EUROPEAN WEED RESEARCH SOCIETY

Europäische Gesellschaft für Herbologie • Société Européenne de Malherbologie

JOINT WORKSHOP OF THE EWRS WORKING GROUPS:

NOVEL AND SUSTAINABLE WEED MANAGEMENT IN ARID AND SEMI-ARID AGRO ECOSYSTEMS AND WEED MAPPING

Organized by

European Weed Research Society

Agricultural University of Athens

BOOK OF ABSTRACTS

Edited by

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Published by

Agricultural University of Athens

Sponsored by

HELLENIC REPUBLIC

Ministry of Rural Development and Food

MAKHTESHIM A G A N

ΑΛΦΑ ΓΕΩΡΓΙΚΑ ΕΦΟΔΙΑ ΑΕΒΕ

ELKE- AUA

29 September - 03 October 2013

Mediterranean Agronomic Institute of Chania Crete, Greece

Local organiser:

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Session Organizers:

Weed mapping

Moderators: Salonen J and Stefanic E

Parasitic weeds

Moderators: Goldwasser Y and Acar O

Herbicide Resistance

Moderators: Kotoula E and Nemli Y

Weed Biology

Moderators: Yaacoby T and Uludag A

Weed Mapping Round Table

Moderators: Kraehmer H, Kalivas D, Streibig J, Eizenberg H

Weed Management

Moderators: Vrbnicanin S and Mennan H

Poster session

Moderators: Economou G and Eizenberg H

Administrative Organization:
Conference Center of Mediterranean Agronomic Institute of Chania

Book of Abstracts published by
Agricultural University of Athens

PREFACE

Welcome to the "Joint Workshop of the EWRS Working Groups: Novel and Sustainable Weed Management in Arid and Semi Arid Agroecosystems and Weed Mapping", in the beautiful city of Chania, in the hospitable region of Crete, the southern part of Europe.

We gathered here in Mediterranean Agronomic Institute of Chania (MAICh), to enjoy the unique experience of sharing scientific knowledge and collegial interactions among scientists, with the common interest to increase the rate of progress in the two important sectors for weed science; "the sustainable weed management in the fragile environment of arid and semi arid regions" and "weed mapping".

The idea of the Joint Workshop was not a temporal approach but the result of a matured thought on behalf of the two working groups for interactive process. Actually, the aims and the tasks of the two WGs in addition to their parallel scientific paths often meet, interact positively and generate ideas and solutions for an effective weed control with environmental point of view.

In the region of the Mediterranean basin, at the crossroads of climate change, particularly for those regions which are located in the center of these changes and subjected by the dramatic reduction of water resources, the need to enforce the crops in terms to the competitive superiority of weeds obtains a prominent role. Despite the advances in biology, ecology, physiology and plant protection, weeds continue to keep their competitive advantage in such a way that unanswered questions seek answers. On this account, we decided to share ideas around the current status of climatic changes on the weed distribution in order to understand their dynamic role in agroecosystems. The questions, the challenges and the goals will be put into consideration.

The scientific program contains keynote addresses, invited lectures, plenary presentations, a round table, poster presentations, a field excursion to meet with the good practice in improving the weed management and environmental performance in the olive oil sector, as well special social activities. Enjoy your participation in the MAICh conference centre and your stay in the hospitable Chania.

The organizers:

EWRS Working Groups
"Novel and Sustainable Weed Management in Arid and Semi Arid Agroecosystems"
"Weed Mapping"

Agricultural University of Athens

Scientific Program

September 29 – October 3, 2013

Oral conference sessions will take place in auditorium **ARISTOTLE**

Poster session at room **THALES**

Sunday, September 29th

18:00-19:00 Arrival and registration at the Conference Center Office of MAICh

18:00- 19:00 Poster mounting

19:00-21:00 Welcome reception in MAICh at the restaurant "Méditerranée"

Registration desk will be open throughout the day.

