaporation from water bodies and natural and artificial soils, thereby reducing the available water supply. , The effects will increase the rate of evapo - transpiration products of crops and natural vegetation. That climate change will increase in future demands on the irrigation potential by 6 to 16 per cent due to the increase in transpiration with the end of the twenty-first century.And lead to changes in climate due to global warming to changes in the distribution of insects and other vectors that transmit human and animal pathogens. The atmosphere warmer, with accompanying climatic instability growing, will increase the risk of floods and droughts are likely to increase drought-affected areas, and likely to increase in cases of rainfall is extreme, in terms of frequency and intensity, and will worsen the risk of flooding and there will be floods and droughts and a water shortages, the main obstacle in most countries in the Arab region. The piece that incorporate measures to mitigate climate change and adaptation strategies and policies in the development of water management strategies that strengthen and increase efficiency.
Keywords: climate change, water resources, evapo – transpiration, the Arab region.

Description of olive cultivars through morphological parameters by using advanced mathematical algorithms

Authors
Blazakis Konstantinos (blazakis@maich.gr) presenting author (Department of Horticultural Genetics and Biotechnology)
Kosma Maria (kosma@maich.gr) (Department of Horticultural Genetics and Biotechnology)
Kostelenos George (info@kostelenosfytoria.gr) (Kostelenos Olive Nurseries)
Baldoni Luciana (luciana.baldoni@ibbr.cnr.it) (Italian National Research Council, Institute of Biosciences and Bio-Resources (CNR-IBBR))
Bufacchi Marina (marina.bufacchi@isafom.cnr.it) (Italian National Research Council, Institute for Agriculture and Forest Systems in the Mediterranean (CNR-ISAFOM))
Kalaitzis Panagiotis (panagiot@maich.gr) corresponding author (Department of Horticultural Genetics and Biotechnology)

Summary
The morphological analysis of olive leaves, fruits and endocarps may represent an efficient tool for the characterization and discrimination of cultivars and the establishment of relationships among them. In recent years, much attention has been focused on the application of molecular markers, due to their high diagnostic efficiency and independence from environmental and phenological variables. In this talk, we will present a semi-automatic methodology of detecting various morphological parameters. With the aid of computing and image analysis tools, we created semi-automatic algorithms applying intuitive mathematical descriptors that quantify many fruit, leaf and endocarp morphological features. In particular, we examined quantitative and qualitative characters such as size, shape, symmetry, contour roughness and presence of additional structures such as nipple, petiole, endocarp surface roughness, etc. We will illustrate the performance and the applicability of our approach on Greek olive cultivars; on sets of images from fruits, leaves and endocarps. Moreover, the

proposed methodology was also applied for the description of other crop species morphologies such as tomato, grapevine and pear. This allows us to describe crop morphologies efficiently and robustly in a semi-automated way.

Interactions Effect of Cyanobacterial Bioactivities and Nitrogen Fertilizers on N_2O and CO_2 Emissions and Soil Productivity

Authors
El-Gamal Manal Abd-Allah Hassan (manal_ahe@yahoo.com) (Soils, Water and Environment Research Institute, Egypt)

Summary
ABSTRACT Different forms of nitrogen fertilizer are applied to cultivated soil with the ultimate goal for maximizing productivity and economic return, but it is known to affect CO_2 and N_2O emissions. A field experiment was carried out in 2012/2013 season at Agric. Res. Station, Giza, Egypt, to study the capability of cyanobacteria to sustain their viability in mitigate N_2O and CO_2 gases emitted from soil fertilized with different nitrogen fertilizer forms and their effects on some soil properties and barley yield. The nitrogen fertilizers were namely: ammonium nitrate, compost and urea-form (UF); which applied separately or in combinations to barley field; where no nitrogen fertilizer was applied to the control. Results showed that application of compost fertilizer either alone or in combination with other fertilizer forms resulted in significant increases in dehydrogenase activity, soil respiration, organic matter, cyanobacterial population, CO_2 and N_2O emissions as well as nutrients availability in soils after harvest. While, less amounts of CO_2 and N_2O emission were monitored due to application of urea-form comparing to either compost or mineral fertilizers. Diminishing percent in N_2O and CO_2 emission ranged from 14.50 to 23.65 % over all treatments due to addition of cyanobacteria, where the highest beneficial effect of cyanobacteria was attained with application of ½ compost + ½ UF. It was also demonstrated that cyanobacteria have the potential to significantly improve soil microbial activities, soil properties and nutrients availability, which in turn reflected on crop productivity increases. The results indicated that the application of ½ mineral nitrogen + ½ urea-form treatment preferably to attain the highest plant productivity, which increased grains and straw yield by 19.12 and 36.53 %, respectively due to application of cyanobacteria. High grains and straw yield and environmental efficiency could be achieved by applying ½ mineral nitrogen + ½ urea-form and cyanobacteria Key words: Nitrogen fertilizers, cyanobacteria, N_2O and CO_2 emission, urea-form, compost, soil productivity.

The direct and indirect effect of climate change on citrus production in Tunisia: a macro and micro spatial analysis

Authors
zouabi oussama (oussamao77@yahoo.fr) (LAREQUA- University of Tunis El Manar and LEAD- University of Toulon)

Summary
In this study, we tried to show the direct and indirect effect of precipitation and temperature on the production of citrus in Tunisia of a governorate i and the neighboring governorates. To do this, we used a new original analysis of spatial econometrics to take into account in an efficient and finely manner the spatial effects, individual and temporal effects of the spatial autocorrelation. This analysis was done on the basis of global spatial autocorrelation test and the spatial autoregressive model (SAR) as well as the spatial Durbin model (SDM). It appears from our results that the available water in the groundwater table of the governorate i can be an effective solution for the farmer who resides there provided that the means are implemented so that he can benefit. Our robustness results based on the cointegration dynamic panel data, also shows the effect of temperature via the hydric resources of the governorate and that the neighboring governorates represent a negative spillover effect.

Adapting crop management practices to climate change: Opportunities and challenges for climate change adaptation in Pakistan

Authors
Abid Muhammad (muhammad.abid@comsats.edu.pk) presenting author (Centre for Climate Research & Development, COMSATS Institute of Information Technology, Islamabad)

Summary
Pakistan is one of the countries most affected by climate change vulnerability and particularly, rural communities in the country are highly sensitive to climate change due to persistence poverty; over-dependence of population on natural resources and lack of resources. Climate change and frequent extreme events such as floods, droughts and storms may act as multiplier of existing threat to food and human security in the country. Hence, adapting food systems is prerequisite to avoid climate change damages and to sustain food security in Pakistan. This study uses a cross-sectional data-set of 450 farm households collected from three agro-ecological zones of Pakistan in 2014 and investigates the socio-economic impacts of climate change, current adaptation strategies and future adaptation measures to deal with projected impacts of climate change. The qualitative analysis presents farmers' actual experiences with climate-related extreme events and their farm level responses to those conditions. Further, current adaptation strategies are also evaluated to see how do they vary across various locations and socio-economic settings and how do they match to recommended adaptation measures. Further, this study will also investigate opportunities and challenges for adapting crop management practices to climate change. The study uses a mix of state-of-the art statistical and econometric approaches such as correlation analysis, multivariate analysis. The study found that extreme temperature events, uncertain rainfalls, increase in crop pest and diseases are affecting crop productivity, water availability and well-being of farmers in many ways. It is also found that farmers mainly use short-term and low-cost measures such as changing crop varieties, sowing dates and crop types to cope with climate change. However, farmers' knowledge regarding the use of adopted measures is very limited and is based on information available from co-farmers. Further, it is also found that farmers have very limited access to institutional and infrastructure services that are

prerequisite for effective adaptation to climate change. More efforts are needed to address changing climate, by helping farmers in adopting advanced crop management practices such as use of improved crop varieties, soil and water conservation practices, water saving technologies. Actions should also be taken to teach farmers about efficient and effective use of available scarce resources particularly water. Further, constraints to adaptation that are mainly related to money and information need to be overcome through involving civic and private sectors and multi-sector investment in agriculture. For this purpose, networking among different stakeholders both at horizontal and vertical level would be required.

On the use of leaf spectral indices for real-time detection of physiological responses of olive under variable water conditions

Authors
Centritto Mauro (mauro.centritto@cnr.it) presenting author (CNR-IVALSA)

Summary
The effective utilisation of renewable water resources in agriculture is a significant challenge in many areas of the globe. To mitigate the effects of increasing chronic water shortages, there is a need to develop and expand irrigation management practices. However, considering the unprecedented pressure on water resources for agriculture caused by rapidly growing water demand for urban and industrial uses, the expansion of irrigation may only become possible through the development of precision water saving irrigation techniques. These are based on the real time detection of crop physiological status, and require the development of advanced, non-invasive phenotyping methods to monitor water relations and photosynthetic status in plants experiencing water-stress. To this end, remotely sensed vegetation indices are increasingly being used as reliable cost-effective plant-based indicators to assess physiological traits associated with plant water status. Furthermore, the real-time detection of plant physiological changes in regions subjected to drought is important for precision crop management and the estimation of terrestrial productivity. Therefore, improved knowledge of the relationship between leaf spectral and physiological responses under variable water conditions is of crucial importance. This work presents an integrated approach to evaluate diffusional limitations to photosynthesis, plant water status and transpiration through the use of canopy spectral reflectance indices in olive (Olea europaea L.) plants subjected to water stress. Our findings demonstrate that photosynthesis, stomatal conductance, mesophyll conductance, total conductance, photochemical reflectance index (PRI), water index (WI) and relative depth index (RDI) closely followed water status. PRI was significant correlated with relative water content (RWC). PRI was also very sensitive to pigment concentrations and photosynthesis, and significantly tracked all CO2 conductance parameters. WI, RDI and WCRI were all significantly correlated with RWC, and most notably to leaf transpiration. Furthermore, the seasonal courses of reflectance indices scaled linearly with gas exchange parameters and resulted correlated with whole-plant transpiration as assessed by stem sap flux density. The proposed analytical approach highlights the importance of combining measured parameters and sensor outputs in order to determine adjustments of specific plant functionality traits, such as the dynamics of water status in trees, for modelling and practical uses.

Drones for Ship Emissions Monitoring at European Emission Controlled Areas

Authors
SARRIS ZACHARIAS (administration@altus-lsa.com) presenting author (President and CEO)

Summary
ALTUS LSA solution for: Ship Emissions Monitoring with Unmanned Aerial Systems. The Problem: What has instigated this the surge in regulation and enforcement measures to curb shipping emissions is the severe impact they have on the environment and public health. Shipping has been found responsible for emitting around 1000 million tonnes of CO2 annually (IMO, 2014) and is responsible for contributing to about 3% to the world's total GHG emissions, with increasing trends. It is projected that unless significant initiatives are undertaken, shipping might contribute to 6% of the global GHG emissions by 2020 and 15% by 2050 (Helfre & Boot, 2013). Regarding non-GHG emissions the contribution of shipping industry is calculated to be at levels of 5-10% (Corbett & Koehler 2003, Eyring et al, 2005). Compared to other transport modes, the emissions from shipping, especially regarding Sulphur, are substantial and have been found to surpass those of road transport by two to three times. (ICCT, 2007). Also international shipping produced approximately 80 times more Sulphur emission compared to aviation in 2000 (Eyring et al, 2005). The heath impact on the populous is enormous and there are an array of studies measuring the impact. Indicatively, research from America says pollution from the world's cargo ships leads to 60 000 premature deaths per year in America, while European research suggests the figure could be 39 000 in the EU. Danish environmental agency says shipping emissions cost the Danish health service over €4.5 billion per year, mainly treating cancers and heart problems. Some reports suggest a container ship using low-grade ship bunker fuels can cause the same amount of cancer and asthma-causing chemicals as 50 million cars. Problem of Enforcement: Enforcement of the regulations in place has proven difficult and costly. Coastguards, law enforcement, governmental agencies and port authorities are ill equipped and the pure volume of the task of inspecting the potentially polluting ships is staggering. Without indication of proof authorities can only run random inspections and are limited in their success in enforcing and penalizing non-compliance ships and operators. As surveys show in Europe alone only one in 1,000 ships is inspected. The burden on taxpayers, resources, manpower is very high to try to implement the mandates of the regulation. The European Parliament in understanding the difficulty and constraints of enforcement as well as the expedited needs to curb shipping emissions introduced Council Directive 2005/35/EC of 7 September 2005, as amended by Directive 2009/123/EC of the 21st of October 2009 on "ship source pollution on the introduction of penalties including criminal penalties for pollution offenses" ALTUS LSA identified the market requirements and potential of emission-monitoring drones in shipping and other industries and the subsequent market that will come with it. In that respect ALTUS has developed the necessary technology and associated methodologies for addressing the "ship emissions Monitoring" requirement with the use of an integrated UAS/cloud based solution which will be further elaborated within the "Climate Changing Agriculture" Conference oral presentation.

On-farm Implementation of ICT tools for sustainable irrigation management under climate change

Authors
Todorovic Mladen (mladen@iamb.it) presenting author (CIHEAM - Mediterranean Agronomic Institute of Bari)
Riezzo Erminio (riezzo@sys-man.it) (Sysman Progetti & Servizi srl)
Galiano Angelo (maurizio.galiano@dyrecta.com) (Dyrecta Lab)
Boari Francesca (francesca.boari@ispa.cnr.it) (CNR – Institute of Science of Food Production)

Summary
Sustainable management of irrigation is of crucial importance for the agricultural sector in the Mediterranean region where the resources are limited and exposed to the climate variability and change. Therefore, the application of modern technologies and tools for water management is of particular relevance in order to enhance the efficiency and safeguard resources for other sectors. This study focusses on the on-ground implementation of an automated Decision Support System (DSS) for the optimization of water management in Mediterranean agriculture. The activities are carried out within the IRRI-TECH project funded by the Apulian region and focussing on the use of advanced technologies for water management in agriculture. IRRI-TECH represents the continuation of activities held within a previous project (HYDRO-TECH, EC-ERDF) when the system was developed and integrated through a collaboration between the private sector (software and hardware development and integration) and scientific institutions (model's development, calibration and testing). Consequently, a commercial DSS for irrigation management (BLULEAF) was built and promoted (www.bluleaf.it). IRRI-TECH aims at the further upgrading of the DSS focussing on the extension of its on-farm implementation in the Apulia region and calibration and testing under different pedo-climatic conditions, crops and management scenarios. The on-farm implementation is going on at eight private farms where the most important horticultural and tree crops and vineyards are cultivated. The ICT water management tool integrates weather, soil, crop, irrigation system, and management data in a unique platform through a standard interfaces connecting the on-field devices with the client software application - a Data Cloud Network. This permits wireless and continuous monitoring of the on-field conditions and the remote control and management of irrigation via new generation of smart devices (tablets, smartphones). The ICT tool uses the real-time daily weather data to run the soil water balance model and schedule/optimize irrigation considering the weather forecasting data and site-specific constraints about water availability and technical characteristics of the on-farm irrigation system. The soil water balance model is based on the standard FAO procedure for the estimation of crop evapotranspiration (FAO 56, 1998) whereas a dynamic multi-crop/multi-plot/farm optimizer supports the user-defined setting of constraints and irrigation priorities at the farm scale. The decision criteria are based on the eco-efficiency concept, which aims to increase the economic benefit of farmers while minimizing the environmental burden. The IRRI-TECH project foresees the integration in the system of already existing geo-referenced soil and climatic databases (e.g. ACLA 2) and weather station networks, which could facilitate the application of DSS in the areas where site-specific weather and soil sensors are not installed or are not functioning well. Further dissemination of the project achievements will be done through a series of on-site demonstration days and short courses organized for the professionals working in the sector of agricultural water management. The preliminary results indicated the satisfaction of the farmers and their need to save water, energy and time (dedicated to irrigation management)

and to increase eco-efficiency of farms, which contribute to both mitigation and adaptation to climate change.

Methods and challenges of remote sensing in climate change impact studies on agriculture

Authors
Toulios Leonidas (leonidastoulios@gmail.com) presenting author (ELGO 'DEMETER', Industrial & Forage Crops Institute)
Spiliotopoulos Marios (spilioto@uth.gr) (University of Thessaly, Department of Civil Engineering)

Summary
The potential and the benefits of the contribution of satellite-derived data for warning purposes in agriculture due to climate variability and change are presented and discussed. Earth observation from space has a unique capacity to provide global data sets continuously and consistently not only on this level, but also on the national and local levels and the use of alert and warning systems must be based on such data. Evaluation of the agricultural impacts represents an important contribution for the assessment of vulnerability of agricultural systems to climate variability and change. Some of the climatic and biophysical variables essential for understanding and monitoring the climate system and the impact on agriculture can be efficiently observed from space since this technology enables their systematic, global and homogeneous measurement. The analysis and the presentation of the data records which have been developed from operational satellite observations, presents the status of satellite climatic and biophysical data for warning purposes for agriculture, in Europe. Among European countries there is a great inhomogeneity concerning climatic and biophysical data received from satellite sensors or collected as satellite-derived ready products. Some of them are currently collecting satellite data for years and these data records could be useful for models for climate change impact studies.

Spraying against the olive fruit fly using a Location Aware System (LAS)

Authors
Pontikakos Costas (costas_pontikakos@yahoo.co.uk) (1Agricultural University of Athens, Informatics Laboratory, Division of Informatics, Department of Agricultural Economy and Development School of Food, Biotechnology and Development)
Perdikis Dionyssios (dperdikis@aua.gr) presenting author (Agricultural University of AthensDepartment of Crop Science, Laboratory of Agricultural Zoology & Entomology)
Tsiligiridis Theodore (tsili@aua.gr) (1Agricultural University of Athens, Informatics Laboratory, Division of Informatics, Department of Agricultural Economy and Development School of Food, Biotechnology and Development)

Summary
The olive fruit fly, Bactrocera oleae (Gmelin) (Diptera: Tephritidae) control has strong

spatiotemporal characteristics associated with landscape features, crop phenology, fruit load, damage dispersal and severity, local climatic conditions and optimal spraying applications. For this reason, the location awareness is the key to the success of the management of this pest in Precision Agriculture. In the framework of the FruitFlyNet project, an agri-environmental Location Aware System (LAS) for managing the olive fruit fly was designed, developed, implemented and evaluated. The operation of the system was realized with the deployment of electronic (ReTIC) traps integrated with the corresponding Wireless Multimedia Sensor Network (WMSN), in an olive orchard in Koropi area, near Athens, in 2015. The data collected used to run the developed Decision Support Systems to decide when, where and how to spray. The sprayings were applied according to the system outputs and were compared with conventional ones applied in the control plot. The full operation of the system was successful and the results showed a high reduction in the volume of pesticide solution applied, the area sprayed and the total spraying duration in the LAS in comparison to the conventional sprayings (84.81%, 76.3% and 63.38%, respectively). Thus, and the proposed system showed a high potential in reducing the cost and the environmental impacts of the spraying applications against B. oleae. Key words: e-trap, location aware system, olive fruit fly, pest control, spatial decision support system, precision agriculture, spraying.

Modeling maize production in limited irrigation conditions for sustainable water use

Authors
Jancic Tovjanin Milena (orhideja007@gmail.com) presenting author (research assistant)

Summary
Modeling maize production in limited irrigation conditions, for sustainable water use Milena Jancic Tovjanin, University of Novi Sad, Faculty of Agriculture Dositej Obradovic Sq 8, 21000 Novi Sad Abstract Water is a natural resource and quantity limited. Modeling climate change, in future conditions, shown a very significant lower precipitation during April – September growing season, especially during summer months of vegetation period (Jancic, 2017). In June – August period, for 2030 year is expected for 22.7 % and for 42.4 % in 2050 year lower precipitation. Maize is one of fundamental field crop in Serbia, widespread produced in April – Septembar period in non irrigated conditions. In previous research, modeling maize production using DSSAT crop model, in non irrigated conditions and with 180 mm water added per growing season, in 2030 and 2050, gave very significant lower yield results (Jancic, 2016). As an adapatation measure, in crop model, irrigation was set on 50 – 60 % available water (Hoogenboom et al, 2012) in our climate and soil conditions. Those new conditions, using crop model, gave high yields as in 1971-2000 period (Jancic, 2016), but the effective irrigation was significant higher. In this study, it was chose Rimski Sancevi location in Northern part of Serbia, Vojvodina province, because it is favorable agricultural area, with great agroclimatic and soil chernozem potential to test lower net irrigation in maize production. For 2030 and 2050 year, as a measure for sustainable water use, irrigation was set for 15% lower, on 35% available water, in DSSAT crop model. The results shown high yield. In a comparison with yield under 50% available water, for Rimski Sancevi location, yield was high and effective irrigation was less for one to two treatments per growing season (about 23 to 35 mm). The reduction of plant water availability in maize production was possible, because maize is a field crop with good developed root and physiology on water stress. Also DSSAT crop model, has an opportunity, to adjust and fixed water availability. When soil water content is below selected percent, in that moment model added neccesary water to crop.

On the base of yield results, it is concluded that maize production, on Rimski Sancevi location, is expected to be high in future climate conditions under lower net irrigation management of 35% plant available water. Key words: climate change, DSSAT crop model, maize yield, net irrigation, water conservation Reference Hoogenboom, G., Paz, J. O., Salazar, M., Garcia A. (2012). Agricultural Irrigation Water Demand Forecast: Procedures for Estimating Monthly Irrigation Demands http://www.nespal.org/sirp/waterinfo/state/awd/AgWaterDemand_IrrAmt_Detail.htm Jancic, M (2016). Climate change adaptation in maize production in Serbia. FACCE MACSUR Reports 2: SP9-3. TradeM Workshop MACSUR 9-12 October 2016. NIBIO, Norwegian Institute of Bioeconomy Research. http://ojs.macsur.eu/index.php/Reports/issue/view/12 Jancic M. (2017). The use of Agriclim model in agriculture production analyses in Novi Sad. In Proceedings Actual Tasks on Agricultural Engineering, Opatia 2017.

Water erosion in olive and citrus tree crops under current and future climate conditions

Authors
Kourgialas Nektarios (kourgialas@nagref-cha.gr) presenting author (Institute of olive tree, subtropical crops and viticulture, N.AG.RE.F, Hellenic Agricultural Organization "DIMITRA")
Karatzas George (karatzas@mred.tuc.gr) (School of Environmental Engineering, Technical University of Crete, Chania, Greece)
Koubouris Georgios (koubouris@nagref-cha.gr) (Institute of olive tree, subtropical crops and viticulture, N.AG.RE.F, Hellenic Agricultural Organization "DIMITRA")

Summary
The proposed GIS modeling method contains the estimation of soil erosion rates due to surface water flow under current and future climate change scenarios A2 and B1 for the years 2030 and 2050. The soil erosion was estimated using the Universal Soil Loss Equation (USLE). The proposed soil erosion model was validated using field measurements at different sites of the study area. The results show that an extended part of the study area is under high erosion risk with a mean annual loss to be 4.85 t/ha year-1. For scenario B1, the mean annual loss is estimated to be 6.43 t/ha year-1 for the year 2030 and 7.32 t/ha year-1 for the year 2050. Regarding the scenario A2, the mean annual loss is estimated to be 4.76 t/ha year-1 for the year 2030 and 5.21 t/ha year-1 for the year 2050. The proposed methodology was implemented at one of the most productive agricultural areas of Crete, Greece dominated by olive and citrus crops.

Soil characteristics and nutrient estimation through spectroscopy

Authors
Antoniuk, Vita1; Stamatakis, Aristidis1; Tzortzakis, Nikolaos2; Kalaitzidis, Chariton1

1Mediterranean Agronomic Institute of Chania, Department of Geoinformation in Environmental Management. 2Cyprus University of Technology, Department of Agricultural Sciences, Biotechnology and Food Science

Summary

This study investigated the use of information obtained with reflected electromagnetic energy over the 400-2500 nm spectrum, at fine spectral resolution, using an ASD FieldSpec® 3 Spectroradiometer, as an alternative method to conventional soil properties measurements. Field spectroscopy can be effectively used to determine soil parameters such as the pH, the amount of Ca, Fe, P, and organic matter, especially when the spectra are acquired through a contact probe.

Five acidic and five alkaline soils were collected from ten different agricultural fields of Chania prefecture and treated with compost and non-organic fertilizer, to achieve nutrient variability. Reflectance data were collected from a distance as well as by using a contact probe. Spectral reflectance was processed and statistically analyzed using Partial Least Squares (PLS) and Principal Component Regression (PCR) (both pre-processed and not pre-processed spectra) against the nutrients concentrations, to develop calibration and validation equations. Spectroscopic measurements were capable of measuring soil Ca (R2=0.99), pH (R2=0.89), P (R2=0.96), Fe (R2=0.74) and organic matter (R2=0.94) with the contact probe, as well as soil Ca (R2=0.88) and pH (R2=0.83) with the distance measurements. Every regression method showed better results on the average soil spectrum with the Savitzky-Golay (A-SG) derivative than on raw soil spectrum.

The best regression result among all soil parameters with the contact probe was found in the correlation between Ca and soil spectrum for both PLS (R2=0.98) and PCR (R2=0.91). R2 values achieved for Ca in remote outdoor measurements were in the 0.88-0.89 range. However, these coefficients were observed only in cases of high Ca concentrations. Since the amount of Ca in the soil is highly correlated with soil pH, the regression results are similar between Ca and pH in both the contact probe and distance measurements, but pH had slightly lower coefficients with R2=0.79 for raw and R2=0.89 for A-SG derived data, for both PLS and PCR. As for P, it was possible to achieve R2 = 0.99 and R2 = 0.96 for PLS and PCR respectively, using contact probe measurements, but those relationships were not evident with the remote spectrum data. Satisfactory regression results were achieved with Fe, with spectra collected with a contact probe (around R2=0.74) but not with the remote measurements. These observations are mainly attributed to main reflectance peaks being found at 1900 and 2430 nm with the contact probe data, while these regions were not included with the remote data, due to the intense atmospheric vapour effects. The results of the regressions performed on the organic matter were not constant with big gap between calibration and validation, and the possible conclusion is that all soils have very low concentration of organic matter, making it difficult to detect and reveal possible changes and variations.

Contribution to the sustainability of solar photovoltaic irrigation systems: agronomy case study

Authors

Đurin Bojan (bojan.djurin@gfv.hr) corresponding author (Faculty of Geotechnical Engineering, University of Zagreb)
Lajqi Shpetim (shpetim.lajqi@uni-pr.edu) presenting author (Faculty of Mechanical Engineering, University of Prishtina "Hasan Prishtina")
Baić Lucija (lucija.baic@gmail.com) (Faculty of Geotechnical Engineering, University of Zagreb)

Summary
Usage of solar photovoltaic (PV) energy, not only in urban water supply systems, but also for irrigation has special importance for the entire human population on the world. Even if location has a sufficient quantity of water, it should be noted that electricity supply for its abstraction, further distribution and use can be a problem. PV energy is particularly suitable for energy supply for irrigation in rural areas because there are locations where classical power network is not available or has limited availability. In this situation, especially in remote areas and on islands, PV energy solves this energy and water distribution problem. Also, using of PV energy contributes to the reduction of greenhouse gasses. In doing so, the emphasis is not only on the use of PV energy, but also on improving of the performance of pumping stations and reservoirs, as well as the remaining parts of the water supply system (for the most part that refers to pipelines). The abovementioned solution is sustainable, given the economic, environmental and social indicators, which is achieved by using original and innovative scientifically method, i.e. Critical Period Method (CPM). CPM includes design elements of the solution: PV system, pump station and water reservoir based on the critical period of operation of each one. By using of solar photovoltaic energy, electric energy is produced and used for operational work of the pumping station. Pumping station pumps water into the water reservoir. From the water reservoir, water is distributed to the irrigation pipelines on the irrigation area. The balancing period of water pumping and water consumption (water and energy balance) is usually at least one day and may be several days, usually no more than five. Also, intention of this paper is to prove that the water reservoir with its usual hydraulic role of storing water also has the function of energy reservoir through the possible functional connection with the source of energy, which is in this case subsystem PV. Such this kind of methodology (CPM) so far hasn't been applied anywhere in the world. Case study on the example of irrigation for agronomy purposes will present application of the mentioned method.

Measuring environmental performance through agri-products environmental footprint and declaration - The case of Olive Oil

Authors
Michalopoulos George (parabem@rodaxagro.gr) (RodaxAgro Ltd)
Schau Erwin (Erwin.M-SCHAU@ec.europa.eu) (2. European Commission, Joint Research Centre, Dir. D – Sustainable Resources – Bio-Economy)
Malliaraki Stella (stellamalli@yahoo.gr) (Union of Merabello)
Aggelaki Katerina (aik_angel@hotmail.com) (Union of Merabello)
Giakoumaki Georgia (ggiakoumaki@gmail.com) (Union of Peza)
Kokkinos George (gkokkinos3@gmail.com) (NILEAS group of farmers)

Summary
Planning more environmentally benign management systems in agriculture is nowadays

facilitated by the Life Cycle Assessment (LCA) approach. LCA supplements the descriptive methods to estimate damage to the environment when Land Use is changed from natural vegetation to cropping. LCA encompasses a wide array of environmental impact categories, such as Climate Change (caused by Green House Gas (GHG) emissions), Ozone Depletion, Acidification and Eutrophication, etc. Quantification of all impacts across the whole Life Cycle of a product, i.e. from the point of extraction of raw materials used for its production, up to the point that any waste is again vanished in nature, is essential for LCA. It is also a suitable base to assess the effects of a farming practice on both economic and environmental outcome, therefore an important decision-making tool in farming. In addition, it offers the opportunity to the producers to share their successes with their customers, and with the consumers via product labels, by means of Product Environmental Footprint (PEF) and Environmental Product Declaration (EPD) to communicate performance and any outstanding product attributes they can prove. The project LIFE oLIVE CLIMA is about both, environmental and economic improvement of olive crop, based on circular economy principles. Use of pruned wood and oil mill waste, i.e. leaves and water -preferably after composting- are combined with a pruning style focused to increase carbon sequestration as much as possible. This is supplemented by photosynthesis of green-manure in winter. The main objective of oLIVE CLIMA is related to climate change in a two-fold way: 1. to maximize carbon uptake from the atmosphere, and 2. to store a good part of this up-taken carbon for as long as possible, in olive tree wood and in soil as Soil Organic Matter (SOM). In order to minimize carbon losses from soil, oLIVE CLIMA is counting on zero tillage. Additional objectives of the project relate to higher productivity in olive fruit yield and oil content of the fruit, by adaptation of pruning. Gradual increase of SOM by oLIVE CLIMA practices guarantee enhanced soil fertility in the medium-long run. Quantification and communication of the environmental benefits gained by oLIVE CLIMA is possible by using LCA and PEF in the development of the Category Rules of which oLIVE CLIMA contributed with primary data. Especially for Climate Change, olive products could benefit from carbon credits due to the long-term carbon storage in the wood of olive trees, and possibly in a fraction of SOM. Our data show that under careful implementation oLIVE CLIMA practices can in some cases lead very reliably to ‘carbon negative’ olive products and even at a lower cost than conventional olive growing.

Influence of soil properties and geographic origin on the elemental composition of olive leaves and pomace

Authors
Pošćić Filip (filip.poscic@krs.hr) presenting author (Institute for Adriatic Crops and Karst Reclamation)
Mikac Nevenka (Nevenka.Mikac@irb.hr) (Institut Ruđer Bošković)
Jukić Špika Maja (Maja.Jukic.Spika@krs.hr) (Institute for Adriatic Crops and Karst Reclamation)
Romić Marija (mromic@agr.hr) (Faculty of Agronomy, University of Zagreb)
Strikić Frane (frane.strikic@krs.hr) (Institute for Adriatic Crops and Karst Reclamation)
Urlić Branimir (branimir.urlic@krs.hr) (Institute for Adriatic Crops and Karst Reclamation)
Bačić Niko (Niko.Bacic@irb.hr) (Institut Ruđer Bošković)
Lučić Mavro (Mavro.Lucic@irb.hr) (Institut Ruđer Bošković)
Runjić Marko (marko.runjic@krs.hr) (Institute for Adriatic Crops and Karst Reclamation)
Fiket Željka (zeljka.fiket@irb.hr) (Institut Ruđer Bošković)

Klepo Tatjana (tatjana.klepo@krs.hr) (Institute for Adriatic Crops and Karst Reclamation)
Žanetić Mirella (mirella.zanetic@krs.hr) (Institute for Adriatic Crops and Karst Reclamation)
Bakić Helena (hbakic@agr.hr) (Faculty of Agronomy, University of Zagreb)
Rengel Zed (zed.rengel@uwa.edu.au) (School of Earth Sciences, The University of Western Australia)
Perica Slavko (Slavko.Perica@krs.hr) (Institute for Adriatic Crops and Karst Reclamation)

Summary
Adaptation of plants to the environmental conditions under global climate change is of high scientific interest. In Croatia, olive trees are of a special concern as they are widespread cultivated species along the Croatian coast, with olive oil being one of the most important agricultural products of the Mediterranean Croatia. Soil characteristics as well as geographic origin are likely to drive variations in plant elements uptake and consequently their transfer to leaves and fruits. In order to test effects of soils from different pedological settings (red soil, rendzic leptasol and anthropogenically modified lithosol) on elements uptake by olive trees, samples of leaves, fruits and the related top-soils and sub-soils were collected in olive orchards from the main Croatian olive-growing regions (Istria, Kvarner, northern, central and southern Dalmatia). After drying and homogenisation, samples of soil, leaves and pomace, were digested in the microwave oven by the appropriate mixture of mineral acids. Total concentrations of major and trace elements in samples were analysed by HR ICP-MS. Characteristics of soils (pH, organic matter, carbonate content) and plant available fraction of elements estimated by extraction with 1 M ammonium nitrate, were determined as well. Multivariate Redundancy Analysis (RDA) and correlation analysis were used to elucidate relationship between analysed parameters and get insight into influence of soil properties and geographic origin on the elemental composition of olive leaves and pomace. Obtained data clearly indicated that elemental composition of olive leaves is dependent on the pedo-geochemical characteristics of related soils. Element distribution in olive leaves and pomace are further discussed in relation to geographic origin. The presented data will be further used as a part of the data set which should enable development of a geochemical method for geographical traceability of virgin olive oils.

Environmental Impact Assessment of Sustainable Development

Authors
Fazelbeygi Mohamadmehdi (fazel_mehdi@yahoo.com) corresponding author (Head of department of education. Suprime Council of Provinces)

Summary
Degradation model consist Degradation coefficient per ecology unit, Total severity of degradation factor of per ecology unit, physiological density (Population in the ratio of arable land) and ecological Vulnerability. In this survey, for studying environmental impact assessment, the first, domain of Horaman zone was divided into 140 networks, (2×2 cm2 on a topography map 1: 250000) which that per one network was 2500 hectare. Ecological vulnerability was calculated and classified by slope, height, hemisphere, herbaceous cover and settlement maps. In the next step, 24 factors of degradation in Horaman zone were identified and severity all of them calculated by topography map, field researches, advice of experts and participates of native people. Physiological density was estimated via dividing population of networks by splitting population of networks to arable land per network. Finally, regarding to table of degradation and Excel software, degradation coefficient was

calculated and analyzed in each network. Degradation coefficient for all networks categorized into 6 classes and 3 sets based on fuzzy set theory. Therefore, all networks were compared together in respect of severity and measure of degradation and whole of the zone was spitted to three areas: A) capability of further development B) need to rebuild and restore and C) need to conservation. Accordingly, 47.1% of study areas prone to further development, 50.6% were need to restore and rebuild and 2.1% of studied areas need to conservation operation.
Keywords: Degradation Model, Ecological Vulnerability, Degradation Factor, Horaman Zone.

Conserving natural resources in a changing agro-environment: practices and policies

Authors
Fleskens Luuk (luuk.fleskens@wur.nl) presenting author (Wageningen University, Soil Physics and Land Management Group)

Summary
Agriculture is facing several challenges due to global change. Some of these challenges directly affect crops, trees and livestock while others affect system productivity and yield stability through their impact on the natural resource base. Exacerbating these impacts are tendencies to reduce labour costs in many agricultural systems. The entangled nature of environmental degradation problems requires innovative ways of thinking about practices and policies towards more sustainable development pathways. This presentation gives an overview of some environmental impacts and potential solutions through a review of a number of case studies. A first case considers altering climate patterns and the challenge this offers to cereal cultivation globally. One of the potential practices to adapt to this challenge is rainwater harvesting. The potentials and limitations of water harvesting will be addressed. A second case considers soil carbon sequestration as a potential climate change mitigation activity. At the same time, carbon sequestration is about restoring degraded environments. A portfolio of soil carbon sequestration practices will be presented together with their suitability and effectiveness limitations. To guide interventions, data is needed about which measures are most effective and financially viable where. Such analyses can also point to a need for policy support. Policy is also a strong driver in the agro-environment and can both lead to degradation and conservation. Two ways in which policy makers can be supported are presented: through targeting mechanisms and through using farmer-informed policy options. Although the examples presented pointed at a number of options in terms of practices and policies to improve the natural resource base, the big question is how to approach the innovation process. This requires a greater level of trans-disciplinarity and co-production of knowledge involving partnerships of stakeholders. Scientific input into this process can take various forms, including big data. Creating knowledge-sharing platforms could be a way forward.

Olive Alive: Toward the design and certification of biodiversity friendly olive groves

Authors
Gutiérrez Jose Eugenio (jegutierrez@seo.org) (SEO/BirdLife)
Ruiz Carlos (cruiz@seo.org) presenting author (SEO/BirdLife)
Cano María (macano@seo.org) (SEO/BirdLife)
Rey Pedro J. (prey@ujaen.es) (University of Jaén)
Murgado Eva María (emurgado@ujaen.es) (University of Jaén)
Valera Francisco (pvalera@eeza.csic.es) (Experimental Station of Arid Zones)
Bermúdez Sonia (sonia.bermudez@dipujaen.es) (Diputación de Jaén)

Summary
Olive Alive (Olivares Vivos, LIFE NAT/ES/001094) is a demonstrative project that aims at defining an innovative model of olive growing, as agriculturally, economically and socially feasible and that has been proven to contribute effectively to halt the loss of biodiversity in the olive groves. The project has started in October 2015 and will last 5 years. First, we selected, on a scientific basis, a set of 20 demonstrative olive orchards, totalling more than 3.500 hectares, according to three criteria: property size, degree of agricultural intensification and complexity of the surrounding landscape. We have been implementing several biodiversity restoration measures in these 20 demonstrative olive orchards, where we had previously surveyed different biodiversity indicators (herbaceous and woody vegetation, epigeal Arthropoda and birds) and that will be monitored again at the end of the project. The biodiversity restoration measures are based on (i) revegetation actions in the unproductive areas within the olive grove, such as edges of rural roads, banks of streams and patches of natural vegetation, (ii) construction of ponds and water troughs and installation of nestboxes for birds, bats and insects, and (iii) changes in the management of the herbaceous cover. Then a certification brand will be developed for the olive oil produced in these monitored olive orchards that certifies an added value relying on the recovery of biodiversity through the restoration and conservation actions implemented in each olive grove. In this way, this certification will show to the consumers that they can actively contribute to the recovery of biodiversity. At the same time, this added value will help to increase the profitability of the certified olive groves. In order to develop the certification brand, we are currently carrying out some market surveys, and we will perform a whole set of marketing studies. An intensive assistance and technical support to the olive growers will be also provided. Additionally the project is completed with an important group of information and raising awareness actions, targeting all involved stakeholders: olive sector, regional, national and international administrators, consumers, schoolchildren and public in general. This group of actions includes activities for a better knowledge of the culture and heritage related with the olive growing and to enhance its value. At the end of the project a certification office will be created, which will be composed of the partners of the project. This office will be in charge of extending the certification to any other interested olive growers.

Effects of addition of organic materials and irrigation conditions on soil quality in olive groves: A case study of the region of Peza, Island of Crete, Greece

Authors
Kavvadias Victor (vkavvadias.kal@nagref.gr) presenting author (Hellenic Agricultural Association HAO-DEMETER", Institute of Soil and Water resources, Department of Soil Science of Athens,)
Papadopoulou Maria (mashapapoulou@yahoo.gr) (Hellenic Agricultural Association HAO-DEMETER", Institute of Soil and Water resources, Department of Soil Science of Athens,)
Vavoulidou Evangelia (evavoul@otenet.gr) (Hellenic Agricultural Association HAO-DEMETER", Institute of Soil and Water resources, Department of Soil Science of Athens,)
Theocharopoulos Sideris (sid_theo@otenet.gr) (Hellenic Agricultural Association HAO-DEMETER", Institute of Soil and Water resources, Department of Soil Science of Athens,)
Manolaraki Chrisa (korep@pezaunion.gr) (Union of Agricultural Cooperatives of Peza (PEZA),)
Giakoumaki Georgia (korep@pezaunion.gr) (Union of Agricultural Cooperatives of Peza (PEZA),)
Koubouris Georgios (koubouris@nagref-cha.gr) (Hellenic Agricultural Organization DEMETER, Institute for Olive Tree, Subtropical Crops & Viticulture, Agrokipion, Chania, Greece)
Psarras Georgios (gpsarras@nagref-cha.gr) (Hellenic Agricultural Organization DEMETER, Institute for Olive Tree, Subtropical Crops & Viticulture, Agrokipion, Chania, Greece)
Vasiliadis Anestis (korep@pezaunion.gr) (Union of Agricultural Cooperatives of Peza (PEZA)

Summary
One of the most important problems of agriculture in Greece is the low content of organic matter. During olive growth a large quantity of plant residues are produced while high loads of both liquid and solid olive mill wastes produced during the extraction of olive oil. Materials such as oil mill wastes, leaves and stems of olive have been studied in the past for their suitability for composting, with encouraging results. However, the implementation for these techniques has not been systematically tested under the prevailing conditions of the Greek/Mediterranean olive forest. In addition, irrigation, although favoring the productivity of trees, can often have an adverse effect on soil productivity mainly due to water irrigation quality, application method and soil properties. A LIFE+ project was initiated (oLIVE-CLIMA; LIFE 11/ENV/000942) aiming to introduce alternative management practices in olive tree crops. The aim of this work was to determine the effects of organic inputs and irrigation conditions on some soil chemical and microbial properties in Mediterranean olive orchards. This study also examined the spatial. The area of study is located in the region of Peza, prefecture of Heraklion, Island of Crete, South Greece during three year soil campaigns. Forty soil plots of olive groves were selected (20 rainfed and 20 irrigated) and carbon input practices were applied on the half of the irrigated and rainfed soil parcels (10 rainfed and 10 irrigated), while the remaining ones were used as controls. In each soil parcel, six composite soil samples were taken from 0-10 cm of depth, at equal intervals, along a straight line joining the trunk of the tree with the middle of the distance from the nearest tree of the next tree series. The first three samples were under the tree canopy. An additional composite sample was taken at the depth of 10-40 cm. Soil physicochemical (texture, pH, EC, total organic carbon, total nitrogen, inorganic nitrogen, humic and fulvic acids, available P, and exchangeable K), and microbial properties (soil basal microbial respiration SMBR and

microbial biomass carbon MB-C) were determined in collected samples. In addition The SMBR/MB-C ratio was also determined (metabolic quotient, qCO_2). The improvement of soil quality in olive groves via recycling organic materials from olive mill wastes and pruning depends on irrigation conditions. Soil carbon content, total and inorganic nitrogen, SBMR remarkably increased by addition of organic material in irrigated plots compared to the control. Olive trees can increase soil carbon content especially closer to the tree trunks. Furthermore, significant decreases with soil depth were registered for SOC, inorganic nitrogen and microbial properties indicating the potential of surface soil in olive groves to sequester carbon is high, whereas carbon inputs and irrigation conditions did not contribute to subsoil C content.