Monday, September 30th

Opening Ceremony

07:30-08:30 Registration at the Conference Center Office of MAICh

Moderator B. Rubin and G. Economou

08:30-09:20 Welcome address:

Prof. B. Rubin, Chairman of the Scientific Committee and the working group of novel and sustainable weed management in arid and semi-arid agroecosystems.

Prof. Garifalia Economou, Chairman of the Organizing Committee and the working group of weeds mapping.

Greetings

Mr. Stavros Arnaoutakis, Governor of Crete Region

Dr. George Baourakis, Director of MAICH

09:20-09:50 (1) (*Keynote address*) Water management and crop/weed interactions under a changing climate in the Mediterranean basin. A. Karamanos.Greece.

09:50-10:20 (2) (*Keynote address*) Weed mapping as a tool for control of weed resistance and invasive species: Experience from Nebraska. S. Knezevic. USA.

10:20-10:30 Discussion

10:30-11:00 ***Coffee break***

Poster session

11:00-12:30 Poster observation

12:30-14:00 Lunch

Weed mapping

Moderators **Salonen J and Stefanic E**

14:00-14:30 (3) (*Keynote address*) Where do weed maps lead us? H. Kraehmer. Germany

14:30-14:50 (4) (*Invited lecture*) Parasitic weed mapping to improve management: the case of broomrape in tomato crops. Y. Cohen, I. Roei, H. Eizenberg. Israel

14:50 -15:05 (5) An interactive web-based application for weed resistance mapping. S. Panozzo, M. Colauzzi, L. Scarabel, A. Collavo, V. Rosan, M. Sattin. Italy.

15:05-15:20 (6) Weed mapping in Finland – information from field to web. J. Salonen, M. Kolářová, P. Hamouz, J. Soukup. Finland.

15:20-15:35 (7) The Weed Science Society of Israel Weed Mapping Project. Y. Goldwasser, Israel.

15:35-16:05 *Coffee break*

16:05-16:20 (8) Are results obtained by different sampling methods comparable? M. Kolarova, E. Stefanic, J. Soukup. Czech Republic and Croatia.

16:20-16:35 (9) Weed mapping as a tool for developing an economical and environmentally friendly weed management practice in cotton. G. Shalev, H. Eizenberg, B. Rubin. Israel.

16:35-16:50 (10) Weed mapping using high resolution imaging from a tetracopter drone. V. Alchanatis, C. Shenderey, S. Katsman, Y. Cohen, S. Meital, G. Shalev, B. Rubin, H. Eizenberg. Israel.

16:50-17:05 (11) Weed patchiness, providing the necessary data for a potential site-specific weed management. G. Economou, D. Kalivas, I. Thomopoulos, V. Kotoulas. Greece.

17:05-17:20 (12) Weed survey project in Latvia. I. Vanaga, Z. Mintale. Latvia.

17:20-17:30 Discussion

20:00 Dinner

Tuesday, October 1st

Parasitic weeds

Moderators: Goldwasser Y and Acar O

08:30-09:00 (13) (*Keynote address*) Advanced technologies for tempo-spatial modeling of broomrapes (*Orobanche* and *Phelipanche* spp.) and herbicides application, H. Eizenberg. Israel

09:00-09:15 (14) Aspects of glyphosate mechanism in Egyptian broomrape control. T. Shilo, S. Wolf, B. Rubin, H. Eizenberg. Israel

09:15-09:30 (15) Effects of salt stress (NaCl) and broomrape (*Phelipanche aegyptiaca*) on superoxide dismutase and peroxidase activities of two tomatoes varieties. B. Şen, O. Acar. Turkey

09:30-09:45 (16) Variation in response of a resistant sunflower cultivar to *Phelipanche aegyptiaca* and *Orobanche cumana*. O. Ben David, B. Rubin, H. Eizenberg. Israel