Assessing biodiversity and its ecosystem services in Andalusian olive orchards through the landscape moderation hypothesis approach

Authors
Rey Pedro J. (prey@ujaen.es) presenting author (Dept. Biología Animal, Biología Vegetal y Ecología. Universidad de Jaén)
Valera Francisco (pvalera@eeza.csic.es) (Estación Experimental de Zonas Áridas, EEZA-CSIC)
Manzaneda Antonio J. (amavila@ujaen.es) (Dept. Biología Animal, Biología Vegetal y Ecología. Universidad de Jaén)
Alcántara Julio M. (jmalcan@ujaen.es) (Dept. Biología Animal, Biología Vegetal y Ecología. Universidad de Jaén)
Molina-Pardo José L. (jmp648@gmail.com) (Dept. Biología Animal, Biología Vegetal y Ecología. Universidad de Jaén)
Tarifa Rubén (atricapilla.15@gmail.com) (Estación Experimental de Zonas Áridas, EEZA-CSIC)
Isla Jorge (jie00001@red.ujaen.es) (Dept. Biología Animal, Biología Vegetal y Ecología. Universidad de Jaén)
Salido Teresa (mtsalido@ujaen.es) (Dept. Biología Animal, Biología Vegetal y Ecología. Universidad de Jaén)
Calvo Gemma (gemma.calvo@gmail.com) (Dept. Biología Animal, Biología Vegetal y Ecología. Universidad de Jaén)
Martínez-Nuñez Carlos (cmn89@correo.ugr.es) (Dept. Biología Animal, Biología Vegetal y Ecología. Universidad de Jaén)
Ruiz Carlos (cruiz@seo.org) (Sociedad Española de Ornitología. SEO-BirdLife)
Gutiérrez José E. (jegutierrez@seo.org) (Sociedad Española de Ornitología. SEO-BirdLife)

Summary
Among the arboreal croplands, the olive tree plantations are the ones with the strongest economic impact in Europe as well as with higher importance for biodiversity maintenance in the Mediterranean Basin. Compared to annual crops, the stability of arboreal croplands makes olive plantations especially favorable for biodiversity establishment and recovery. To this sums that the cultivated species was developed from a common wild tree from the same region where it is mainly cultivated, thus keeping many ecological and evolutionary relationships with the wild vertebrate and invertebrate fauna. There is evidence that agricultural practices have pauperized considerably plant and animal biodiversity in olive

croplands. Nevertheless, the knowledge of the biodiversity supported by olive plantations is rather limited and even more incipient is our understanding of the consequences of biodiversity loss for ecosystem services in this culture. As part of a long-term project on biodiversity and ecosystem services recovery in olive plantations, we present here the first regional evaluation of biodiversity of olive orchards in Andalusia (Southern Spain) and of the factors affecting it. Our study is framed in recent conceptual advances on the effects that landscape complexity has modulating the opportunity for enhancing biodiversity and ecosystem services through extensification practices, i.e., 'the hypothesis of the landscape moderation of biodiversity pattern and function'. We report here preliminary results on plant and animal biodiversity in relation to landscape complexity, extensification-intensification practices (density of plantation and herbaceous cover management), property size (related to the scale of management) and climatic-geographic features. We further present preliminary data on some pest control and pollinator services by insects. Our results are based on 20 pairs of farmlands (each pair composed by intensified and extensified olive farmlands) distributed throughout Andalusia, encompassing 300 km of olive orchard landscapes and substantial differences in mean rainfall and temperature. We used birds, ants, auxiliary insects and insect pollinators as indicators of animal biodiversity, and herbaceous cover and woody vegetation as indicators of plant biodiversity. We aim to provide (1) a complete picture of how biodiversity is being affected by intensification of agricultural practices in olive plantation landscapes and (2) a diagnostic of the opportunity for enhancing biodiversity and ecosystem services by extensification, after considering the landscape complexity scenery of each olive farmland.

Study of Rainfall erosivity estimation, relation with runoff and climate adaptation in Northern Semi-arid Tunisia

Authors
BELAID Hechmi (belaidhfr@yahoo.fr) (ESIER Tunisia)

Summary
Rainfall erosion, a flail of agricultural lands in Tunisia. The Zaghouaneese in general and Sbaihia watershed in particular, frame of our study, is one of the best examples for the investigation and analysis of the process of this deeply complicated problem. The main objective of our work is the study of the physical process of erosion. In the study of this process, the most important problem in such semi-arid regions in general and Sbaihia in particular deals simultaneously with water and soil. In the water side it is mainly rainfall erosivity and runoff. When studying erosivity we can conclude that erosive storms or those more than 12,7 mm occupy the most important part, say 82%, in which 45% are for torrential storms or those more than 30 mm. from equations that give a prediction of the monthly erosivity index for the two respective cases of estimate using I15max and I30max, it is possible to estimate monthly values of the erosivity Wishmeier index for all the non pluviographe equipped stations of Remel watershed. Annual values are than deduced. An iso erosivity map was than elaborated using Krigging method on ArcGIS for the Remel watershed. At the watersed scale or the field scale, trend curves showed that runoff is well correlated with erosivity in general and it is better correlated with the one estimated using I15max. Adaptation measures to the new climatic conditions are very important in such environments, they were also well discussed in the frame of field or water channels.

The buried diffuser a new efficient technology for olive trees plantations in climate change conditions

Authors
chahbani bellachheb (bchahbani@chahtech.com) presenting author (chahtech SA)

Summary
Tunisia has the biggest olive trees "forest" in the world with about 80 millions trees. 90% of this man made "forest" is rain fed (dry farming). With the new Climate Change conditions inducing more and more annual (seasonal) and multi annual droughts(2 till 4 successive years), the olive trees suffered from severe water scarcity . If during annual drought only the olive oil production is affected (loss of 30 till of 50%), during long droughts multi annual droughts, the national olive oil production is reduced to 30 %. Arid Regions Institute (Medenine-Tunisia) has developed a new technology (the buried diffuser) allowing: -Important irrigation water saving(70 % less water than drip irrigation) which could be used in rain fed olive trees plantations for complemented irrigation , or for permanent irrigated olive trees plantations, -In permanent irrigated olive trees plantations, it is possible to reduce the number of irrigations per year. Depending on the clay soil content it is possible to irrigate 12 irrigation per year(1 irrigation per month) or 4 irrigation per year(1 irrigation per 3 months) or 1 irrigation per year(in December and January). -To mitigate the negative impacts of long droughts on olive trees, the buried diffuser, to inject and to store the excess of water during floods, in the deep soil layers of rain fed olive trees plantations. This injection and storage can reach the olive trees water requirements (for an optimal yield) for 3 completely dry years. -By delivering the water, underground, 50 cm below the soil level, the buried diffuser increases the roots development in the deep soil layers (2 till 4 meters deep). This contributes to capture more and more CO_2 of the atmosphere and store it, underground, in the deep root system. The buried diffuser is recently (2014) worldwide distributed, and there are many small farmers using it in their olive trees grooves with successful results in Tunisia, in Greece, in California, in France. But this technology is also used for all kinds of fruit trees (citrus, date palm trees, apple trees, grape trees, almonds trees, figs trees, etc) and for vegetables.

Airborne pollen dynamic in Northern Tunis from 2011 to 2016

Authors
Hadj Hamda Sahar (riahisahar@hotmail.fr) presenting author (National Institute of Agronomy / Olive Tree Institute)
Ben Dhiab Ali (bendhiabali@yahoo.fr) (Olive Tree Institute)
Msallem Monji (msallemonji@yahoo.fr) (Olive Tree Institute)

Summary
The impact of climate change is being a major global issue affecting several physical and biological systems. Airborne pollen is one of the most biological structures that may be exposed to these environmental changes and it is commonly known to be a reliable bio indicator of climate change. The main goal of this work is to study the dynamic of airborne pollen in northern Tunis, Tunisia in relation with the meteorological parameters from 2011 to

2016. Pollen data were collected using a volumetric Hirst-type spore traps model Lanzoni VPPS- 2000 placed in Mornag (36°39N; 10°16E) at 12 m above ground level with a free and continue air flow during spring flowering season from 2011 to 2016. 29 different pollen types were identified with a clear dominance of herbaceous species (48%). The highest pollen index (PI) was recorded in 2011 (34033.62) while the lowest one was recorded in 2014 (6335.29). The statistical analysis showed a significant correlation between pollen index and total rainfall during pollen preseason. Whereas a negative correlation was expressed between airborne pollen counts and maximum temperature during pollen season. Regarding the sharp heterogeneity of airborne pollen concentrations during the monitoring period the different taxa were clustered according to their individual contribution in the PI and five groups were defined. Nevertheless some species were in proliferation from year to year thus can migrate from a class to another with an increasing contribution. However other pollen types had a decreasing trend revealing changes of the vegetation and the most competitive species take advantage when the environmental conditions are suitable for their propagation. Key words: Airborne pollen, taxa, climate change, environmental conditions.

Stakeholders' workshop: OLIVE – MIRACLE Modelling solutions for improved and resilient management strategies for Olive tree against future climate change

Authors
Koubouris Georgios (koubouris@nagref-cha.gr) presenting author (Hellenic Agricultural Organization DEMETER, Institute for Olive, Subtropical Crops & Viticulture)
Kourgialas Nektarios (kourgialas@nagref-cha.gr) (Hellenic Agricultural Organization DEMETER, Institute for Olive, Subtropical Crops & Viticulture)
Zaharouli Antonia (antzacharoulisfa@gmail.com) (Hellenic Agricultural Organization DEMETER, Institute for Olive, Subtropical Crops & Viticulture)
Voulgarakis Apostolos (voulgarakisaua@yahoo.gr) (Hellenic Agricultural Organization DEMETER, Institute for Olive, Subtropical Crops & Viticulture)
Doupis Georgios (gdoupis@gmail.com) (Hellenic Agricultural Organization DEMETER, Institute for Olive, Subtropical Crops & Viticulture)
Sergentani Chrysi (csergen@NAGREF-CHA.GR) (Hellenic Agricultural Organization DEMETER, Institute for Olive, Subtropical Crops & Viticulture)
Michelakis Evangellos (michevangelo@hotmail.com) (Hellenic Agricultural Organization DEMETER, Institute for Olive, Subtropical Crops & Viticulture)
Gianni Fila, Council for Agricultural Research and Economics, Italy

Summary
From this workshop we aim to draw on the knowledge and expertise of advisors, farmer representatives, leading farmers and policy makers to understand specifically about (1) current management practices in olive tree cultivation in order to better cope with climate change; (2) identify barriers and incentives which prevent diffusion of desired innovations and incentives which could favour them. The expert information captured during the workshop will be used to perform an online post-workshop multi criteria analysis (AHP) to quantitatively evaluate the management solutions. In particular: given the context of the problem (climate change and its effects on olive tree cultivation), having in mind the goal

(what are the best adaptation options for olive tree cultivation in order to better cope with climate change), participants should identify the possible management options, to be adopted in order to achieve the goal, what are the existing incentives/barriers favouring/hampering the options, and therefore what are the criteria to be used to assess the options themselves. Project consortium consists of Institute of Biometeorology of the National Research Council-Italy, Council for Agricultural Research and Economics-Italy, Agricultural Research Institute-Cyprus, University of Cordoba - Spain, Hellenic Agricultural Organization - Greece. Project is funded by FACCE SURPLUS Sustainable and Resilient Agriculture for Food and Non-Food Systems.

Using microbes in a climate changing agriculture: challenges and perspectives

Authors
Kavadia Athanasia-Eleni (akavadia@ari.gov.cy) presenting author (Agricultural Research Institute, Department of Agrobiotechnology)
Omirou Michalis (michalis.omirou@ari.gov.cy) corresponding author (Agricultural Research Institute, Department of Agrobiotechnology)
M. Ioannides Ioannis (ioannide@ari.gov.cy) (Agricultural Research Institute, Department of Agrobiotechnology)

Summary
Global food demand is likely to be doubled by 2050 as a result of human population growth and increased consumption of animal products. Under these conditions and in the face of an unpredictable global climate change there is an urgent need to sustain food and fiber production through environmentally friendly practices. In particular, the use of chemical nitrogen fertilizers in agriculture has substantially changed the nitrogen cycle globally. The complexity of agricultural ecosystems implies that no single practice can provide a complete mitigation solution since the integration between mitigation options with adaptation measures should be secured. Recent findings highlighted the potential effects of microbial inoculants on water and nutrient use efficiency. We will present the potential use of soil functional microbial communities like symbiotic nitrogen fixing bacteria, mycorrhizal as well as plant growth promoting bacteria in the battle against climate change. Future priority areas and challenges regarding the interactions between soil microbial communities and cultivated plants will be presented.

LIFE PROSODOL: Strategies and tools developed by capitalizing project's achievements

Authors
Doula Maria (mdoula@otenet.gr) corresponding author (Benaki Phytopathological Institute)
Sarris Apostolos (asaris@ims.forth.gr) (Foundation for Research and Technology, Hellas)
Komnitsas Konstantinos (komni@mred.tuc.gr) (Technical University of Crete)

Summary
The LIFE PROSODOL "Strategies to improve and protect soils from the disposal of Olive Oil Mill Wastes in the Mediterranean region" (www.prosodol.gr), was a very successful project that was awarded as one of the Best LIFE project for 2014, and aimed to protect soil and water quality from the disposal of olive mill wastes (OMW) in the Mediterranean region and contribute to the sustainable development of the olive oil producing industry. The project succeeded in developing an integrated approach to the problem of disposing OMW on agricultural soil and delivered: a system and software application tools for soil monitoring; an optimised set of soil quality indicators; a GIS-based tool for the risk assessment of the OMW disposal sites; a land application system to ensure safe disposal/use/application of OMW on soil; a web GIS application for the interactive representation of waste disposal areas indicating spatial and temporal variations of different soil parameters such as pH, polyphenols, and others. PROSODOL results and achievements were capitalized and further improved from the implementation of three more projects, namely LIFE-Agrostrat, LIFE-WasteReuse and INTERREG-BalkanRoad. The AgroStrat project (2012-2017), www.agrostrat.gr, aimed to develop and demonstrate an integrated approach for the sustainable management of intensively cultivated areas in the Mediterranean, using as example the cultivation of pistachio trees in Aegina Island, Greece. Some of the project achievements are: a holistic strategy for waste implementation on soils at regional level; development of a software for fertilization consultancy and reuse of waste on soils; development of a web GIS-based application that can be used as Management and Monitoring Tool by Regional authorities for cultivated or waste disposal/reuse areas; a GIS-based Land Information System and land suitability maps that enable the controlled and sustainable application of waste, and others. The WasteReuse project (2011-2015), www.wastereuse.eu, aimed at evaluation of innovative as well as, traditional technologies for agricultural wastes treatment regarding their suitability for crop cultivation (irrigation and fertilization); development of alternative cultivation practices for the most widely cultivated and water consuming crops in Mediterranean by recycling nutrients and water from agricultural wastes (AW) via identification and development of Best Management Practices for waste application to main market crops; protection of soil quality from the disposal of processed and un-processed AW by developing and using cultivation practices which are suitable for representative, including degraded and vulnerable, Mediterranean soil types; reduction of carbon footprint by recycling AW and minimizing the use of fertilizers; conservation of natural resources from excessive use and uncontrolled wastes disposal; and increasing competiveness of Mediterranean agricultural products and profits via the reduction of external inputs (irrigation water and fertilizers). The BalkanRoad project (2017-2019) aims (1) to improve Balkan agricultural environment by developing strategies and technologies for natural resources conservation, reduction of GHGs, reduction of waste generation/disposal and increase recycling/reuse ratio in farm systems, and (2) to develop a common Balkan Protocol for the production of eco-labeled agricultural products.

Growing lentils in a changing environment: cultivar selection and phosphorus fertilization as means for earliness

Authors
Theologidou Georgia (gtheologidou@gmail.com) presenting author (PhD candidate)

Baxevanos Demetrios (baxevano@gmail.com) (Researcher)
Tsialtas Ioannis (tsialtai@agro.auth.gr) corresponding author (Assistant Professor)

Summary
Lentil (Lens culinaris Medik.), a grain legume grown in Mediterranean basin since antiquity, still remains a structural block of the Mediterranean diet pyramid. Early maturing of lentils is a desirable agronomic feature especially under the semi-arid, Mediterranean conditions. Though early sowing could be a means of drought avoidance, its effectiveness is sometimes hindered by negative implications (e.g. increased susceptibility to diseases). It has been reported that phosphorous (P) fertilization leads to earliness resulting in increased yields. Therefore, the aim of this work was to study the effect of P fertilization on the earliness and its correlation with seed yield. A field experiment was conducted for two growth seasons (2013-2014 and 2014-2015) at the farm of Aristotle University of Thessaloniki (40o32′12N, 22o59′21E, 6m). Under rainfed conditions, four lentil cultivars [Samos, Thessaly, Flip 2003-24L (Flip), Ikaria], were pre-seeding supplemented with four phosphorus (P) rates [0 (P0), 30 (P30), 60 (P60) and 90 (P90) kg P2O5/ha] in a split-plot design with P rates in the main plots and cultivars in the subplots with three replications. At seven growth stages, two vegetative [V4-5 (4-5 nodes), V7-8 (7-8 nodes)] and five reproductive [R1 (first bloom), R2 (full bloom), R4 (flat pod), R6 (full pod cavities) and R8 (fully maturity)], growth degree days (GDDs) were calculated per subplot. Daily temperatures (maximum and minimum), from sowing to harvest, were obtained from a nearby meteorological station. At R2, biomass carbon isotope discrimination (Δ) was measured to assess plant water use efficiency. At R8, a 0.125m2 surface was harvested by hand to determine seed yield (SY). Neither cultivar nor P had a significant effect on GDDs of vegetative stages. On the contrary, earliness of the reproductive stages was significantly affected by cultivars, P rates and the interactions P×cultivar and P×growth season. The high yielding cv. Flip was the earliest (1649.33oC) and Ikaria the latest maturing (1790.02oC). Phosphorus effects on earliness were cultivar specific. In Flip, high P rates (P60 and P90) caused significant earliness at R4 and R6 stages. In this line, P induced earliness in cv. Thessaly at R2 and R4 stages. On the other hand, P delayed maturing in cvs. Samos and Ikaria at R6. For the P×cultivar interaction, strong negative correlations between GDDs and SY were found at R1, R2, R4 and R6 stages with that at R1 to be the strongest.

Yield improvement by using biostimulant products in winter wheat managed with No Till

Authors
Márquez-García Francisco (fmarquez@uco.es) presenting author (University of Córdoba)
Gil-Ribes Jesus A. (gilribes@uco.es) (University of Córdoba)
González-Sánchez Emilio J. (egonzalez@agriculturadeconservacion.org) (Spanish Association of Conservation Agriculture)
Blanco-Roldán Gregorio L. (ir3blrog@uco.es) (University of Córdoba)

Summary
Crops productivity are closely linked to the use of fertilizers, being the form of application and the products used the principal factors affecting to yields. Not only is the higher cost for cereal production, but also produces the highest greenhouse emissions related to agricultural inputs. The use of different products commonly known as biostimulants (liquid fertilizers, different micronutrients, bacteria, enzymes, microalgae, etc.) have sown to be an effective method to improve the assimilation of the solid fertilizers and subsequently increase yields

and the sustainability of agriculture. The objective of the research is to evaluate the benefits that the application of different biostimulants can produce in the crops development and in the final production. The study was conducted during one season in the Experimental Farm of the University of Cordoba. The research was developed with winter wheat (Tritucum durum) managed with No Till. Test plots had a surface of 3,000 m2 (15 m x 200 m). There were five treatments with four replications, so the total surface was six ha. The treatments studied were: T1: Control T2: Liquid Fertilizer (10 l/ha) T3: Biostimulant 1 (2 l/ha) T4: Biostimulant 1 (2 l/ha) + Liquid Fertilizer (10 l/ha) T5: Biostimulant 2 (3 l/ha) The products were applied mixed with herbicide with a sprayer in the month of February 2016. Furthermore, all the treatments was fertilized with: (1) 40 kg/ha of microcomplex fertilizer applied with the seeder along with the seed; (2) 130 kg/ha Nitrocom Expert 30% N applied with spreader; 200 kg/ha Nitrolent 40% N applied with spreader. The total amount of nitrogen applied was 130 kg/ha. The research evaluated how affected the application of different biostimulants to different parameters related to the cereal production: 1) Normalized difference vegetation index (NDVI); 2) Biomass production; 3) Number of spikes; 4) Yield; 5) Strow production. The application of biostimulants increased the NDVI respect the control (T1) with statistics differences. A bigger NDVI produced more biomass and consequently a higher yield. For the other parameters studied all the treatments with biostimulants (T2-T5) showed statistics differences respect the control (T1), except for the T5 that not presented differences respect T1 in straw production and number of spikes. Treatments T2, T3 and T4 showed very similar results for all the parameters. They approximately increase the biomass production respect the control in a 25%, T5 improve this parameter in a 15%. The straw production was increase in a 19% (T2-T4) and 12% (T5) respect the control. Number of spikes: 29 % (T2-T4), and 11% (T5). Finally, yield was increased respect the control in 26% (T2-T4) and 15% (T5). Results showed how all the biostimulants product improve the sustainability of the wheat production. However, important differences were measured between some treatments. Acknowledgements The authors would like to thank to the company Sipcam Iberia S.L. for financing the research and the European Commission's LIFE (Financial Instrument for the Environment) for co-financing the LIFE + Climagri project, Best Agricultural practices for Climate Change, LIFE13ENV/ES/000541. Keywords: Rainfed arable crops, sustainable agriculture, climate change, NDVI, yield.

Evaluation of land suitability for Olive Mill Waste distribution on soil

Authors
Gounela Eleni (elenigou@hotmail.com) presenting author (Agricultural University of Athens)
Kolovos Chronis (ch.kolovos@bpi.gr) (Benaki Phytopathological Institute)
Papadopoulos Antonis (a.papadopoulos@bpi.gr) (Benaki Phytopathological Institute)
Doula Maria (mdoula@otenet.gr) (Benaki Phytopathological Institute)
Theocharopoulos Sid (sid_theo@otenet.gr) (ELGO DEMETER, Dept. Soil Science of Athens)
Kalyvas Dionysis (kalivas@aua.gr) (Agricultural University of Athens)

Summary
Worldwide, several studies demonstrated that the controlled spreading of agricultural waste onto agricultural land could offer a significant solution for the management of such materials, especially in areas with soils poor in organic matter. For Mediterranean areas and under the threat of progressive soil degradation due to climate change, recycling organic waste on soil

seems to be a mitigation practice under the precondition that all appropriate measures for soil protection will be considered and taken. Therefore, the sustainable approach is "converting waste disposal to organic matter and nutrients exploitation practice". In this context, the main priority when considering waste addition on soil should be to ensure that soils are suitable to accept waste and furthermore, that no adverse effect of the procedure will affect future sustainability of the soil system. In the framework of the LIFE Agrostrat project (http://www.agrostrat.gr), a land suitability system, based on FAO land classification method, was developed as decision-making process for pistachio waste recycling on the soils of Aegina island, Greece. The proposed evaluation system can be adopted by local, regional and national authorities and, most importantly, is flexible to be conformed to different circumstances, legislative restrictions, priorities of authorities and waste types. To ensure soil quality protection, the proposed parameters to be considered for land evaluation were (1) physical and chemical characteristics of the areas of interest (2) specific soil parameters that are mostly affected by the disposal (i.e. soil indicators), and (3) waste properties. For the adaptation of such a system to other waste types, as for example for olive mill waste (OMW), the specific properties of this waste stream have to be taken into account accompanied with the soil parameters that are expected to be affected by the disposal. As it was revealed during two LIFE projects (Agrostrat and Prosodol-http://www.prosodol.gr), different waste types affect different soil parameters. For pistachio waste, it was found that electrical conductivity, organic matter, total nitrogen, available phosphorus, total polyphenols, exchangeable potassium and available copper and zinc are the most appropriate parameters to be used as soil indicators. On the other hand, during LIFE Prosodol project, the soil indicators that were defined for the distribution of OMW were soil pH, electrical conductivity, organic matter, total nitrogen, available phosphorus, total polyphenols, exchangeable potassium and available iron. The aim of this study, therefore, was to conform the land evaluation system developed for the distribution of pistachio waste on soil to the distribution of OMW. For this purpose, the soil indicators for OMW distribution were considered and inserted in the evaluation system and the respective GIS maps were developed. Moreover, a process was developed for the calculation of the appropriate OMW amount to be added on soil in relation to soil properties, waste composition and soil indicators thresholds.

Seasonal variation effect on essential oil content and composition of Pelargonium graveolens cultivated in Crete, Greece

Authors
Lydakis-Simantiris Nikos (lydakis@chania.teicrete.gr) (Department of Environmental and Natural Resources Engineering, Technological Education Institute of Crete)
Ben Jeddou Khaoula (khawla.benjeddou@gmail.com) (Mediterranean Agronomic Institute of Chania)
Jancheva Magdalena (magdalena@maich.gr) (Mediterranean Agronomic Institute of Chania)
Benchennouf Amina (benchenouf_amina@hotmail.fr) (Mediterranean Agronomic Institute of Chania)
Grigorakis Spyros (grigorakis@maich.gr) (Mediterranean Agronomic Institute of Chania)

Summary
The aromatic plant Pelargonium graveolens was examined for the seasonal variation effects on the essential oil content and composition. Cultivated plants were collected every two

months starting from December and dried in a dark chamber until constant mass. The essential oil was obtained by hydrodistillation of the aerial parts with Clevenger type apparatus. The yield of essential oil (%v/w) during different months of harvesting varied from 0.55 to 1.0 %, with the highest yield recorded in the samples harvested in summer. In the final step, the oils were analyzed by GC-MS. The major components of oil samples were citronellol, geraniol, 10-epi-γ-eudesmol and citronellyl formate. Our results clearly indicated that there are seasonal variations in the percentage of several components of the essential oil.

Optimization of cropping techniques under climate change conditions in Tunisia and its effect on the balance of carbohydrates and the quality of olive oil of the cultivars "Koroneiki" and "Chetoui"

Authors
Annabi Khouloud (annabi_khouloud@yahoo.fr) presenting author (Phd student)
Van-Labeck Marie-Christine (mariechristine.vanlabeck@ugent.be) (professor)
Ayadi Mohamed (mohamed.ayadi@iresa.agrinet.tn) (Research Fellow in Food Technology)
Laribi ibtissem (ibtissem.laaribi@yahoo.fr) corresponding author (Phd. student)
Gouta hassouna (hsouna.gouta@iresa.agrinet.tn) (Research Fellow)
Laabidi fouad (f.labidi@yahoo.fr) (senior technician)
ayachi mouna (ayachimouna@yahoo.fr) (Master of conference)
HANNACHI CHERIF (hannachi_tnfr@yahoo.fr) (HIGHER EDUCATION PROFESSOR)

Summary
The vulnerability to climate change in the southern Mediterranean region was underlined by the increased occurrence and intensity of agricultural droughts in recent years. This remarkable variation in temperature, rainfall, degree-days and sunshine, has enormously affected olive production throughout the Mediterranean region and precisely in Tunisia. It can easily have negative effects on whole plant physiology and ultimately on its productivity. We are looking for solutions that can remedy this fluctuation. To achieve this purpose, three trees of each cultivar "Koroneiki" and "Chetoui". Lead heavy requirement in Taous (Sfax, south of Tunisia) for each treatment. So in total, we have four sub-groups: R0 (girdled shoot years "ON"); R1 (ungirdled shoot years "ON"); R2 (girdled shoot years "OFF"); R3 (ungirdled shoot years "OFF"). The present study was designed to measure the carbohydrates (soluble sugars and starch) on leaves and fruit in two dates, considering physicochemical quality criteria of oil (free fatty acids, peroxide value, K232 and K270 extinction coefficients) and compositional parameters (pigments, total phenol). As a result, differences on carbohydrate concentration were observed on leaves of girdled and ungirdled shoots of both treatments "OFF" and "ON" years. The starch content of the "ON" girdled and ungirdled trees was always lower than the "OFF" tree girdled and ungirdled. This reduction in starch was accompanied by an accumulation of soluble sugars at the leaves. Sucrose is the most accumulated carbohydrate in follicular tissue. U ntil this level of results, an anatomical and enzymatic study will be essential in the future to better understand the reaction of the mechanisms of the olive tree to these climatic changes which do not hesitate to evolve.

Study of the impact of efficient irrigation by the use of innovative technologies on pomological parameters of olives and physico-chemicals of oils

Authors
Grati Kammoun Naziha (kamoun_naziha@yahoo.fr) presenting author (Institut de l'Olivier)

Summary
In Tunisia, olive growing is of great economic and social importance, where olive production is mainly destined for the production of olive oil. To ensure a regular production that meets the demands of international markets, the irrigation of the olive tree in an arid country like Tunisia is necessary. However, the scarcity of available water resources for irrigation is still faced. Of the olive tree. the use of water-saving irrigation systems could help solve this problem. This study consists of assessing the quality of olive oil over five maturity dates of two Chemlali and Koroneiki varieties grown in the Gabes region of southern Tunisia based on physicochemical analyzes of Free acidity, peroxide index, UV absorption, total polyphenols content and tocopherols, fatty acid composition and pomological analysis of olives for average fruit weight, olive water content and Fat content. In addition, this study emphasized the impact of irrigation systems (with water saving) on the quality of olive oil. The evaluation of the quality criteria of the oils studied, according to The trade standard of the International Olive Oil Council, allowed us to classify them in the categories of extra virgin olive oil. The results obtained showed that the main quality criteria for olive oil such as acidity and peroxide index are significantly influenced by irrigation systems. For total polyphenols and tocopherols, the levels have increased considerably to 2.5 times greater than the control in some cases and in particular for the Chemlali variety irrigated with this treatment (Irrigation with the Ecotubolar draining tubing at 66% ETc + 360 grams / tree of a water absorber which is the stockosorb distributed at a depth of 50 cm on each side of the tree, over a distance of approximately 3 m on each line in two superimposed layers). In addition, the pomological parameters of olives were significantly influenced both by maturity and by irrigation systems.
Keywords: Efficient irrigation, water resources, pomological, physic-chemical, parameters,olive oil.

Ecophysiological and biochemical response of Chemlali and Koroneiki olive tree cultivars under salt stress and gibberellic acid

Authors
Moula Ines (moula.ines@gmail.com) presenting author (Olive Tree Institute - Unit of Sousse)
Boussadia Olfa (boussadio@yahoo.fr) (Olive Tree Institute - Unit of Sousse)
Ben Hassine Mortadha (benhassinemortadha@yahoo.fr) (Olive Tree Institute - Unit of Sousse)
Ghariani Wafa (wafab6@yahoo.fr) (Olive Tree Institute - Unit of Sousse)
El Hafi Mariem (mariomahafi@yahoo.fr) (Olive Tree Institute - Unit of Sousse)
Van Labeke Marie Christine (MarieChristine.VanLabeke@ugent.be) (Faculty of Bioscience Engineering, Ghent University)

Braham Mohamed (braham2015@yahoo.fr) (Olive Tree Institute - Unit of Sousse)

Summary

Recently, climate change has created the need for a new strategic agenda for crop management. A variety of adaptation options has been proposed to mitigate the vulnerability of agricultural systems to risks related to climate change, especially illustrated by drought and salinity. The aim of this study is to investigate the effects of different levels of NaCl salinity on ecophysiological and biochemical response of two olive tree cultivars (Olea europaea L. cv Chemlali and Koroneiki) and to assess the effects of foliar spray of gibberellic acid GA3 for salinity correction. The study was conducted under greenhouse conditions in the Olive Tree Institute (Unit of Sousse, Tunisia). One-year-old olive trees (Chemlali and Koroneiki) were grown in 4L pots containing sand-perlite mixture (3:2). The plants were irrigated with Hoagland nutrient solution before imposing salt stress treatments. Plants were subjected to salt stress during 56 days. Five treatments levels were considered and compared to control treatment: (T0) control, plants receiving nutrient solution; (T1) moderate salinity, plants receiving saline solution containing 100 mM NaCl with electric conductivity CE=8.51 mS/cm; (T2) high salinity, plants receiving saline solution containing 200 mM NaCl with electric conductivity CE=17.24 mS/cm; (T1+GA) moderate salinity plus 100 ppm gibberellic acid GA3 ; (T2+GA) high salinity plus 100 ppm gibberellic acid GA3. Leaf gas exchange measurements, chlorophyll index determination and carbohydrates quantification were performed. The main results showed that increasing salinity levels decreased photosynthetic assimilation for both cultivars, reaching 80% under high salinity compared to control for the Koroneiki cultivar. Foliar application of GA3 improved photosynthetic assimilation up to 43% for the Koroneiki cultivar under (T2+GA) compared to (T2). Results related to stomatal conductance and transpiration revealed that different levels of salinity caused a decrease in these parameters and an improvement with the application of GA3. For the chlorophyll index, control plants showed the higher level during the experimental period. This parameter decreased with the increase of salinity levels, reaching 31% under high salinity for the Koroneiki cultivar. Both cultivars showed an increase in chlorophyll index with the foliar spray of GA3. At the end of the experiment, accumulation of carbohydrates in leaves showed a variation according to the treatments. Mannitol concentration, which is the most abundant sugar, increased with the increase of salinity levels for both cultivars. The foliar spray of gibberellic acid under moderate salinity level (T1+GA) compared to (T1) showed a decrease in mannitol content to 12% for the Koroneiki cultivar. Salinity induced negative effects on ecophysiological parameters for both cultivars, but the Chemlali cultivar showed a higher resistance to increasing NaCl salinity. GA3 treatments improved the ecophysiological parameters especially for the Koroneiki cultivar. Mannitol content is positively correlated with the increasing level of salinity proving the osmoregulation role.

Durability of the olive tree cultivation in arid conditions under the climate change

Authors

MEZGHANI AYACHI Mouna (ayachimouna@yahoo.fr) corresponding author (Olive Tree Institute)

ANNABI Khouloud (annabi_khouloud@yahoo.fr) presenting author (Olive Tree Institute)

Summary

The olive orchards have been established in very different climate conditions from arid condition (Southern Mediterranean) to more humid conditions (Northern side) and even in poor soil conditions with low organic matter. The olive cultivation is a crop capable of establishing a sustainable system in subsistence agricultural areas. In Tunisia, the traditional cultivation method still remain the most frequent system used on extensive conditions in spite of emergence of new intensive and irrigated modern olive growing methods. The Tunisian olive growing counts about 82 millions of olive trees covering 1 835 000 ha. The major part of the olive orchards are conducted under rain-fed conditions (97% of the area). More than 80% of olive orchards are located in semi-arid and arid conditions (center and south), where the average of rainfall oscillated between 100-300mm. In Tunisia, temperature increased during the 20th century, was higher than the global average (+1.1 ° C compared to 0.6 ° C). Strong regional disparity in thermal and rainfall regimes, flood increases since 1958 and droughts since 1988, were noted. Water deficit varied from10 to 40% from north to south. So, disturbance of plant physiology and modification of their land use areas, were observed. Although, the production of the rain-fed crops (olive, arboriculture and cereals ...) decreased. In this work, we proposed some innovative techniques for the management of olive growing, used in Tunisia. The establishment of modern training system using adapted varieties (autochthonous and foreign), the application of foliar fertilization, the irrigation with a right quantity of water (20-50% ETc), without wastage can improve the quantitative and qualitative production. Keywords: Climate change, Olive tree, Rain-fed conditions, Variety, Irrigation, Fertilization, Yield.

Fingerprinting of Olive (Olea europaea L.) germplasm in Tunisian national collection by using Simple Sequence Repeat markers

Authors
Souabni Hana (souabni.hana@gmail.com) presenting author (PhD student)
Saddoud-Debbabi Olfa (olfa.lf@gmail.com) (Assistant teacher)
Fendri Mahdi (fendrimahdi@yahoo.fr) (PhD)
Triki Mohamed Ali (trikimali@yahoo.fr) (Master conference)
Ben Amar Fathi (fathibenamar@yahoo.fr) (Assistant teacher)

Summary
Conservation of autochthonous olive cultivars is priority in Tunisia while it represents a secondary center of diversity and one of the most economically important crop. This study aims to the preservation of olive genetic resources belonging to National olive germplasm collection located in the south of Tunisia. A total of 22 accessions were fingerprinting by using a set of six Simple Sequence Repeat markers (SSR). These markers allowed the genotyping and the study of the genetic diversity of varieties. The total number of alleles is 50 and varied from 3 to 13 alleles. The total number of genotypes is 57 and varied from 3 to 14 genotypes. Data recorded were submitted to different statistical analyses . The polymorphism information content (PIC) varied from 0.44 to 0.87 with a mean of 0.72. The parameters of Wright's subdivisions allowed to conclude that the intra population heterozygosity is higher than the inter population heterozygosity. The genetic distances between individuals allowed to make UPGMA classification. DICE coefficient ranged from 0.00 to 0.92 with a mean of 0.38. The Dendrogram classified the 22 studied cultivars into two major clusters. Based on multilocus genotypes, it was possible to draw an identification key discriminating all the

varieties studied. We assume the power of the microsatellite markers and the richness of our local germplasm in Tunisia.

Water status and biomass response of two olive tree cultivars under water stress

Authors
Ben Hassine Mortadha (benhassinemortadha@yahoo.fr) presenting author (Olive tree Institute, Unit of Sousse)
Boussadia Olfa (boussadio@yahoo.fr) (Olive tree Institute, Unit of Sousse)
Moula Ines (moula.ines@gmail.com) (Olive tree Institute, Unit of Sousse)
El Hafi Mariem (mariomahafi@yahoo.fr) (Olive tree Institute, Unit of Sousse)
Braham Mohamed (braham2015@yahoo.fr) (Olive tree Institute, Unit of Sousse)

Summary
Water resources in semi-arid and arid zones of the Mediterranean basin are under increasing pressure from rapidly growing demands and climate change conditions. In fact, higher temperatures and changes in extreme weather conditions are projected to affect availability and distribution of rainfall amounts. Under present climate variability, water stress is already high and climate change adds even more urgency for action. Without improved water resources management, the progress towards poverty reduction targets, sustainable development in all its economic, social and environmental dimensions, will be jeopardized. In Tunisia, water resources are decreasing from one year to another and agricultural sustainability is threatened. Olive production is the main agricultural practice. The effect of two water stress levels compared to the control water treatments (100%, 50% and 0% Available Water Content (AWC)) was investigated on olive one-year-old plants in order to assess the behavior of olive trees in water stress conditions. Two olive cultivars, Koroeniki, a promosing Greek cultivar, and Chemlali, the best local cultivar were chosen and measurements were made for 35 days under semi-controlled conditions in the greenhouse of Olive tree Institute. Behavior assessment of the two olive cultivars was carried out by monitoring leaf water status and dry matter accumulation parameters. The results of water potential showed that Koroneiki and Chemlali T0% plants had a water potential that decreased to -5.8 and -4.54 MPa, 35 days after applying water treatments, which represents 60 and 36% compared to control plants (T100%), respectively. Chemlali plants appear to be more tolerant to water restriction than Koroneiki plants, and, for both cultivars, a 50% AWC permits to maintain regular water potential. Osmotic adjustment results show that Koroneiki T50% plants exhibit a very low osmotic adjustment. T0% plants had, also, a low osmotic adjustment but it increases strongly by 85%, from the 21st to the 28th day after applying water treatments, and reach 2.46 MPa. Both Chemlali water treatments show a progressive increase in their osmotic adjustment and reach 1.25 and 1.7 MPa respectively for T50% and T0%. Osmotic adjustment components showed that Koroneiki T50% and T0% plants had a 100% passive osmotic adjustment compared to more active than passive osmotic adjustment for Chemlali plants. The Chemlali T50% plants root/shoot ratio was the highest (1.08) comparatively with the other two treatments. This result shows that Chemlali plants valorize low quantities of water (T50%) rather than high quantities (T100%). However, for Koroneiki at T100% water treatment, plants show the best root/shoot ratio compared to T50% and T0%. This result seems to indicate that Koroneiki plants behave better when it is irrigated at 100% AWC. In conclusion, Chemlali T50% plants had the best response under water stress conditions by decreasing their osmotic potential to maintain regular water potential and

develop the best roots and leaves dry weights and in consequence the best root/shoot ratio. This response indicates that olive tree management strategy to mitigate water stress depends on the specific adaptive cultivar mechanisms.

Molecular and Agronomic characteristic of the local Tunisian olive cultivar Sradki

Authors
Mnasri Sameh (mnasrisameh@yahoo.fr) (National Gene Bank of Tunisia)
Summary
The optimal management and use of the olive genetic resources required the identification of local olive cultivars. The inventory of olive resources in Tunisia was begun since 1981; however, several minor varieties remain unknown. The objective of this study was to identify a local olive cultivar "Sradki" based on morphological parameters as recommended by the International Olive Council (1997) and eight preselected nuclear microsatellite markers to compare the genetic fingerprint of the olive variety "Sradki" with the major local olive varieties in Tunisia. The morphological characteristics of this variety unveiled an original fruit and endocarp shape. The molecular analysis confirmed the important variability of the Tunisian local olive cultivars. Thirty seven alleles were revealed by SSR markers with a mean number of 3.7 alleles per locus and the variety Sradki is the alone cultivar which present the locus 75 pb for the SSR marker (DCA 18). The average heterozygosity rate ranged from 30% to 98% with a mean percentage of 71%. The UPGMA cluster analysis based on molecular data grouped cultivars into three main clusters; the variety "Sradki" could not be reliably classified into any of these cultivar groups, which confirmed the divergence of this cultivar from the other olive varieties. Key words: olive genetic resources, SSR, management, Sradki, Tunisia.

Inventory of phytopathogenic soilborne fungi causing wilt and die-back disease of olive tree in Tunisia and opportunities for biological control management

Authors
Triki Mohamed Ali (trikimali@yahoo.fr) presenting author (Olive Tree Institute of Tunisia)
Summary
During the last years, wilt and dieback of olive trees are the most devastating disease in some olive growing area in Tunisia. A complex of soil borne fungi causing die-back and wilting symptoms is nowadays the most serious threatening disease affecting olive tree in Tunisia and presumably in all the Mediterranean basin countries, due to its extension during last year's. Root rot symptoms were very frequent in diseased olive trees from field or nursery origin, and they were the main cause of decline and die-back syndrome. The most frequently isolated fungi from rotted roots and collar were Verticillium dahlia, Fusarium solani, Fusarium oxysporum, Rhizoctonia solani, Rhizoctonia bataticola, Cylindrocarpon.sp.. Isolation frequency of different fungi varied among olive cultivars. Pathogenicity tests showed that

Verticillium dahlia,Fusarium solani and Rhizoctonia solani were the most pathogenic on olive trees and reproduced symptoms of wilt and dieback. Furthermore, amplification with specific primers pairs for D (defoliating) and ND (non defoliating) revealed the appearance of defoliating V. dahliae pathotype for the first time on olive trees in Tunisia. Artificial inoculation of olive plant resulted in typical wilting with defoliation proving that the isolate is pathogenic on olive and belongs to the D pathotype. In order to biologically manage the disease, a multitude of indigenous antagonists' bacteria were isolated from several soils Tunisian and from Saharan weeds (Xanthium spinosum, Desmazeria rigida and Anacyclus clavatus) growing in the south of Tunisia. One of tested bacteria identified as Bacillus subtilis by sequencing the RNA 16 S produced a novel antimicrobial peptide (bacteriocin) obtained after precipitation by ammonium sulphate, chromatography on Sephadex G-25 and C18 reverse-phase HPLC. The SDS-PAGE analysis of purified bacteriocin revealed a single band with an estimated molecular mass of approximately 14 kDa. The bacteriocin exhibited an antifungal mode of action against Fusarium solani, Rhizoctonia solani, Rhizoctonia bataticola, and especially Verticillium dahliae. The microscopic observations showed that the bacteriocin inhibited spore germination of all tested fungi. The biological treatment of inoculated olive trees by the bacteriocin as preventive and curative model were efficient in reducing the incidence of verticilliosis symptoms on inoculated olive trees. Overall, the findings presented in the current study indicate that purified bacteriocin promising potential for future application as biocontrol agents for the mitigation and prevention to Verticillium wilt of olive trees. Keywords: Olive tree, wilt, dieback, fungi, Bacillus subtilis, bacteriocin, Antifungal activity.

Survey of the Fusarium Species Associated to Olive-tree (Olea europaea) in Tunisia

Authors
Trabelsi Rahma (rahmatrabelsi84@yahoo.fr) (Faculty of Sciences of Sfax)

Summary
Wilting and dieback diseases caused by the complex of soil borne fungi are nowadays one of the problems threatening the olive trees (Olea europaea) in Tunisia and in many Mediterranean basin countries. Fusarium is one of the important phytopathogenic genera associated to dieback symptoms of herbaceous plants in the nursery and in the field cuttings from olive trees and old olive trees. Our investigation showed that intercropping of Solanaceous crops (pepper, potato and tomato crops) within olive groves may be a source of transmission of fungal diseases as these crops are very susceptible to soilborne pathogens. These crops are themselves a high potential for the Fusarium spp., and could be considered as a risk factor threatening the olive culture. The objective of this study is to confirm the pathogenicity of different isolates of Fusarium spp. fundraising olive groves from different regions in Tunisia. According to the pathogenesis test conducted on the young olive trees, twenty three out of 104 isolates of Fusarium spp. collected were found to be pathogenic and the others were weakly or not pathogenic. Molecular identification of these 23 isolates by use of molecular technique based on PCR-ITS revealed the predominance of species Fusarium solani (56.5%) and Fusarium oxysporum (21.7%) compared to the species of Fusarium chalmydosporum (8.7%), Fusarium brachygibbosum (8.7%) and Fusarium accuminatum (4.34%). Based on pathogenicity test, disease severity was highly variable among the 23 pathogenic isolates tested, where Fusarium solani, was the most aggressive dieback agent. In order to focus on the role of the genes coding for the Cell Walls Degradation Enzymes in the

virulence of isolates of Fusarium spp., qRT- PCR was used to monitor the expression of CWDE genes in 7 Fusarium spp. isolates differing in aggressiveness and host of origin. In fact, the transcripts level of polygalacturonase, pectin esterase, pectate lyase, xylanase, endoglucanase G1, cutinase and 1,4-β glucosidase was determined in a time course of 12 h, 24 h, 48 h and 72 h after incubation in simulated roots medium. The results indicated that during the time course, the isolate of Fusarium spp. produces CWDE in sequence, in which pectinases were produced earlier than xylanase and endoglucanase G1. Correlation of the results with the host of origin indicates that isolates of Fusarium produce their CWDE according to the cell wall composition of their hosts. In fact, isolates from potato tends to produce more pectinases and cutinase whilst the olive ones tend to produce more xylanase and glucanase. In most studied cases, there is a correlation between the presence of pectic enzymes, disease symptom and virulence, being also their production decisive in the infection process.