09:45-10:00 (17) (*Invited*) Development of molecular markers based on ITS and rbcL genes to identify and distinguish between broomrape species in a soil sample. R. Aly, A. Londner, M. Kocherman, J. Abu-Nassar, I. Saadi, H. Eizenberg. Israel

10:00-10:15 (18) Modeling imazapic movement applied by drip irrigation to maximize broomrape control. O. Rabinovitz, Y. Goldwasser, Z. Gerstl, A. Nasser, N. Lazarovitch, G. Aryeh, A. Paporisch, B. Rubin. Israel

10:15-10:30 Discussion

10:30-11:00 ***Coffee break***

Resistance

Moderators: Kotoula E and Nemli Y

11:00-11:15 (19) Proposed glyphosate resistance mechanism in *Conyza bonariensis*. Z. Kleinman, B. Rubin. Israel

11:15-11:30 (20) Absorption and translocation of C^{14}-glyphosate in the glyphosate resistant *Conyza sumatrensis* under two different temperature regimes. F. González-Torralva, J.A. Domínguez-Valenzuela, R. De Prado. Spain.

11:30-11:45 (21) New and dangerous evolution of ALS-resistant Brassicaceae weed species. M. Matzrafi, B. Rubin. Israel.

11:45-12:00 (22) Screening for glyphosate-resistant *Conyza* spp. in Greece and mechanism of resistance. D. Chachalis, E. Tani, I.S. Travlos, R.D. Sammons. Greece

12:00-12:15 (23) BrIFAR: A comprehensive resource for functional characterization of herbicide resistance mechanism in grass weeds. M. Matzrafi, Y. Gadri, B. Rubin, Z. Peleg. Israel

12:15-12:30 Discussion

12:30-14:00 ***Lunch***

Weed Biology

Moderators: Yaacoby T and Uludag A

14:00-14:30 (24) (Keynote address) Weed research in Serbia. Sava Vrbnicanin, Serbia.

14:30-14:45 (25) Effects of cover crops and their residues on weed suppression and subsequent composite cross populations of maize in organic cropping system. N. Nol, G. Bocci, A.C. Moonen, P. Bàrberi. Italy

14:45-15:00 (26) Cover crops as a tool for prevention of soil erosion and weed management in potatoes. E. Hayut, Y. Goldwasser, G. Eshel, B. Rubin. Israel

15:00-15:15 (27) An analytical approach to evaluate the effect of imported outdoor ornamentals on flora in turkey. İ. Üremiş, Y.E. Ertürk, A. Uludağ. Turkey

15:15-15:30 (28) Distribution and control of *Ambrosia* spp. (Ragweed) in Israel. Y. Yair, Y. Mekori, M. Sibony, A. Goldberg, E. Shahar, and B. Rubin. Israel

15:30-15:45 (29) Seedling emergence of *Echinochloa crus-galli* affected by soil depth. A. Taab, M. Sadeghi. Iran

15:45-16:00 (30) Investigation of using cover crops in weed control on Kiwi orchards in black sea region of Turkey. D. Isik, M. Dok, K. Ak, I. Macit, Z. Demir, H. Mennan. Turkey

16:00-16:15 Discussion

16:15-16:45 ***Coffee break***

16:45-18:00 **Weed Mapping Round Table**

Moderators: **Kraehmer H, Kalivas H, Streibig J, Eizenberg H**

Status of weeds distribution/rules for data collection and processing

Wednesday October 2nd program

Whole day

1. *Field excursion,*
2. *Visit to traditional oil-mill (http://www.biolea.gr/)*
3. Visit to Falassarna, one of the best-known beaches in the Chania Prefecture and indeed the whole of Crete, which attracts large numbers of tourists every summer. Nowadays Falassarna is a famous Cretan destination, thanks to its beaches and also its ecological interest. Falassarna is part of the Natura 2000 network, both due to its variety of flora and fauna and as an area of outstanding natural beauty.
4. ***Gala dinner***