Climate change impacts on agricultural drought across Ankara, Turkey

Authors
Danandeh Mehr ALI (danandeh@tabrizu.ac.ir) presenting author (Department of Water Resources Engineering, Faculty of Civil Engineering, University of Tabriz, Iran)
Nourani Vahid (nourani@tabrizu.ac.ir) presenting author (Department of Water Resources Engineering, Faculty of Civil Engineering, University of Tabriz, Iran)
Sharghi Elnaz (sharghi@tabrizu.ac.ir) (Department of Water Resources Engineering, Faculty of Civil Engineering, University of Tabriz, Iran)

Summary
Agricultural drought is mainly defined by insufficient soil moisture to maintain average crop growth and yields. It has been already approved that climate change may effect agriculture sector in Middle East. This study conducts a station-scale agricultural drought analysis at six meteorology stations in Ankara Province, Turkey. The standardized precipitation index (SPI) as well as standardized precipitation evapotranspiration index (SPEI) were estimated at the reference period 1971–2000 and compared with those of two future climate periods (2016–2039 and 2040-2070) under RCP4.5 and RCP8.5 greenhouse gas scenarios. Historical simulations and projections of future changes on the drought indices at each station were derived using Regional Climate Model RegCM4.3.4 to obtain a series of high-resolution simulations of three global climate models (GCMs) used in the Coupled Model Inter-comparison Project Phase 5 (CMIP5) experiments. In general, the results indicated that temperature difference values tend to increase and precipitation difference values tend to decrease in both future periods. The significant decreasing trend in both SPI and SPEI indices at the period 2040-2070 was projected in summer seasons, which is mainly due to significant increase (up to 4°C) in the future temperature amounts. Consequently, insufficient soil moisture is expected at summer seasons at the period 2040-2070, particularly at the eastern part of the province.

An assessment of pan coefficient equations for calculating reference crop evapotranspiration (ET0) under the humid environment

Authors
Pandey Pankaj K. (pkpnerist@gmail.com) presenting author (NERIST, India)

Summary
An assessment of pan coefficient equations for calculating reference crop evapotranspiration (ET0) under the humid environment aP.K.Pandey, and bVanita Pandey a,bAssistant Professor, and Department of Agricultural Engineering, North Eastern Regional Institute of Science and Technology (NERIST), Nirjuli, Itanagar, Arunachal Pradesh, India ABSTRACT Seven different pan coefficient (Kp) equations were assessed in term of predictive power to estimate ET0 for Jorhat, Assam (India). The estimates of ET0 based on different Kp values were compared with Penman-Monteith FAO-56 Reference Evapotranspiration Model (FAO56PM) method. The Coefficients of Determination (R2) of all equations were found in range of 0.97 to 0.98. Findings reveals that sequential performance of selected equations as follows; Synder equation > Cuenca equation > Orang > Modified Snyder equation > Allen and Pruitt equation > Pereira equation > Raghuwansi and Wallender. The Snyder (1992) method gave the best performance (R2= 0.985, RMSE=0.206 mm day-1). The Cuenca equation performed reasonably well (with under estimation = 0.72%, R2= 0.984, and RMSE = 0.25 mm day-1). Among the selected methods the Raghuwanshi and Wallender was ranked poorest. Keywords: Reference Evapotranspiration, Evaporation, Pan Coefficient, humid climate, Jorhat (Assam) India.

POSTER PRESENTATIONS

Assessment of soil water content variation patterns in olive trees cultivation

Authors
Arampatzis George (arampgeo@gmail.com) presenting author (ELGO DEMETER, NAGREF – Soil and Water Resources Institute)
Hatzigiannakis Evangelos (hatzigiannakis@gmail.com) (ELGO DEMETER, NAGREF – Soil and Water Resources Institute)
Kourgialas Nektarios (kourgialas@nagref-cha.gr) (ELGO DEMETER, NAGREF – Institute for Olive Tree, Subtropical Crops & Viticulture)
Psarras George (gpsarras@nagref-cha.gr) (ELGO DEMETER, NAGREF – Institute for Olive Tree, Subtropical Crops & Viticulture)
Kinigopoulou Vasiliki (vkinigopoulou@yahoo.gr) (ELGO DEMETER, NAGREF – Soil and Water Resources Institute)
Panagopoulos Andreas (panagopoulosa@gmail.com) (ELGO DEMETER, NAGREF – Soil and Water Resources Institute)
Koubouris George (koubourisg@gmail.com) (ELGO DEMETER, NAGREF – Institute for Olive Tree, Subtropical Crops & Viticulture)

Summary
Olive trees constitute one of the most dynamic cultivations for Mediterranean countries, while their economic importance is high. Considered as particular ecosystems, olive trees cultivation has to be based on integrated approaches including best agricultural practices and improvement plans, specially designed for the specific soil, climatic and plantation conditions. Due to the fact that water constitutes a fundamental factor affecting olive trees production, soil water content is one of the most critical parameters that has to be monitored in order to improve olive trees cultivation management. With this in mind, soil water content was systematically monitored at various depths in two Mediterranean areas in order to identify seasonal variation patterns and implications. The first area is Merambello, located in eastern Crete (Greece) and characterized by hot-summer Mediterranean climate, while the second area is Trifilia, located in south-western Peloponnese, in which wet Mediterranean climate conditions are dominant. The soil water content monitoring scheme included six irrigated and six rainfed groves for each area, while the monitoring period covered three years (2013-2015). With regard to irrigated fields, the average soil water content for the dry period

(May to October) was found to vary between 15 and 21% in Merambello and between 22 and 23% in Trifilia. This difference is mainly attributed to higher irrigation water volumes applied in Trifilia due to higher irrigation water availability. Average soil water content during dry period for rainfed fields was found to be 1% lower than the corresponding average of irrigated fields in Merambello and 3% lower in Trifilia. The higher difference in Trifilia reflects the higher irrigation water volumes applied. Considering the wet period (November to April), the average soil water content for irrigated fields in Merambello was found in the range of 24 to 28%, while the corresponding range for Trifilia was 37-40%. This difference is mainly attributed to the higher precipitation Trifilia receives. With regard to rainfed fields during the wet period, average soil water content was documented to be 1% lower compared to the corresponding average soil water content of irrigated fields in Merambello and almost equal in Trifilia. Concerning olive fruit yield, the comparison between rainfed and irrigated field values in Merambello exhibited small differences, which can be attributed to the imposed deficit irrigation conditions. The corresponding comparison in Trifilia presented higher olive fruit yield in irrigated fields. Olive fruit yield in Trifilia was found to be higher than Merambello both for rainfed and irrigation fields mainly due to higher irrigation water volumes applied and higher received precipitation which contributes to higher rain water volume stored in the soil. ACKNOWLEDGEMENTS With the contribution of the LIFE+ financial instrument of the European Union, in the framework of project LIFE11 ENV/GR/942 /oLIVECLIMA.

Farmer's adaptation measures to changing climate in Karnataka state of India

Authors
T H Gajendra (gaja.smg@gmailo.com) presenting author (scientist)
biradar nagaratna (nagaratna123@gmail.com) (scientist)
L manjunath (gaja.smg@gmail.com) (professor)
s onkarappa (onkarappas@yahoo.com) (professor)
M k naik (druahs@gmail.com) (director)

Summary
Farmer's adaptation measures to changing climate in Karnataka state of India Gajendra T H., Nagaratna Biradar, Manjunath L., M. K. Naik. K S Kadian, and Onkarappa Author 1: Scientist, University of Agricultural Sciences, Shimoga,Karnataka,India E-mail: gaja.smg@gmail.com Abstract: This paper estimates the adaptation measures to negative impact of climate change on Indian agriculture. This negative impact of climate change on agriculture is likely to have a serious impact on poverty. Farmers adopted many technologies of university. The study was conducted in Karnataka state of India in 2016. Ex-post-Facto research design was followed. The total sample for the present study was 150. The objectives of the study was to document farmers adaptations to climate change as felt by farmers. Appropriate statistical tools were employed. Exactly 90.00 per cent of the farmers changed their time of application of chemicals and fertilizers to evening hours and the same proportion of farmers changed number of inter cultivation operations depending on the rainfall occurrence, and more than 80.00 per cent of the farmers used to apply more of FYM, chemical fertilizers and penning to reduce the loss of soil fertility. Nearly two third (65.33 %) of the farmers changed their cropping pattern from mono cropping to diversified cropping pattern. Farmers (42.00%) were practicing wider spacing in case of cotton, sorghum and soybean. In case of pest and disease infestation, farmers (24.67%) adapted to grow resistant

varieties, applied neem and glyricedia leaves to overcome the frequency of damage. Farmers response are prime importance in analysis of extent of climate change. rapid adaptation may be less plausible in a developing country, where access to information and capital is limited. So, there is need to encourage farmers to follow more adaptive strategies based on their experience and also to organise training programs to the farmers on climate resilient technologies that help them to more effectively mitigate climate change. Key words: climate change, farmers, adaptations. Impact.

The effect of photo-selective nets on yield and fruit quality of apple cv. Braeburn and peach cv. Suncrest under Croatian agro-climatic conditions

Authors
Fruk Mladen (mladenfruk@agr.hr) presenting author (University of Zagreb, Faculty of Agriculture)
Jemric Tomislav (tjemric@agr.hr) (University of Zagreb, Faculty of Agriculture)
Fruk Goran (gfruk@agr.hr) (University of Zagreb, Faculty of Agriculture)
Vukovic Marko (mvukovic@agr.hr) (University of Zagreb, Faculty of Agriculture)
Buhin Josip (josip.buhin.zg@gmail.com) (University of Zagreb, Faculty of Agriculture)
Jatoi Mushtaque Ahmed (mushtaqjatoi@gmail.com) (Shah Abdul Latif University, Date Palm Research Institute)

Summary
The usage of photo-selective anti hail nets has been studied recently because of its ability to reduce damages from hailstorms and flying pests and increase yield and fruit quality of various fruit crops. It represents a new, innovative and ecofriendly approach that is being tested on various horticultural crops worldwide. In this study, four types of nets (three types from Tenax (Italy) (red, white and yellow) and Stop Drosophila Normal from Artes Politecnica (Italy)) were used on apple cv. Braeburn and peach cv. Suncrest orchard in northern Croatia in order to evaluate their efficacy on fruit quality and yield apart from their anti-hail and pest damage protection properties. The apples were harvested on 12th October 2015 and peach were harvested at two different times due to the difference in maturation (04 August 2015 yellow, drosophila nets and control fruit and on 07 August 2015, red and white net fruit were harvested). On apple, significant difference in fruit weight existed between red, white and yellow nets (188,88 g, 183,28 g, 181,73 g, respectively) on the one hand and Stop Drosophila Normal and control nets (157,34 g, 159,78 g, respectively) on the other hand. Trees under red and drosophila nets had significantly higher yield (12,6 and 10,33 kg per tree, respectively) than under yellow (9,73 kg per tree), and white nets (5,93 kg per tree) as well in control (5,68 kg per tree). Trees under yellow nets had significantly higher yield than those under white net and control. Trees under yellow, red and Stop Drosophila Normal nets had significantly higher yield efficiency (0.52 kg·cm-2, 0.51 kg·cm-2 and 0.48 kg·cm-2 TCSA, respectively) efficiency than white nets and control (0.29 and 0.27 kg·cm-2 TCSA, respectively). Among all tested nets no significant differences were recorded for firmness, soluble solids concentration (SSC), titratable acidity (TA), SSC/TA and TCSA. Color index was higher in fruit grown under Stop Drosophila Normal and red nets than under white and yellow nets. No significant difference was between fruit under control, red and drosophila nets on the one hand, and control, white and yellow nets on the other hand. On peach, the results show that all the tested nets significantly affected yield (26.80 – 29.56 t·ha-1) as

compared to control (21.64 t·ha-1). Significant difference in firmness existed between fruit grown under yellow and Stop Drosophila Normal nets (4.77 and 5.20 kg·cm-2, respectively) on the one hand and those grown under red and white nets (3.79 and 3.73 kg·cm-2, respectively) on the other hand. The control trees had significantly smaller yield efficiency than white and red nets, while no significant difference was showed between control trees and trees under yellow and drosophila nets. There were no significant differences for SSC, TA, SSC/TA ratio, fruit weight, and TCSA among all tested nets.

Effect of biological and mineral nitrogen on wheat productivity under newly reclaimed land conditions

Authors
Abd El-Lattief Essam El-Deen (essameldeen@agr.svu.edu.eg) (Professor, Agronomy Dept., Faculty of Agriculture, South Valley University, Egypt)

Summary
Biofertilizer is a wide term which includes a diverse category of bioinoculants such as nitrogen fixers, phosphate and potassium solubilizers and plant growth promoting rhizobacteria which helps in the growth and improve the productivity of plants, especially in the newly reclaimed land. In addition, the use of biofertilizer reduces environmental pollution by reducing the rates of mineral fertilizers used in agriculture. Therefore, this study was conducted to find out the effect of the use of certain bio-fertilizer for the free-living bacteria (Azospirillum and Azotobacter) which fix atmospheric nitrogen in cereal crops without any symbiosis with different ratios of recommended nitrogen mineral fertilizer to get the best combination of these fertilizers. This study was conducted at the Experimental Farm of the Faculty of Agriculture, South Valley University at Qena on sandy soil and used of bread wheat varity "Sides 12". Six different treatments with four replications each were carried out in the plot in RCB design. Treatments significantly affected yield and yield attributes, as well as grain protein content. The highest values of spike length, kernel weight spike, 1000-kernel weight, grain yield and straw yield as well as grain protein content were obtained from treatment T5 (75% recommended chemical N + bio fertilizer with Azospirillum and Azotobacter). Therefore, it can be recommend this treatment to give the highest yield of wheat and reduce the use of mineral fertilizers by about 25% and the preservation of the environment from pollution by mineral fertilizers.

Climate change effects on biochemical compounds and antioxidant activity of Olea europaea cv. Meski

Authors
Ben Mansour-Gueddes Samia (bm_samiatn@yahoo.fr) (Olive Tree Institute)
Saidana Dhouha (dhouhasaidana@yahoo.com) (Olive Tree Institute)
Ben Dhiab Ali (bendhiabali@yahoo.fr) (Olive Tree Institute)
Braham Mohamed (braham2015@yahoo.fr) (Olive Tree Institute)

Summary
To tolerate water stress and high temperature, Olive tree Meski, the main variety of table olives in Tunisia, developed several biochemical change. The objective of this research was to study the impact of climatic changes on bioactive compounds synthesis in Meski leaves collected from different bioclimatic ranges of Tunisia (North (Sub-humid), Centre (Higher semi-arid) and South (Lower arid)). This study contributed to evaluate the content of phenolics, chlorophylls, carotenoids, saponin, steroid and the antioxidant activity of northern, center and southern leaves of Meski cultivar. Southern Meski leaves produced more polyphenols, flavonoids, o-diphenols and tannins than the northern one's. Furthermore, the results showed that according to the severity of climate, from the North to the South, Meski leaves showed an increase of carotenoids and a decrease of chlorophyll a and b contents. The highest level of antioxidants compounds of southern leaves could be contributed to reduce the oxidative stress of Meski. The Spectrophotometric analysis of antioxidant capacity against DPPH and ABTS radicals was studied. Radical scavenging activity seemed to be higher in the center and southern areas comparatively to the northern ones at different extract concentrations. Therefore, the increase of these bioactive compounds can be considered as a response of the tree to surround aggressions and to oppose the oxidative stress that resulted from the severity of climatic conditions, characteristic of the Southern area. Keywords: Olive tree, leaves, climatic conditions, phenolic compounds.

LIFE-Stymfalia: The nature of business

Authors
Skouloudaki Katerina (skouloudakia@piraeusbank.gr) (Piraeus Bank)

Summary
(Short Summary of LIFE-Stymfalia project) Lake Stymphalia is located in the Northern Peloponnese and is included in the European Network of protected areas, Natura 2000 (SPA/SAC GR2530002). In recent years, the wetland of Stymphalia has been significantly degraded. Covered by dense reeds and without any management plan for the area, the result was the unsustainable use of its natural resources and the reduction of life in the Lake. LIFE-Stymfalia is an innovative project, co-funded by the European Union which aims at the restoration of Lake Stymphalia and at the same time the creation of a business scheme that will generate profits through utilizing reed biomass removed from the wetland and the area's unexploited biomass from agriculture residues. On a long term basis these profits can be used for self-financing management. In other words, LIFE-Stymfalia aspires to establish a sustainable management and financing scheme for the protected wetland, by converting a wetland ecosystem service into a marketable product and creating economic benefit. LIFE-Stymfalia is implemented by Piraeus Bank in partnership with Piraeus Bank Group Cultural Foundation, Municipality of Sikyonion, OIKOM Ltd., Society for the Protection of Prespa and Centre for Renewable Energy Sources and Saving. The project is built on the notion of circular economy as well as the European policy for business and biodiversity. In addition, LIFE-Stymfalia is in accordance with the recent targets of the EU (EU Biodiversity Strategy to 2020) as it provides a tangible solution to the problem of financing Natura 2000 areas and engaging the private sector in conserving biodiversity and ecosystems.

Soil management in agriculture for climate change mitigation

Authors
Carbonell-Bojollo Rosa (rosam.carbonell@juntadeandalucia.es) corresponding author (IFAPA. Area de Agricultura y Medio Ambiente)
Ordóñez-Fernández Rafaela (rafaelam.ordonez@juntadeandalucia.es) (IFAPA. Area de Agricultura y Medio Ambiente)
Moreno-García Manuel (mogam79@hotmail.com) (IFAPA. Area de Agricultura y Medio Ambiente)
Repullo Ruibérriz de Torres Miguel (mangel.repullo@juntadeandalucia.es) (IFAPA. Area de Agricultura y Medio Ambiente)

Summary
Agriculture and changes in soil management systems, represent a source of the three most important greenhouse gas emissions (GHG); carbon dioxide (CO2), methane (CH4) and nitrous oxide (N2O). The soil management system contributes to over 25% of global anthropogenic greenhouse gas emissions, between 10 and 14% comes directly from production processes and 12%-17% by changes in the soil surface thanks to the use of groundcovers Agriculture is currently responsible for 13,5% of global GHG emissions, being the 4th sector involved in global warming. CO2 is stored in the soil pores in which an exchange flux between soil and atmosphere exists due to different concentration gradients. These fluxes can be changed by the agricultural management practices and climatic conditions. Historically, the intensive tillage of the agricultural soils has provoked substantial losses of the organic carbon (OC) content in the soil (30%-50%). The harvest residues are buried and the soil is in optimum conditions to produce CO2 losses. One way to study the influence of tillage on carbon soil emissions is to measure the CO2 flux from the soil surface which will allow us to quantify the agricultural activities as favourable or unfavorable factors to the soil carbon fixation. Therefore , we did a research in which we compared the total CO2 emission volumes in soils under no tillage with others under traditional tillage. The measurements have been carried out at Rabanales farm located in Córdoba (southern Spain). The difference in the quantity of emitted gas due to the mechanical alteration of soil by tillage operations between the two systems show up to 139,5 kg of CO2 more in the plots under traditional tillage than in the non tillage ones. This value extrapolated to the great agricultural areas shows the great mitigating potential of the no till systems. If no till management practices had been used on the total of the maize surface cultivated in 2015/16 season , 4858 tones of CO2 would not have been emitted into the atmosphere. In this study we have also measured the soil organic carbon sequestration potential under the two management systems. The results show an average content of this element which is 12% higher in the no till plots than in the traditional tilled ones. Moreover, spatial distribution maps of the OC content were made using the results obtained in this research which show greater uniformity of this element content in the no tilled plots.

The pH effect on soil selenium's absorption in plant tissues of lettuce (Lactuca sativa L.) and berseem

(Trifolium alexandrinum L.), as affected by the application of sodium selenate

Authors
TSIOUMPRI MYRTO (myrtotsioubri@yahoo.com) corresponding author (Agricultural University of Athens)

Summary
Selenium (Se) is considered by many researchers, a controversial chemical element, primarily due to its nature as a common toxic non metal and one of the major antioxidant components of the cell, against the oxidative stress, which is caused due to an increase of the concentration of free radicals in the cytoplasm. Selenium combined with vitamins constitute the second antioxidant protection line to cell environment, while the selenium deficiency leads to its lack, from the structure of first line of defense, antioxidants compounds (SOD and GPx), leading to the appearance of clinical diseases. In the present research paper, is studied the natural selenium input way into the food chain, through the contribution of plant species, in combination with soil parameters, with the ultimate aim of creating food products for human consumption and animal domesticated species. For this purpose, was chosen the plant species of Lactuca sativa for human consumption and Trifolium alexandrinum for animal feed. The plant species were grown in two different soil substrates, based in soil acidity, as the primary soil parameter, which contribute to the final absorption of selenium from the plants. The acidic substrate had initial pH value of 5.6, while the alkaline pH value was 7.8.To each cultivation samples were selected as controls(no adding Se) and replicates(adding Se), the number of which could ensure reliable statistic measurements. The chemical reagent which added was sodium selenate (Na2SeO4 1 M), at a dose of 5ppm/sample and selenium fertilizing, was performed in two stages, with an interval of two months. From the chemical analyzes were observed higher selenium content values in the acidic substrate of the crops, with significant differentiation in the genus of Trifolium alexandrinum. The particularly reduced selenium content values in the alkaline soil are caused mainly, due to the presence of very high organic matter percentage (4-8%), a parameter which acts against the soil acidity. It was also observed significant percentage reduction in plant biomass of Lactuca sativa cultivation in acid environment combined with selenium fertilizing (~ 45%). Keywords: selenium, bioaccumulation, Trifolium alexandrinum, Lactuca sativa, pH, organic matter, sodium selenate.

The olive grove a tool to develop mitigation strategies to climate change

Authors
Savé Robert (robert.save@irta.cat) presenting author (IRTA)

Summary
The olive grove a tool to develop mitigation strategies to climate change Robert Savé 1; Inma Funes1; Carme Biel1; Xavier Aranda1; Felicidad de Herralde1; Beatriz Grau1; Agusti Romero1; Jordi Vayreda2; Gabriel Borras3; Gemma Canto3; Juan Albert Lopez Bustins4; Eduard Pla2; Diana Pascual2; Sergio Vicente5; Javier Zabalza5 1.- IRTA; 2.- CREAF; 3.- OCCC; 4.- UB; 5.- IPE-CSIC º96 Mediterranean Ecosystem was defined during 70s of last

century for Mitrakos, Money, Montenegro, Fuentes…., which characterized for some soil and environmental conditions, that promotes important adaptations of vegetation as sclerophyllous traits. Under Mediterranean and in semiarid environmental conditions, more than 440 mm of annual rainfall are required for oaks forests to persist. Summer drought and winter cold are thus important abiotic factors limiting the distribution of oak species and fosters the development of shrub and secondary tree communities, mostly pine. In both cases, drought stress is involved Olive groves have been, are and will be an important option in Mediterranean, semiarid and arid areas of the world in order to provide food, ecosystemic services, landscape, culture and population stabilization,….similarly, this crop avoid fire risk, erosion….and desertization. Under these environmental and cultural conditions this crop is a real carbon sink by means of management in woody parts of plants and soil. So, in Catalonia (North East of Iberic Peninsula) carbon stock in an olive grove is close to 92 Mg or tons /ha in woody part of plants, besides, to this amount about 40 tons of the carbon in the soil can be added. This values of carbon stock in wood are between the 107 Mg C/ha of an Abies alba forest and the 28 Mg C/ha of a Pinus halepensis community. This important carbon stock can be developed according 4x1000 strategy and conservation agricultural practices…., in this way, olive groves are not the solution, but they are one of the real solutions against climate change in Mediterranean and semiarid conditions.

Comparing reference evapotranspiration calculation methods to determine olive trees irrigation schedule in different bioclimatic stage of Tunisia

Authors
Bchir Amani (ameni.bchir@gmail.com) presenting author (Olive Tree Institute, Unit of Sousse)
Boussadia Olfa (boussadio@yahoo.fr) (Olive Tree Institute, Unit of Sousse)
Ben Dhiab Ali (bendhiabali@yahoo.fr) (Olive Tree Institute, Unit of Sousse)
Lemeur Raoul (raoul.lemeur@ugent.be) (Laboratoire d'Ecologie des Plantes, Université de Gent)
Ben Mariem Fethi (fethi_mariem@yahoo.fr) (Olive Tree Institute, Unit of Sousse)
Boukhrissa Najet (najet_boukrissa@hotmail.fr) (Olive Tree Institute, Unit of Sousse)
Ghariani Wafa (wafab6@yahoo.fr) (Olive Tree Institute, Unit of Sousse)
Braham Mohamed (braham2015@yahoo.fr) (Olive Tree Institute, Unit of Sousse)

Summary
The study of olive trees water requirements allows a better water efficiency management by using more accurate methods including maximum parameters of the continuum soil-plant-atmosphere. The Penman-Monteith equation (ET0-PM) is considered as the most rational approach and the most reliable for calculating evapotranspiration, only this approach necessarily requires an important number of climate parameters. The use of other equations, less complicated and using less climate parameters may be a reliable and efficient alternative. This experimental study was carried out on two cultivars cv. "Meski" and cv. "Chemlali" conducted in intensive system in different bioclimatic stages (Subhumid, Semi-Arid and Arid) in Tunisia. This study aims to estimate olive trees water needs using evapotranspiration calculation in three different bioclimatic stages. For that we compared the Penman-Monteith formula (PM) with Blaney-Criddel (BC), Hargreaves-Temperature (HT), Hargreaves-

Radiation (HR) and Priestley-Taylor (PT) formulas to estimate reference evapotranspiration (ET0). The results of our work show that ET0 values calculated by Blaney-Criddel (ET0-BC) and Priestley-Taylor (ET0-PT) formulas were more or less similar to Penman-Monteith. The ET0 values found by Hargreaves-Temperature and Hargreaves-Radiation were twice the values calculated by Penman-Monteith formula. We also found good correlations between the reference evapotranspiration calculated by the Penman-Monteith equation and that calculated by Priestley-Taylor and Blaney-Criddel equations in all bioclimatic stages.

Bioclimatic Assessment Of A Representative Mediterranean Agroecosystem

Authors
Papadakis Manolis (manour.papa@gmail.com) corresponding author (University of Aegean)

Summary
Olive (Olea Europea L.) is an evergreen tree grown primarily between 30 and 45o latitude in the temperate zone for both hemispheres (Fereres et al., 2009). It is a representative agroecosystem in Mediterranean basin of relative socio-economic importance (Ponti et al., 2013). Almost all the Mediterranean countries and, in addition, Argentina, Iran, Iraq, and Uruguay, are members of International Olive Council (IOC), which account for 95% of the world production (UN, 2015). Several phytoclimatic studies have linked the olive distribution with specific characteristics of Mediterranean climate (Emberger, 1930; Bagnouls and Gaussen, 1953; UNESCO - FAO, 1963; Rivas-Martinez, 1996; FAO, 2001). Daily observations from 8 meteorological stations have been processed for the common reference period 2010-2016. Emberger, Bagnouls-Gaussen and Rivas-Martinez indices have been calculated and intersected with Corine Land Cover 2012 data, in order to describe bioclimatic patterns in olive distribution. Daily and monthly predictions of an increased emissions scenario (RCP 8.5) of the CMIP5 project in the period 2017-2100 are then used to compare future bioclimatic conditions (Riahi et al., 2011). Results show significant impacts in microclimatic scale, expected to affect the olive yield. An overall increase in number of dry days is predicted for the Xerothermic Index X and a decrease in days of rain for the Standardized Precipitation Index (SPI) may lead to an agricultural drought. Olive tree cover changes between CLC 1990 and CLC 2012 are compared and a land cover 2100 scenario map is constructed, based on regional downscaled land use of RCP 8.5 predicted fractions for the CMIP6 project (Eyring et al., 2016).

Transpiration modeling and determining the climatic key component of the olive tree in Semi arid Tunisian area

Authors
Bchir Amani (ameni.bchir@gmail.com) presenting author (Olive Tree Institute-Unit of Sousse)

Escalona Lorenzo José (jose.escalona@uib.es) (Departamento de Biologia, Universidad de las Islas Balears)
Douthe Cyril (douthecyril@gmail.com) (Departamento de Biologia, Universidad de las Islas Balears)
Boussadia Olfa (boussadio@yahoo.fr) (Olive Tree Institute-Unit of Sousse)
Ben Dhiab Ali (bendhiabali@yahoo.fr) (Olive Tree Institute-Unit of Sousse)
Lemeur Raoul (raoul.lemeur@ugent.be) (Laboratoire d'Ecologie des Plantes, Université de Gent)
Ben Mariem Fethi (fethi_mariem@yahoo.fr) (Olive Tree Institute-Unit of Sousse)
Boukhrissa Najet (najet_boukrissa@hotmail.fr) (Olive Tree Institute-Unit of Sousse)
Gariani Wafa (wafab6@yahoo.fr) (Olive Tree Institute-Unit of Sousse)
Braham Mohamed (braham2015@yahoo.fr) (Olive Tree Institute-Unit of Sousse)

Summary
This study was conducted on field irrigated olive trees (cv. Meski) grown under a semi-arid climate of Enfidha (Tunisia), during two consecutive years (2009/2010). This study aims to estimate and predict olive tree transpiration, by the determination of the key climatic and physiological components influencing transpiration To achieve this objective, olive tree transpiration was estimated with both physiological and climatic methods. While the physiological method was based on the xylem sap flow estimations using the thermal dissipation method, the climatic method used calculated transpiration using Penman-Monteith (PM) and Priestley-Taylor formulas (PT). The sap flow estimations correlate well with the transpirations calculated by PM equation (R2 = 0.83) and by PT equation (R2 = 0.80). Results showed that sap flow estimations is mainly driven by the net radiation (Rn with R2 = 0.84) and air temperature (Ta with R2 = 0.78). These results give us the possibility to establish an empiric model of transpiration based on these climatic components (Rn and Ta). So to achieve the goal of spreading the physiological method in different bioclimatic stages, the use of the transpiration modeling can be used for a better adjustment of irrigation scheduling and an improve of the crop water use efficiency. Keywords: Olive tree; Sap flow; Evapotranspiration; Climatic parameters; Modeling transpiration.

The role of the olive tree in the protection against the hydric erosion (the case of the Tunisian sahel)

Authors
Lahmar karim (lahmar_karim@yahoo.fr) presenting author (ISEAH Mahdia, University of Monastir)

Summary
The culture of the olive tree marks the limit of the Mediterranean region. It constitutes its outline. The olive tree is specy which makes history of the Man in the quoted zone. Besides, this plant has only no socioeconomic role but it plays a role of protection of its ground. The results obtained in the Tunisian sahel show that the olive tree participated strongly in the protection against the hydric erosion. In fact, the measurements of the heads of ravines give that the olive tree reduces the hydric erosion. Also, the sedimentary contribution also decreases. Key words: soil erosion, olive tree, sedimentation, SIG.

OLIVE – MIRACLE Modelling solutions for improved and resilient management strategies for Olive tree against future climate change

Authors
Marco Moriondo[1], Gianni Fila[2], Michalis Omirou[3], Luca Testi[4], Georgios Koubouris[5]
[1]National Research Council, Italy; [2]Council for Agricultural Research and Economics, Italy; [3]Agricultural Research Institute, Cyprus; [4]Universidad de Cordoba, Spain; [5]Hellenic Agricultural Organization DEMETER, Greece

Summary
The aim of this project is to provide accurate tools to test the effectiveness of adaptation/mitigation management strategies to support long-term investment decision making. Central to this evaluation will be the harmonization between farmers' and sustainable ecosystems objectives, coupling profitability with the capacity of providing environmental services, to be reached by purposely-developed simulation tools to support decision-making. Advanced modelling approaches will be used to integrate available physiological knowledge into existing and well established modelling platforms, to assess climate change impact and evaluate mitigation/adaptation strategies by tuning agro-management factors. The analysis will be based on a consistent set of data layers, including weather, soils, and current agro-management information, and it will be conducted against present-time and short to mid-term future scenarios of climate change, derived from global circulation models. Project consortium consists of Institute of Biometeorology of the National Research Council-Italy, Council for Agricultural Research and Economics-Italy, Agricultural Research Institute-Cyprus, University of Cordoba - Spain, Hellenic Agricultural Organization - Greece. Project is funded by FACCE SURPLUS Sustainable and Resilient Agriculture for Food and Non-Food Systems.

Influence of climatic and bioclimatic parameters on the intensity and chronology of the Olea europaea L. pollen season in Tunisia

Authors
Ben Dhiab Ali (bendhiabali@yahoo.fr) presenting author (Olive Tree Institute of Sousse)
Hadj Hamda Sahar (riahisahar86@gmail.com) (Institut National Agronomique de Tunisie)
Bchir Ameni (ameni.bchir@gmail.com) (Olive Tree Institute of Sousse)
BEN MIMOUN Mehdi (mehdibenmimoun@yahoo.com) (Institut National Agronomique de Tunisie)
MSALLEM Monji (msallemonji@yahoo.fr) (Olive Tree Institute of Tunis)

Summary
Aerobiological monitoring of Olea europaea L. is of great interest in the Tunisian region because olive pollen is one of the most represented pollen types of the airborne spectrum, and the pollen Index is considered one of the major parameter that determines the harvest in this region. The main aim of this study was to develop a statistical model Which allows the arrangement of the phenoclimatic and agronomic parameters, according to their importance in

the intensity and chronology of pollen season, across a 23-year period (1993-2016), thus to trace the trends of the pollen season parameters in a climate change context. For this purpose, aeropalynological data obtained from five olive growing regions of Tunisia (Mornag, Jemmel, Menzel M'Hiri, Chaal and Zarzis) were used. Pollen sampling was performed using Cour volumteric traps, placed on top of different buildings at a similar heigt from the ground. Several methods, dates and threshold temperatures for determining the chill and heat requirements needed to trigger flowering were tested. The meteorological data used were provide by the Tunisian National Institute of Meteorology. The amount of chilling was calculated by four models: Crossa Raynaud, Utah, Dynamic and Utah+. Our results showed that the most appropriate models to determine chilling amounts are dynamic and Utah+. From these models, we found that Mornag region has the highest amount of chilling. Furthermore, results obtained by these models indicated that 2007 year was characterized by a mild winter in all studied regions. The heat was calculated by six models: ACTmax, ACTmed, Heat, HR, HU and GDD. In the Mornag region the HR model was the most appropriate, in Jemmel the most suitable model is the ACTmed and for the other regions the GDD model is most appropriate one. Both studied parameters (chilling and heat) combined with rainfall are the main factors involved positively in the formation of pollen grains and the chronology of pollen seasons. However, the harvest of the previous year contributes negatively to the formation of the pollen in all the olive growing regions. This study allowed us to trace the decreasing tendency of chilling quantities and the increasing tendency of the heat quantities accumulated by the olive tree before flowering phase during the study period, which affect the chronological (early and more spreading distribution) and the intensity (decreasing pollen index) parameters of the pollen season, causing a reduction in fruit production. keywords: Pollen intensity, Chilling, Heat Pollinic season chronology.

Assessing environmentally sensitive areas to desertification – An application in two Mediterranean watersheds

Authors
Morianou Giasemi (morianou@nagref-cha.gr) presenting author (Institute of olive tree, subtropical crops and viticulture, N.AG.RE.F, Hellenic Agricultural Organization "DIMITRA")
Kourgialas Nektarios (kourgialas@nagref-cha.gr) corresponding author (Institute of olive tree, subtropical crops and viticulture, N.AG.RE.F, Hellenic Agricultural Organization "DIMITRA")
Psarras George (gpsarras@nagref-cha.gr) (Institute of olive tree, subtropical crops and viticulture, N.AG.RE.F, Hellenic Agricultural Organization "DIMITRA")
Koubouris George (koubouris@nagref-cha.gr) (Institute of olive tree, subtropical crops and viticulture, N.AG.RE.F, Hellenic Agricultural Organization "DIMITRA")
Karatzas George (karatzas@mred.tuc.gr) (School of Environmental Engineering, Technical University of Crete)

Summary
Desertification is the consequence of a set of important processes which take place in arid and semi-arid environments, where water is the main limiting factor of land use performance in ecosystems. In Europe, the most susceptible areas to desertification are found in the Mediterranean region where physical loss of soil by water erosion is identified as the

dominant problem. The present study focuses on two watersheds in the island of Crete (Greece) and maps the environmental sensitivity areas to desertification. The most frequently applied system for assessing land degradation and desertification (LDD) is the Environmentally Sensitive Area Index (ESAI) method which is developed in a Geographical Information System (GIS) environment. The method is based on the evaluation of four different categories ESAI that affect desertification, which are related to (a) soil quality, (b) climate quality, (c) vegetation quality, and (d) land management quality. The four indicators were combined to produce the final ESAI map for desertification. In the present work, two study areas were then divided into seven regions characterized by a different degree of desertification risk ranging from non-affected to critical. Results show that the biggest part of the two areas are classified as critical or fragile to desertification. This could be attributed to the lack of water, the soil characteristics and to the non-appropriate agricultural practices.

Different nutrient management strategies reduce soil N_2O emissions in olive orchards

Authors
Omirou Michalis (michalis.omirou@ari.gov.cy) presenting author (Agricultural Research Institute, Department of Agrobiotechnology)
Anastopoulos Ioannis (ianastopoulos@ari.gov.cy) (Agricultural Research Institute, Department of Agrobiotechnology)
Christodoulou Eleni (christodoulou.t.eleni@ucy.ac.cy) (University of Cyprus, Department of Chemistry)
Agapiou Agapios (agapiou.agapios@ucy.ac.cy) (University of Cyprus, Department of Chemistry)
M. Ioannides Ioannis (ioannide@ari.gov.cy) (Agricultural Research Institute, Department of Agrobiotechnology)

Summary
To increase crop yields and quality, nitrogen is often applied in olive oil orchards either in the form of chemical fertilizers or as organic amendments (green manures, manures, composts, etc). However, increased N inputs have enormous environmental and economic costs. Previous studies showed that organic amendments exhibit lower soil N2O emissions. The challenge in olive orchards is to develop strategies in a climate-changing environment where organic inputs will meet the crop's needs. To evaluate the impact of different nutrient management schemes in soil N2O direct emissions of olive orchards we established a microcosm study. In detail, incubation studies (0-20 days) were conducted by applying chickpea residues, composts, ammonium nitrate and compare them with soils received no nitrogen inputs. The water holding capacity of the soil was maintained at 70%. Nitrous oxide emissions were estimated at different interval times. The results showed that the treatments had a significant impact on N2O emissions and soils received chemical fertilizers exhibited a substantial higher emission. Compost had the lowest N2O emission and was not different from that measured in soils received no inputs, but the nutrient availability was very low. Our results indicate that nitrogen availability and carbon source are important factors affecting N2O emissions. Incorporation of chickpea residues into the soil could be an alternative strategy in olive orchards to cover a significant amount of N needs of olives with a minimal GHG emission footprint.

Does the application of post-harvest industry wastes reduce direct soil fluxes of N_2O in organic farming?

Authors
Ioannides Ioannis (ioannide@ari.gov.cy) presenting author (Agricultural Research Institute, Department of Agrobiotechnology)
Kavadia Athanasia-Eleni (akavadia@ari.gov.cy) (Agricultural Research Institute, Department of Agrobiotechnology)
Anastopoulos Ioannis (ianastopoulos@ari.gov.cy) (Agricultural Research Institute, Department of Agrobiotechnology)
A. Vasiliades Michalis (michalis.omirou@ari.gov.cy) (University of Cyprus, Department of Chemistry, Lab of Heterogeneous Catalysis and Environmental Technology)
Efstathiou Angelos (efstath@ucy.ac.cy) (University of Cyprus, Department of Chemistry, Lab of Heterogeneous Catalysis and Environmental Technology)
Omirou Michalis (michalis.omirou@ari.gov.cy) (Agricultural Research Institute, Department of Agrobiotechnology)

Summary
Postharvest industry produces high quantities of the wastes, and there is an urgent need for their management to reduce the associated environmental risks. The citrus industry is one of the most important postharvest industries in Mediterranean region. Particularly for Cyprus, 25000 tn are used for the production of juices creating, therefore, a substantial amount of waste that has to be managed. A possible strategy is the incorporation of these wastes into soils to increase organic carbon and to support plant nutrition in annual crops providing nutrient such as nitrogen. For this purpose, incubation studies (0 – 51 days) were carried out, at a constant water holding capacity of 70%. For comparison reason, ammonium nitrate fertilizer treatment was also used. The dose of peels (orange: C/N = 57, mandarin: C/N= 43 and banana: C/N=38) and for fertilizer was so as to achieve 100 ppm soil N. At different times, except for N_2O emissions measurements, others parameters such as pH, nitrogen forms (nitrate, ammonium), microbial activity and community were also estimated. The results showed that use of raw peels lead to significant differences in the examined parameters and are potential beneficial amendments, combined cheap N source with low N_2O emissions.

Carbon sequestration by cover crops in olive orchards

Authors
Repullo Ruibérriz de Torres Miguel A. (mangel.repullo@juntadeandalucia.es) presenting author (IFAPA, Area of Agriculture and Environment)
Ordóñez Fernández Rafaela (rafaelam.ordonez@juntadeandalucia.es) (IFAPA, Area of Agriculture and Environment)
Moreno García Manuel (mogam79@hotmail.com) (IFAPA, Area of Agriculture and Environment)
Márquez García Javier (jmarquez_6@hotmail.com) (IFAPA, Area of Agriculture and

Environment)
Carbonell Bojollo Rosa M. (rosam.carbonell@juntadeandalucia.es) (IFAPA, Area of Agriculture and Environment)

Summary
Olive trees have been traditionally cultivated in shadow soils located on hills. These soils have been gradually degraded due to erosion, which is favoured by some practices like the intensive tillage, furthermore, soil organic matter is decreased by erosive processes. Cover crops, sown or spontaneous, in the inter-row of olive trees have proven to be an efficient practice to reduce soil and nutrient losses acting as a sink of atmospheric carbon and improving soil fertility. The aim of this study has been to assess the CO2 sequestration potential of several species used as cover crops in two olive orchards. The experiment was conducted during three growing seasons in two olive orchards from Andalusia (Spain), the most important area of olive cultivation in the world. In the experimental field 1, a gramineous (Brachypodium distachyon) and two cruciferous (Eruca vesicaria and Sinapis alba) were sown and compared to the spontaneous vegetation of the area (Spon1), mainly composed by mallows, Convolvulus arvensis, Diplotaxis virgata, Lolium rigidum and Taraxacum officinale. In the other experimental field, three leguminous, usually used as cover crops, were sown: common vetch (Vicia sativa), bitter vetch (Vicia ervilia) and hairy vetch (Vicia villosa). They were studied and compared with vegetation that grew naturally in the field (Spon2), Medicago polymorfa, Bromus sp, Diplotaxis virgata, Hordeum leporinum and Anagallis arvensis were identified as the most abundant species. The decomposition and carbon release of cover crops after the mechanical mowing were studied through residue samples from a 0.25 m2 and the analysis of carbon content. At the beginning and the end of the decomposition period, soil samples were taken at 20 cm depth and carbon analyzed to assess the atmospheric fixation. The carbon release in the decomposition period was variable depending on meteorological conditions each year. The averages for the three-year study period were: 1.56 Mg C ha-1 for B. distachyon, 1.07 with E. vesicaria, 0.81 S. alba and 0.82 Spon1 in field 1. Carbon released from root system was not considered. In the field 2 the averages of carbon release with legumes at decomposition period were 1.75 with V. sativa, 1.05 for V. ervilia, 2.81 in V. villosa and 0.47 Mg C ha-1 yr-1 with Spon2. This C input to soil led to improve the soil organic carbon (SOC), at 20 cm depth. The annual averages of C fixation were 1.42 Mg SOC ha-1 yr-1 for B. distachyon, 1.17 with E. vesicaria, 2.56 S. alba and 1.36 Spon1 in field 1. The legumes in field 2 reached lower values: 0.56 with V. sativa, 0.04 with V. ervilia and 0.70 Mg SOC ha-1 yr-1 in V. villosa. There was no fixation with Spon2. The result indicated that root system had great influence in the increment of SOC, mainly with crucifers due to their tap root. Although leguminous improved the soil nitrogen, higher carbon sequestration was obtained with the gramineous and cruciferous species. Using cover crops is an efficient tool for atmospheric carbon sequestration and protecting the soil from erosion.

Evaluating water stress in irrigated durum wheat based on remote sensing techniques

Authors
Mzid Nada (nada.mzid@hotmail.com) presenting author (Higher Agronomic Institute of Chott Mariem)
Todorovic Mladen (mladen@iamb.it) (Mediterranean Agronomic Institute of Bari)
ALBRIZIO Rossella (rossella.albrizio@cnr.it) (CNR-ISAFOM)

Cantore Vito (vito.cantore@ispa.cnr.it) (CNR–ISPA)

Summary
The Mediterranean water resources are almost fully exploited in many areas and the impacts on water scarcity are projected to multiply under climate change. The most effective mean to save water appear to be through the adoption of carefully managed irrigation strategies. Plant indicators enable the grower to use the plant directly for clues as to when irrigate. These indicators could be obtained through the use of remote sensing that is widely involved in numerous disciplines such as agriculture. Remote sensing is one of the solutions that can significantly contribute to providing a timely and accurate imagery of the agricultural sector. The main objective of this study is to compare satellite and ground-based sensing techniques as tools describing the variations of crop stress related indices under different water regimes (case of durum wheat). The experimental layout was established in Policoro (Matera) located in Southern Italy about 3 km far from the Ionian coast. The growing season was from February to June 2015 with three distinguished water management practices (rain-fed, 50% and 100% of irrigation requirements). The Landsat 8 images and ground-based sensing data were acquired regularly in April, May and June together with plant physiological parameters. The overall results indicated no significant differences of both biomass and yield among the irrigation regimes. This could be explained by the abundant precipitation (205 mm) which limited the needs for irrigation. Correlated to the leaf gas exchange parameters, Water Index (WI), CWSI_Jackson and CWSI_Alves and Pereira performed better than CWSI_Idso. Water Deficit Index (WDI) was found strongly related to plant water status, than Crop Water Stress Index (CWSI) with average R^2 of 0.96 in respect to 0.57 (CWSI_Idso). High correlation appear to be evident for satellite and ground-based derived WDI regressions (R^2=0.81). Nevertheless, the satellite data could provide reasonable indications about the crop status when other means of measurement are missing.

Ecophysiological response of two olive tree cultivars (Olea europaea L. ‘Chemlali’ and ‘Koroneiki’) under water stress and salt stress

Authors
Boussadia Olfa (boussadio@yahoo.fr) presenting author (Olive Tree Institute Unit of Sousse)

Summary
Low water and high salinity were the effects of climate change. The objective of this experiment is to study the ecophysiological behavior of two varieties of Olea europaea L., 'Chemlali' and 'Koroneiki' under two types of abiotic stresses (water deficit and salinity) The experimentation was conducted under controlled conditions in greenhouse for a period of 49 days and includes five treatments: T0 control, T1 (6 g NaCl / l), T2 (6 g NaCl / l with Stockosorb), T3 (without irrigation) and T4 (without irrigation with Stockosorb). The evaluation of the response of the olive tree to the application of a water deficit and salt stress showed a decreased water potential of the two varieties 'Chemlali' and 'Koroneiki' and all treatments compared to the control. A decrease in the ecophysiological parameters was also detected. The use of Stockosorb in association with water deficit has not shown a significant correction in stomatal conductance and photosynthesis rate for both varieties. Whereas, a good correction of the stomatal conductance and photosynthesis rate was detected in salt stress especially for the Koroneiki variety. These observations are discussed in relation to the adaptations developed by both cultivars in order to be able to cope with abiotic stress.

Survey on orchard management practices applied in two olive growing areas of Crete, as compared to the approach proposed by LIFE AgroClimaWater project

Authors
Psarras Georgios (gpsarras@nagref-cha.gr) presenting author (HAO "Demeter" - Institute of Olive Tree, Subtropical Crops & Viticulture)
Kourgialas Nektarios (kourgialas@nagref-cha.gr) (HAO "Demeter" - Institute of Olive Tree, Subtropical Crops & Viticulture)
Morianou Giasemi (morianou@nagref-cha.gr) (HAO "Demeter" - Institute of Olive Tree, Subtropical Crops & Viticulture)
Koubouris Georgios (koubouris@nagref-cha.gr) (HAO "Demeter" - Institute of Olive Tree, Subtropical Crops & Viticulture)

Summary
The project LIFE AgroClimaWater aims to increase the adaptive capacity of tree crops to predicted climate change effects, by applying agricultural practices that could improve water use efficiency at farm lvel. Two pilot areas are included in the project: a) the area of Platanias in Western Crete and b) the area of Merambello in Eastern Crete. A set of agricultural practices will be applied in commercial farms, aiming to increase soil organic matter (application of compost, shredding of pruned wood), maintain and enrich existing flora during winter (weed conservation and cover crops), reduce evapotranspiration losses (mulching, winter and summer pruning and summer application of kaolin), apply deficit irrigation based on actual crop water needs and use of fertigation and foliar application of mineral nutrients in order to develop a fertilizing strategy according to the specific climate conditions of each growing season. In the initial phase of the project, the current status was recorded in 100 commercial olive groves in Merambello area and 91 in Platanias area. It was observed that, despite the fact that the proposed cultural practices are well-proved within the scientific community, their acceptance and application by farmers are still ranging in very low percentages. Indicatively, winter pruning is applied at a rate of only 45% in Merambello, while the rate of summer pruning is zero in both regions. Application of mulching ranges between 2-13%, use of organic matter at 3-12% and the application of cover crops at 0-6% in the two pilot areas. There was no olive grower applying fertigation, while olive orchards with no application of fertilizers reached 23% in Platanias and 66% at Merambello areas. Concerning the irrigation strategy followed, all farmers irrigate empirically, with average annual irrigation water consumption much lower than the typical olive crop requirements. However, the quantities of water per irrigation event are higher than the indicated and in combination with the application of irrigation in periods that are not critical for the crop, leads to a non-proper use of water. From the above-mentioned, it can be concluded that resources management and yield of olive orchards, in the two pilot areas, can be optimizing by adopting an alternative scheme of orchard management.

Behavior of the olive tree Chemlali in climate change conditions

Authors
SAIDANA Dhouha (dhouhasaidana@yahoo.com) (Institute of olive tree, Sousse Station, Tunisia)
BEN MANSOUR Samia (bm_samiatn@yahoo.fr) (Institute of olive tree, Sousse Station, Tunisia)
BRAHAM Mohamed (braham2015@yahoo.f) (Institute of olive tree, Sousse Station, Tunisia)

Summary
The Mediterranean basin might be particularly affected by climate change, which could have extensive impacts on olive production, specific to it. To identify new indicator of stress imposed by climate changes, Chemlali, the main Tunisian olive tree, was studied for its leaf and root volatiles in the north and the south of the country. Great changes in volatiles composition were noted in the both aerial and underground organs summarized by enrichment in phenolic and carbonylic compounds and reduction in hydrocarbons and fatty acids in south samples. Anatomic study of leaves, woods and roots of Chemlali grown in the north and the south was realized and compared. Additionally, mineral analysis was performed in the different olive tree organs in the both regions which demonstrate an important variation of mineral content and distribution.

Broccoli cultivars for reducing atmospheric CO_2. Study of different cultivars grown under salinity

Authors
Sagarduy Ana L. (Agatha.Agudelo@sakata.eu) (1Sakata Seed Iberica)
Agudelo Agatha (Agatha.Agudelo@sakata.eu) (Sakata Seed Iberica)
Rios Juan J. (jjrios@cebas.csic.es) (Grupo de Aquaporinas, Departamento de Nutrición Vegetal. CEBAS-(CSIC).)
Martinez-Ballesta M. Carmen (mballesta@cebas.csic.es) (Grupo de Aquaporinas, Departamento de Nutrición Vegetal. CEBAS-(CSIC).)
Carvajal Micaela (mcarvaja@cebas.csic.es) presenting author (Grupo de Aquaporinas, Departamento de Nutrición Vegetal. CEBAS-(CSIC).)

Summary
The fixation of CO2 by plants constitutes an important point in the global balance of carbon. On a global scale it is estimated that the Earth's biosphere takes up nearly 2.000.000 tons of CO2 per year (UNESA 2005). This amount is a result of the small differences between the photosynthetic absorption of CO2 and its loss through respiration, decomposition of organic matter and different types of natural disturbances, but emissions in crops are high due to the agricultural practices. Therefore, in this study the annual rate of CO2 fixation by different cultivars of broccoli in Mediterranean areas (Region of Murcia, Spain) with high salinity has been determined. The study has been based on data obtained from biomass production and their concentration of carbon. The growth, the water use efficiency and the amount of carbon fixation by individual plants were calculated. Also, the use of the by-product has been

determined for a cero residue. The results showed that the carbon fixation capacity of plants depends on the cultivars and their resistance to abiotic stress conditions. The utilisation of broccoli plants by-products in food industry and pesticides production is also dependent on the glucosinolates profile of each variety.

Wastewater Treatment By Floating Macrophyte (Salvinia Natans) Under Algerian Semi Arid Climate

Authors
LAABASSI AYACHE (laabassiayache@gmail.com) presenting author (UNIVERSITY OF BATNA 2)
HARZALLAH DAOUD (harzaldaoud@yahoo.co.uk) (UNIVERSITY OF SETIF 2)
BOUDEHANE ASMA (biologie-ecologie@hotmail.fr) (UNIVERSITY OF BATNA 2)
FERCHA AZZEDINE (ferchazzed@yahoo.fr) (University Abbas Laghrour Khenchela)

Summary
Macrophyte pond has developed strongly in the field of wastewater treatment for irrigation in rural areas and small communities. Their association allows, in some cases, to increase the hydraulic capacity while maintaining the highest level of quality. The present work is devoted to the treatment of domestic wastewater under climatic conditions of Algeria (semi-arid) through a system using two tanks planted with Salvinia natans. The performance study and treatment efficiency of the system overall shows that the latter provides a significant removal of nitrogen pollution: total Kjeldahl nitrogen NTK (85.2%), Ammonium NH4+-N (79%), Nitrite NO2--N (40%) also, a major meaningful reduction of biochemical oxygen demand BOD5 was observed at the output of the system (96.9 %). As BOD5, the chemical oxygen demand (COD) removal was higher than 95 % at the exit of the two tanks. A moderately low yield of phosphate-phosphorus (PO43-P) was achieved with values not exceeding 37 %. In general, the quality of treated effluent meets the Algerian standard of discharge and which allows us to select a suitable species in constructed wetland treatment systems under semi-arid climate.

Morphological variability among Stipagrostis ciliata (Desf.) De Winter accessions growing under North African arid bioclimate

Authors
Mnif Fakhfakh Lobna (mniflobna@yahoo.fr) (Faculty of Sciences of Sfax)
Jeddi Kowther (kaoutharjeddi@yahoo.fr) (Faculty of Sciences of Sfax)
Chaieb Mohamed (mchaieb133@gmail.com) (Faculty of Sciences of Sfax)

Summary
Abstract: Most ecological studies in North Africa arid bioclimate reveal a process of continuous degradation of pastoral ecosystems as a result of overgrazing during a long time. This degradation appears across the depletion of perennial grass species. Indeed, the majority of steppe ecosystems are characterized by a low density of perennial grasses. The objective of

the present work is to examine the phenology and the above ground growth of several Stipagrostis ciliata (Desf.) De Winter accessions, growing under different regions of lower arid bioclimate of Tunisia. The results of the ANOVA test, next to the mean values of all measurements show significant differences in all morphological parameters of S. ciliata accessions. Plant diameter, bio volume, root biomass with protective sleeve and spike number show very significant differences between S. ciliata accessions. Significance tests for the differences of means indicate high distinctiveness of accessions. Comparative studies on Above ground Biomass of Stipagrostis ciliata accessions showed significant differences in shoot dry matter accumulation (F =2.986; P=0.053). This variability emphasizes the importance of variability in phytomass production in this perennial grass. Turkey's tests indicate the presence of three groups of accessions. Pearson's correlation analysis of the morphological traits suggests that these traits are significantly and positively correlated. The Principal component analysis (PCA) is applied on a table with four observations and 12 variables. Dispersion of Stipagrostis ciliata accessions on the first two axes of principal component analysis confirms the presence of three groups of plants. PCA reflected the results of ANOVA analysis, indicating that almost all morphological characters varied significantly between Stipagrostis accessions. From this study, it may be concluded that Stipagrostis ciliata shows a high intraspecific variability. It is morphologically very heterogeneous. The reintroduction of Stipagrostis ciliata, necessarily would have a multiple role, namely; regeneration of vegetation cover by maintaining different biological types, improving the quality of the steppes, the regeneration of soil environment and finally the maintenance of biodiversity. Key words: Morphological characters, Phenology, Stipagrostis ciliata, Accession, Arid zones.

Developing drought action plans at farmers' organization level in order to improve their climate change adaptation potential

Authors
Arampatzis George (arampgeo@gmail.com) presenting author (ELGO DEMETER, NAGREF – Soil and Water Resources Institute)
Pisinaras Vasilis (vpisinar@gmail.com) (ELGO DEMETER, NAGREF – Soil and Water Resources Institute)
Hatzigiannakis Evangelos (hatzigiannakis@gmail.com) (ELGO DEMETER, NAGREF – Soil and Water Resources Institute)
Panagopoulos Andreas (panagopoulosa@gmail.com) (ELGO DEMETER, NAGREF – Soil and Water Resources Institute)

Summary
Within the context of climate change, droughts are expected to significantly affect the agricultural sector, especially in the Mediterranean region where water availability problems already occur. Therefore, the compilation of drought action plans is of high importance in order to enhance agricultural sector adaptability to the foreseen climate change, thus alleviating potential impacts. This study aims at presenting how drought action plans can be compiled at farmers' organizations level (F.ORs), which is a common organizational scheme in the Mediterranean. Drought management constitutes a very complex and demanding task, since a wide spectrum of sectors (e.g. agriculture, industry, tourism, environment, socioeconomical aspects) are interacting in a complicated way. Therefore drought

management plans are commonly compiled at national and regional levels for which a management procedure can be established on a common basis. Subsequently, compiling a drought action plan only for a specific sector (agriculture) and for a very specific area (area of F.ORs) constitutes a tricky and demanding task that in any case will have to be linked to its spatial and sectoral extensions in order to be efficient and meaningful. The proposed drought action plan development methodology comprises of two main sections: a) the drought risk assessment section, in which the potential of drought occurrence is assessed and b) the drought risk management section, in which specific actions are proposed in order to enforce the drought preparedness level of the FOR. Drought risk assessment section aims to identify, analyze and evaluate drought risk. Based on drought risk assessment results, specific actions are proposed, according to which the F.OR is getting prepared to deal with droughts. The above methodological approach was adopted in order to develop drought action plans in two F.ORs located in Crete island-southern Greece, for which olives constitutes the main cultivated crop. With regard to drought risk assessment, it is concluded that summer droughts cannot be considered of high risk for the agricultural production of the two F.ORs, since they constitute typical climate conditions during a critical time span of the cultivation period. Prolonged droughts, on the other hand, are the major risk for agricultural production in the two F.ORs, since water resources availability decreases considerably (reduction of reserves and often deterioration of quality). Moreover, based on previous studies, it was identified that prolonged droughts frequency is of major concern for the two F.ORs. With regards to drought management, a wide range of agricultural practices are proposed to serve both as preventive and operational actions. These practices can be categorized as follows: 1. Practices for reduction of water evaporation losses 2. Practices for reduction of water transpiration losses 3. Practices for the improvement of soil water holding capacity 4. Practices for reduction of surface runoff losses 5. Practices for improving irrigation efficiency Compilation of F.OR specific drought action plans have to be strongly connected to the regional drought management plans that in turn need to be compiled for drought vulnerable areas, in accordance to Directive 2000/60/EC (art. 13.5). In regional drought management plans, each F.OR can identify specific drought management directions, understand its role as a water user in the basin, and comprehend its interactions with the other water users and sectors. ACKNOWLEDGEMENTS This work has been elaborated in the framework of the LIFE AgroClimaWater project (LIFE14 CCA/GR/000389).

The olive tree varieties behavior in different Tunisian area

Authors
SAIDANA Dhouha (dhouhasaidana@yahoo.com) presenting author (Institute of the olive tree)
BEN MANSOUR Samia (bm_samiatn@yahoo.fr) (Institute of the olive tree)
BRAHAM Mohamed (braham2015@yahoo.fr) (Institute of the olive tree)

Summary
Mediterranean countries especially the southern ones seem to be the most seriously concerned by the climate change, which have many impacts on agricultural productivity and food safety and quality. The olive culture is a characteristic of the Mediterranean region where it takes economic, social and environmental places. Chemlali and Chetoui are the main Tunisian variety of olive tree. To adapt to different climatic conditions characterizing the North, the Center and the South of the country, these varieties synthesis many interesting compounds

which were screened and compared. Indeed, the chemical compositions of their foliar methanolic extracts were analyzed quantitatively for their content in antioxidant compounds. The antioxidant activities of these extracts were tested against both radicals, DPPH and ABTS. While, antioxidants were identified using chromatographically analyses by GC-FID and GC-MS. Tested at a concentration of 1mg/ml against DPPH, the methanolic extracts of both Chemlali and Chetoui exhibited an interesting antioxidant activity reaching 90%. However, Chemlali activity was more important in the Center (80%) and the South (70%), while, Chetoui's was in the North and the South. These activities were lower against ABTS but steeled more important in the South comparatively to the other areas. Total phenols of Chemlali showed an increase in its content in the South, it tripled comparatively to the North's. Additionally, flavonoids, diphenols, saponin and carotenoids increased significantly in this area differently to those of Chetoui, which showed a decrease in a lot of them. Benzyl alcool, Ionene, Pyrazole and its derivates, Benzaldehyde, 4-vinyl methoxyphenol, known for their antioxidant activity were identified in these varieties. Keywords: olive tree, Chemlali, Chetoui, antioxidants, climatic conditions.

Olive mill wastewater phytoremediation in a pilot scale unit using Myrtus communis and Punica granatum plants

Authors
PETOUSSI MARGARITA (mpetousi@isc.tuc.gr) presenting author (School of Environmental Engineering, Technical University of Crete, Chania, Greece)
PAPADIMITROPOULOS CHRISTOS (chris.papadimit@hotmail.com) (School of Environmental Engineering, Technical University of Crete, Chania, Greece)
KALOGERAKIS NICOLAS (nicolas.kalogerakis@enveng.tuc.gr) corresponding author (School of Environmental Engineering, Technical University of Crete, Chania, Greece)

Summary
Olive mill wastewater (OMW) constitutes a major environmental issue, especially for the Mediterranean region, where the overall annual production is estimated to be over 30 million m3. OMW generated by the traditional three-phase decanter process, has generally extremely high organic pollution (COD values up to 220 g/L) and high phenolics content (up to 80 g/L) which are not easily biodegradable and toxic to most microorganisms. Thus, the overall biotoxic character of OMW constitutes a significant inhibitor of the biological processes that take place in common wastewater treatment plants. Phytoremediation technologies use plants and their associated microorganisms for the degradation of toxic organic contaminants in soil and water and are generally considered effective, inexpensive and environmentally friendly technologies. Punica granatum and Myrtus communis (commonly known as pomegranate tree and myrtle, respectively) are two small tree species interesting for bioremediation purposes as they are both cultivated throughout the Mediterranean region and have a long history of application in the perfume, cosmetic, food, and pharmaceutical industries. The aim of this study was to evaluate the potential of M. communis and P. granatum plants to form a soil environment capable for bioremediating OMW and at the same time provide opportunity for crop exploitation. For this purpose, two identical 1m3 volume pilot units were constructed with wastewater recirculation. Each pilot was planted with two plants; the first one with P. granatum plants and the second one with M. communis plants. OMW was pumped continuously for 12h/d to the soil surface of each unit. The

wastewater passed through the soil compartment and it was collected at the bottom layer of the pilot which was filled with large gravel. The collected wastewater was pumped back from the bottom of the tank to the top layer of the unit. Several experimental runs have been conducted over a period of 3 months, treating OMW of low strength from an evaporation pond. Wastewater was sampled every 24h from the wastewater collected at bottom of each unit. The samples were analyzed and the following parameters were determined: COD, BOD5, TN, TP and total phenolics content. In addition, the EC, pH, TDS, salinity and DO of the samples were measured immediately following sampling. Moreover, soil from specific points of the unit was sampled for quantification of TC and average bacterial biomass. Finally, the chlorophyll content of plants leaves was measured weekly and assesed in comparison to control values, in order to estimate the stress level of the plants during the experimental cycles. The results are very encouraging, since remediation of OMW with parallel production of high-valued agricultural products is feasible.

Landscape influences on population dynamics of Bactrocera oleae

Authors
Stattegger Sophie (s.stattegger@posteo.de) presenting author (University of the Aegean, Biogeography and Ecology Lab)
De Moraes Consuelo (consuelo.demoraes@usys.ethz.ch) (ETH Zurich, Institute of Agricultural Sciences)
Tscheulin Thomas (t.tscheulin@geo.aegean.gr) (University of the Aegean, Biogeography and Ecology Lab)

Summary
The olive fruit fly (Bactrocera oleae) is the most common pest in olive production worldwide. Its larvae cause serious damage to the olive fruit, which leads to substantial yield losses. However, highly different infestation levels can be observed in olive orchards situated in close vicinity to each other. Here we introduce an ongoing study aiming to investigate, at different spatial scales, the causes leading to differences in infestation by B. oleae. The study area is on Lesvos Island, where B. oleae populations are monitored in six regions in total, each existing of eight sites. Population monitoring started in spring 2016 and lasts until autumn 2018, using McPhail traps with ammonium salts as attractant. Traps are checked once a week between April and November, and adult flies counted. B. oleae populations are likely influenced by the surrounding landscape. In order to examine to which extent landscape characteristics affect B. oleae's behavior, various topographic variables like adjacent water bodies, altitude, as well as the overall landscape composition are recorded. Also the ongoing climate change is expected to affect populations dynamics leading to a shift of B. oleae occurence in altitude and time. Therefor, temperature variation and humidity are measured regularly. Furthermore the potential impacts of abandoned, extensively managed, as well as intensively managed olive groves in the landscape are assessed. In addition plant species compositions surveys are conducted. First statistical analyses of the limited data obtained so far revealed interesting and far-reaching trends, showing for example negative and positive impacts of the understorey plant composition on infestation levels and fly abundance. In particular the presence of certain aromatic plants seems to negatively affect B. oleae abundance, while certain other plants seem to benefit them. Chemical, physiological and ethological experiments and trials are underway, which are expected to reveal the underlying mechanisms. The expected study results will provide important background information

potentially allowing the reduction of herbicides, pesticides, bait sprays, their associated economic costs and thereby contributing to a more environmental friendly olive production, as well as giving hints about areas that are or will become more susceptible due to climate change.

Certification organic snails and future market-consumption edible snails

Authors
KARAMANI EVANGGELIA (ekaramani@agro.auth.gr) corresponding author (Aristotelian University Thessalonica, Faculty of Agronomics Dasologias and Natural Environment, Department of Agronomics, Sector of Rural economy)
TZIMITRA-KALOGIANNI EIRINI (tzim@agro.auth.gr) corresponding author (Professor, Aristotelian University Thessalonica, Faculty of Agronomics Dasologias and Natural Environment, Department of Agronomics, Sector of Rural economy)
KARAMANI MARIA (karamani_m@yahoo.com) corresponding author (Graduate of department Diets from Alexandreio Technological Educational Institution Thessalonica)
Summary
The main objective of this study is to investigate consumer attitudes towards buying and consumption of food and biological snails (which to date is not possible certification of a snail farm as organic.) In the region of Thessaloniki. The questionnaire of this study was applied to a sample of 353 people during: December 13, 2013 until April 28, 2014 in the city of Thessaloniki. The questions included were mostly "closed" type, so it can be statistical processing and analysis of data to provide a number of conclusions. Data analysis was performed using the statistical package IBM SPSS statistics 21. The method chosen as appropriate for the statistical investigation of attitudes and consumer opinion, is the categorical regression (Categorical Regression), which is an extension of classical statistical technique of regression analysis used when some of the variables are not numerical or suspected that the relationship between them is not linear. The results show that consumers were to consumption of organic snail if there were because they consider organic products of better quality, also shows that the socio-economic characteristics (income, age, gender, marital status, education) of the Thessalonians consumers influence their consumption trends for snails, and it is proven that consumers prefer to purchase the snails from farmers' markets than from supermarkets and delicatessen stores. It draws some suggestions aimed, the need for the introduction of biological heliciculture industry, better promotion and improvement of heliciculture industry, and finally the proper promotion of snails on the market . Keywords: • Consumer's behavior, • Thessaloniki • snails consumption, biological heliciculture • Categorical regression.

Use of olive mill waste sludge and clinoptilolite as soil additives for pepper cultivation

Authors

Kosmidis Stavros (stauros_kosmidis@hotmail.com) presenting author (TEI of Peloponnese, Department of Agricultural Technology)
Doula Maria (mdoula@otenet.gr) (Benaki Phytopathological Institute)
Assimakopoulou Anna (assimakopoulou.a@gmail.com) (TEI of Peloponnese, Department of Agricultural Technology)
Troyanos Yerasimos (y.troyanos@bpi.gr) (Benaki Phytopathological Institute)
Papadopoulos Antonis (a.papadopoulos@bpi.gr) (Benaki Phytopathological Institute)
Kolovos Chronis (ch.kolovos@bpi.gr) (Benaki Phytopathological Institute)
Kostopoulos Panagiotis (panaggkost@windowslive.com) (Agricultural University of Athens)
Gounela Eleni (elenigou@hotmail.com) (Agricultural University of Athens)

Summary
Olive Mill Wastes (OMW) are still considered as a major problem in the Mediterranean region although many research works provide solutions for OMW treatment and production of clean or almost clean effluents that can be further used for irrigation or discharge. However, the issue that remains unanswered is the high cost for establishing such a treatment facility, which inhibits the adoption of these solutions. On the other hand, OMW distribution on soil, under specific conditions and restrictions still seems to be an advantageous choice, considering that is a low cost method, it recycles nutrients on soil and returns organic carbon in soil, and is considered, therefore, as a practice that contribute to climate change mitigation. Distribution of Olive Mill Wastewater on soil and exploitation for irrigation purposes have been extensively studied during the past years and it is believed that such practices could provide a sustainable alternative methodology for OMW management, supposed that all appropriate measures will be taken to avoid soil degradation. The aim of this study was to investigate the potential of using the natural zeolite, namely clinoptilolite, as soil additive in order to make the addition of olive mill waste sludge more favorable for vegetable cultivation and eliminating the risk for soil and underground water degradation. For this reason, a pot experiment was conducted under greenhouse conditions during which pepper seedlings were transplanted and grown onto different substrates containing combinations of 0, 2.5%, and 5.0% zeolite and 0%, 2.5% and 5.0% of OMW sludge (v/v). Each treatment was composed of 12 replicates arranged in a split-plot design using zeolite as the main treatment. Plants were irrigated twice a week while leachates were collected at a weekly basis. Leachates were further analyzed for electrical conductivity, pH, Cl-, Na, K, polyphenols, Cu, Zn, Mn, and Fe while the results were associated with the risk for soil and groundwater degradation.

Influence of spreading olive-mill wastewater on earthworm survival and growth

Authors
Chalkia Christina (Christinachalkia@outlook.com) presenting author (Agricultural University of Athens. Lab. of Agr. Zoology and Entomology)
Vavoulidou Evangelia (lia.vavoul@nagref.gr) (ELGO DEMETER, Soil Science Institute of Athens.)
Koubouris George (koubouris@nagref-cha.gr) (ELGO DEMETER, Institute of Olive Tree, Subtropical Plants and Viticulture)
Chatzipavlidis Iordanis (chatzipavlidis@aua.gr) (Agricultural University of Athens. Lab. of General & Agricultural Microbiology)
Kalaitzaki Argyro (akalaitzaki@nagref-cha.gr) (ELGO DEMETER, Institute of Olive Tree, Subtropical Plants and Viticulture)

Perdikis Dionyssios (dperdikis@aua.gr) (1. Agricultural University of Athens. Lab. of Agr. Zoology and Entomology)

Summary

The potential side-effects of the application of olive-mill wastewater (OMW) on the earthworm Octodrilus complanatus, an anecic species widely distributed in Greece, was investigated. To achieve this, the survival rate and the weight of the animals were monitored in treatments where the animals were reared with or without OMW application. Six adults or fully developed juvenile individuals were placed in a plastic box filled with 2.5kg of soil. The surface area of each box was 346.2 cm2. Each box was considered as one replicate. The boxes were kept in room temperature and air humidity. The OMW was applied on the surface of the soil of each box by spraying at two concentration levels, 40m3 and 80m3 per ha, according to the recommended dose from the Greek Ministry of Rural Development and Food. The animals were fed, twice a week, with chopped senescent leaves of wines, which were placed on the soil surface, since this is the recommended method for rearing the anecic earthworms. Records on the individual animal weight were taken a) in the beginning of the experiment, b) 28 days from trial initiation and c) 56 days from trial initiation. In total, four replicates (boxes) were used for each dose and the control at each time period. The individual animal weight in the initiation of the experiment measured 4.42g, 4.76g and 4.98g/earthworm in average for the treatments of 80m3/ha, 40m3/ha and the control, respectively. After 28 days, all the animals were alive, except of two, attributed to the control (death rate 8.33%). The individual weight increased during the first 28 days in all treatments and the control, although the animals avoided taking their food during the first period after the application of the OMW, a behavior that was more intense for the higher dose. The increase in weight was higher at the high dose (0.97g/earthworm in average), followed by the lower dose and the control (0.76g and 0.70g/individual, respectively). The above differences were not statistically significant (ANOVA, P>0.05). The longer interval of 56 days, yielded similar results. The mean weight difference was higher when 80m3/ha were applied and measured 1.12g, corresponding to 1.09 and 0.81g of the lower dose 40m3/ha and the control, respectively. The differences were not statistically significant. The respiratory activity of the soil was estimated with the aid of Birch and Friend apparatus and was found to fluctuate in a broad range (3.89, 0.95 and 0.57cm3O2/h/100g dry soil in average, for the treatments of 80, 40m3/ha and the control respectively. Overall, this laboratory study showed that soil application of OMW did not cause a significant adverse effect on the earthworm species studied.

Yield and quality of lettuce as related to hydroponic system and NaCl concentration in irrigation water

Authors

Tzerakis Konstantinos (tzerakis@nagref-cha.gr) presenting author (Hellenic Agricultural Organization “DEMETER” – Institute of Olive Tree, Subtropical Plants and Viticulture)

Michelakis Evangelos (michevangelo@hotmail.com) (Hellenic Agricultural Organization “DEMETER” – Institute of Olive Tree, Subtropical Plants and Viticulture)

Psarras Georgios (gpsarras@nagref-cha.gr) (Hellenic Agricultural Organization “DEMETER” – Institute of Olive Tree, Subtropical Plants and Viticulture)

Summary

The influence of NaCl concentration in the irrigation water on growth and quality, in terms of leaf nitrate content, of lettuce was studied. A winter and a spring lettuce cultivation was

performed in two consecutive experiments, using two closed-cycle hydroponic systems, the Deep Flow Technique (DFT) and the Nutrient Film Technique (NFT). A low (0.2 mmol/l) and a high (15 mmol/l) NaCl concentration were applied at the irrigation water entering into the system. During the experiments, pH and conductivity were corrected to maintain the initial levels. The results showed that the fresh marketable yield of lettuce in NFT was significantly higher, as compared to DFT during the spring experiment under low NaCl concentration, while the situation was reversed under high NaCl concentration. No significant differentiations in yield were observed during the winter cultivation. The positive effects of the NFT treatment under low NaCl conditions could be attributed to better aeration of the nutrient solution (NS), as compared to DFT. During the winter experiment, leaf nitrate content (LNC) of lettuce increased slightly in NFT while in DFT remained stable until harvest. The respective concentrations in NS were increasing for DFT system probably due to lower NO3 uptake concentration. The treatments with high NaCl concentration had nearly the same behavior during the winter experiment. In the spring experiment, and for high NaCl treatment, LNC at the harvest stage was significantly reduced, as compared to low NaCl treatment, for the NFT system. This was attributed to the very low nitrate concentration in the NS during the last week of cultivation, due to limitations of the EC correction procedure, arising from the excessively increased conductivity of the recycling NS. In the case of the DFT system, the LNC almost doubled during the experiment, regardless of the NaCl treatment. However, in all cases the LNC at harvest did not exceed the established safety limits (4500 mg/kg FW). The above mentioned data provide useful information on selecting the appropriate cultivation system depending on the quality of the available water and the timing of cultivation.

Effect of temperature on Phelipanche Ramosa Pomel parasitism on tomato crop

Authors
Tarantino Emanuele (emanuele.tarantino@unifg.it) corresponding author (University di Foggia)

Summary
The Phelipanche ramosa, also known as Orobanche ramosa L., is the crhrolopyll-lacking root parasite of many dicotyledonous species. It cause severe damage to vegetable in the field, especially in the semiarid regions of the world (Linke et al., 1989). Seeds, of the parasitic weeds like P. ramosa, have to undergo two processes before they will germinate in response to germination stimulants. These processes are after-ripening and conditioning. After-ripening occurs in dry seeds and, within the population, the progress of dormancy loss is predictable as a function of temperature. The rate of after-ripening increases with increase in temperature, but the temperature range over which the process can take place is limited by the ability of imbibed seed to survive at high temperatures. So the optimum is around 20 °C in Orobanche. During conditioning, seed became increasingly sensitive to germination stimulants (Joe et al., 1991; Matusova et al., 2004) over period of up to about 14 days. This period decreasing with increase in temperature. Simulations using CLIMEX software indicated a potential suitability of climatic conditions for Orobanche establishment in large areas with Mediterranean and tropical climate (Sauerborn and Grenz, 2005). Particularly in Southern Italy, temperature increases are expected and even more frequent extreme events, both in terms of temperature and precipitation, are particularly significant and growing trends in the occurrence of heat waves and periods of dryness (dry spell) as well as a predictive decrease in late frosts (Acutis

and Ventrella, 2005). This study was made to asses if two different tomato transplanting dates (early and later crop cycle) affect the P. ramosa infestation on the field crops. The study, indirectly related the temperature effect of Phelipanche parasitism. The results show that the infection level was reduced on later crop, probably as a result of unfavorable developmental conditions for Phelipanche under different temperatures. Too much anticipated tomato seedling transplants do not allow rapid development of the crop, favoring the infamous competitive action of P. ramosa. Therefore, the choice of the transplant time can have a significant influence on the competitive relationships between tomato crop and Phelipanche ramosa parasite. References - Acutis M., Ventrella D., 2015. L'acqua, l'agricoltura e il clima che cambia. In. L'acqua in agricoltura. Edagricole, 43-63. - Linke K.H., Saxena M.C., 1989. Study on viability and longevity of Orobanche seed under laboratory conditions. In: Progress in Orobanche research (Eds. Wegmann K., Musselman L.J.), Eberhard-Karls_Universitat, Tubingen, FRG, 110-114. - Joel D.M., Back A., Kleifeld Y., Gepstein S., 1991. "Seed conditioning and its role in Orobancheseed germination: inhibition by paclobutrazol," in Progress in Orobanche Research. Proceedings of the International Workshop on Orobanche Research, eds Wegmann K., Musselman L. J., editors. (Obermarchtal, FRG: Eberhard Karls Universität;), 147–156. - Matusova R., van Mourik T., Bouwmeester H.J., 2004. Changes in the sensitivity of parasitic weed seeds to germination stimulants. Seed Sci Res 14:335–344. - Sauerborn J. and Grenz J.H., 2005. Potential distribution of Orobanche under current and predicted future climate. COST Action, 849, Parasitic Plant Management in Sustainable Agriculture. WG1+4 Workshop on Means for limiting Orobanche propagation and dispersal in agricultural fields. 4-6 Dicember 2005, Newe-Years Research center, Israel.

Physiological comparative study of halophytes and glicophyte plants for adaptation to Mediterranean salinity coastal areas

Authors
Agudelo Agatha (Agatha.Agudelo@sakata.eu) presenting author (Sakata Seed Iberica)
Chelbi Najla (najla.chelbi.85@gmail.com) (Laboratory of Extremophile Plants, Center of Biotechnology)
Martinez-Ballesta M. Carmen (mballesta@cebas.csic.es) (Grupo de Aquaporinas, Departamento de Nutrición Vegetal. CEBAS-(CSIC))
Rios Juan J. (jjrios@cebas.csic.es) (Grupo de Aquaporinas, Departamento de Nutrición Vegetal. CEBAS-(CSIC))
Carvajal Alcaraz Micaela (mcarvaja@cebas.csic.es) corresponding author (Grupo de Aquaporinas, Departamento de Nutrición Vegetal. CEBAS-(CSIC))

Summary
During the last few decades a need for salt tolerant crops appeared as substantial percentages of cultivated land worldwide are affected by salinity. The prospect is that fresh water for irrigation is becoming scarce as a result of higher demanding. One of the main areas in Europe suffering from increasing salinity is the Southeast Spanish Mediterranean area. In this work, the comparative study of different crops differing in salinity tolerance has been carried out. The crops were Brassica napus (medium tolerant), Cakile maritima (highly tolerant), Salicornia fruticosa (Na+ includer-halophyte) and Atriplex halimus (Na+ excluder-halophyte) that were grown in 0,100, 200, 300 mM NaCl in hydroponic culture. The comparative results

of growth with the different range of salinity fitted with the expected. Between halophytes, Atriplex showed lower affinity to salinity than Salicornia. Catalase activity and water relations reported high stress conditions of both halophytes under 0 mM NaCl than for glycophytes under 300 mM NaCl. The metabolic analyses showed that putative industrial application can be implemented for both halophytes.

Fingerprinting of Olive (Olea europaea L.) germplasm in Tunisian national collection by using Simple Sequence Repeat markers

Authors
Souabni Hana (souabni.hana@gmail.com) presenting author (Institut de l'Olivier)
Saddoud-Debbabi Olfa (olfa.lf@gmail.com) (National Gene Bank of Tunisia)
Fendri Mahdi (fendrimahdi@yahoo.fr) (Institut de l'Olivier)
Triki Mohamed Ali (trikimali@yahoo.fr) (Institut de l'Olivier)
Ben Amar Fathi (fathibenamar@yahoo.fr) (Institut de l'Olivier)

Summary
Conservation of autochthonous olive cultivars is priority in Tunisia while it represents a secondary center of diversity and one of the most economically important crop. This study aims to the preservation of olive genetic resources belonging to National olive germplasm collection located in the south of Tunisia. A total of 22 accessions were fingerprinting by using a set of six Simple Sequence Repeat markers (SSR). These markers allowed the genotyping and the study of the genetic diversity of varieties. The total number of alleles is 50 and varied from 3 to 13 alleles. The total number of genotypes is 57 and varied from 3 to 14genotypes.Data recorded were submitted to different statistical analyses . The polymorphism information content (PIC) varied from 0.44 to 0.87 with a mean of 0.72. The parameters of Wright's subdivisions allowed to conclude that the intra population heterozygosity is higher than the inter population heterozygosity. The genetic distances between individuals allowed to make UPGMA classification. DICE coefficient ranged from 0.00 to 0.92 with a mean of 0.38. The Dendrogram classified the 22 studied cultivars into two major clusters. Based on multilocus genotypes, it was possible to draw an identification key discriminating all the varieties studied. We assume the power of the microsatellite markers and the richness of our local germplasm in Tunisia.

Allelopathic effects of Acacia saligna (Labill.) Wendl. and Cupressus sempervirens L. on germination and seedling growth of alfalfa in arid Mediterranean lands

Authors

JEDDI Kaouthar (kaoutharjeddi@yahoo.fr) presenting author (Faculty of Sciences of Sfax- Tunisia)
MNIF Lobna (mniflobna@yahoo.fr) (Faculty of Sciences of Sfax- Tunisia)
CHAIEB Mohamed (mchaieb133@gmail.com) (Faculty of Sciences of Sfax- Tunisia)

Summary
The allelopathic effects of some introduced multipurpose trees in arid Mediterranean agricultural ecosystems present a risk or disadvantage to the growth of associated crops. In this study, the allelopathic potential of Acacia saligna (Labill.) Wendl. and Cupressus sempervirens L. was evaluated based on germination and early seedling growth of alfalfa (Medicago sativa L.) in a laboratory bioassay. Aqueous leaf extracts were applied at 0, 5, 10, 15 and 20%. Seed germination of alfalfa was inhibited when treated with all aqueous extracts and the degree of inhibition was higher when using the extract with the highest concentration. The inhibition was more pronounced in seedling growth. Hypocotyl and radicle lengths decreased and their reduction extents by Acacia leaf extracts were greater than those by Cupressus leaf extracts. The results from this study highlight the importance of allelopathy of Acacia saligna and Cupressus sempervirens as a mechanism for controlling seed germination and seedling growth of some associated economic crops. It's suggested that careful planning needs to be undertaken before using these tree species in any integrated land use systems. However, further studies are still required to determine responsible phytochemicals and to better understand the response of the target species to allelopathic effects under natural habitats.

Reducing the impact of drought by potassium application in olive trees (Olea europaea L.)

Authors
Dbara Soumaya (soumayadbara@yahoo.fr) presenting author (Regional center of horticulture and organic farming / Olive tree Institute)
Abboud Samia (samia_abd@hotmail.fr) (Higher agronomic institute chott mariem)

Summary
For confronting the water scarcity various solutions were adopted particularly the regulated deficit irrigation. Despite its benefits this technique needs the good knowing of tolerant stages which affected by the climate change ie the blooming perturbation. In another way, it is known that potassium away from its action on fruit quality, it is involved in physiological processes by reducing transpiration and therefore maintains the cell turgor. This last feature was being exploited to our research objective. The present study aims the increase of water use efficiency in olive tree. The experiment consisted on the combination of the regulated deficit irrigation (RDI) and the potassium application. This is has been achieved in an olive orchard seven years old in the region of Sidi Bouzid located on the centre of Tunisia. Potassium treatments were 0%, 50%, 100% and 200% of olive tree needs and each one of them was subject to two water regimes (50%ETC and 100%ETC). The main results given that the 50%ETC irrigation regime combined with 50%, 100% and 200% potassium treatment slightly improved the water use efficiency. With these treatments the average yield was ameliorated. Also the oil content of olive was also increased. Keywords: Olive – regulated deficit irrigation, potassium, yield, water use efficiency.

LIFE oLIVECLIMA partners

Conference Sponsors


ΤΡΑΠΕΖΑ ΠΕΙΡΑΙΩΣ


YARA


Knowledge grows


SCIENTACT A.E.
www.scientact.com.gr
Astrikas Estate
BIOLEA


terra creta


digital print shop
Πέτρος Μαστοράκης


agrotypos.gr
Περιοδικό
Γεωργία
ΚΤΗΝΟΤΡΟΦΙΑ


FlashNews.gr
Οι e-ιδήσεις στην Κρήτη την ώρα που συμβαίνουν!


skywalker
GR


Olive
news


HELLENIC REPUBLIC
Ministry of Rural Development
and Food


MINISTRY OF
ENVIRONMENT
& ENERGY


GEOTECHNICAL
CHAMBER
OF GREECE


ΣΕΔΗΚ


HELLENIC REPUBLIC
REGION OF CRETE


ΠΕΡΙΦΕΡΕΙΑ ΚΡΗΤΗΣ
ΠΕΡΙΦΕΡΕΙΑΚΗ ΕΝΟΤΗΤΑ ΧΑΝΙΩΝ


ΔΗΜΟΣ
ΧΑΝΙΩΝ
MUNICIPALITY OF
CHANIA - CRETE


Δήμος Ρεθύμνης


ΔΗΜΟΣ
ΗΡΑΚΛΕΙΟΥ


ΔΗΜΟΣ
ΑΓΙΟΥ ΝΙΚΟΛΑΟΥ


ΔΗΜΟΣ ΠΛΑΤΑΝΙΑ
MUNICIPALITY of PLATANIAS


ΔΗΜΟΣΚΙΣΣΑΜΟΥ