Thursday October 3rd

Weed Management

Moderators: Vrbnicanin S and Mennan H

08:30-09:00 (31) (Keynote address) The benefits of using a pre-emergence herbicide (pendimethalin) for weed control in crops of Southern Europe. E. Marinan-Arroyuelo, A. Marchi, F. Marchal-Rubio, C. Bozoglou. F. Servis, C.N. Giannopolitis. Greece

09:00-09:15 (32) Relative tolerance of weedy sunflower to nicosulfuron applications. S. Vrbnicanin, D. Bozic, M. Saric-Krsmanovic, D. Stojicevic. Serbia

09:15-09:30 (33) Sensitivity of different *Zea mays* (shrunken endosperm type) cultivars to the herbicide foramsulfuron. A. Paporisch, T. Weinberg, B. Rubin. Israel

09:30-09:45 (34) Molecular techniques for discrimination of *Echinochloa oryzicola* and *Echinochloa oryzoides* species and their distribution in Turkish rice production areas. H. Mennan, E. Kaya-Altop. Turkey

09:45-10:00 (35) Some thoughts on strategies for management of *Solanum elaeagnifolium*. C.E. Bell. USA

10:00-10:15 (36) The possible impact of a 2°C air temperature increase on the weed flora and an arable crop in Greece. D.S. Voloudakis, V.E. Kotoulas, C. Vlachos, G. Economou. Greece

10:15-10:30 (37) Creation of national program to manage *Ambrosia confertiflora* in Israel. T. Yaacoby, J.M. Dufour-Dror, A. Zask, D, Milstein, A. Uzan. Israel

10:30-11:00 *Coffee Break*

Poster session

Moderators: Economou G and Eizenberg H

11:00-12:30 Poster observation and discussion

12:30-14:00 ***Lunch***

Weed Management

14:00-14:15 (38) Imazapyr is a best solution for non-selective management of *Ambrosia confertiflora* in Israel. T. Yaacoby, J.M. Dufour-Dror. Israel

14:15-14:30 (39) The vegetation in archaeological sites. An approach of integrated weed management to protect the historical landscape - Thalis project. I. Kanellou, D. Lyra, S. Knezevic, G. Economou and M. Papafotiou, Greece

14:30-14:45 (40) The effect of a long-term irrigation with treated wastewater on the fate of ALS inhibiting herbicide in the soil. G. Dvorkin, M. Sibony, B. Chefetz, B. Rubin. Israel

14:45-15:00 (41) The usage of PELMO model to estimate the influence of the climate change on the pollution of the groundwater: The case for terbuthylazine. S. Vizantinopoulos. Greece

15:00-15:15 Discussion

15:15-15:45 ***Coffee break*** (Posters collection)

15:45-17:00 Working group discussion and conclusion

17:00-17:30 Closing Ceremony: Moderators: Prof. B. Rubin and Prof. G. Economou

20:00 Dinner (Event in honor of Prof. Rubin retirement)

Posters

(42) Phytotoxicity of a medicinal plant, *Hypericum perforatum* against grass and broadleaf weeds of faba bean (*Vicia faba*) and its potential use as natural herbicide. I.S. Travlos, G. Economou, P. Kanatas, A. Gatos. Greece

(43) Study of hydrolysate and emulsion bioactivity of two *Origanum onites* biotypes on *Avena sterilis*, *Echinochloa crus-galli* and *Amaranthus retroflexus* seeds. A. Kamini, D. Lyra, E. Gavriil, I. Travlos, P. Tarandilis, G. Economou. Greece

(44) The effect of some cultivated plants root exudates and green manures on the germination and growth stages of *Sinapis alba* L. (White mustard). Ö. G. Dişli, Y. Nemli. Turkey

(45) Investigation of the effect of thyme oil on germination of some crops and weed species. Y. Sokat, K. Kaçan. Turkey

(46) *Oxalis pes-caprae* plant extract reduces negative effects of aflatoxin B1 on oxidative stress and inflammation in swine blood. D. Marin, M. Gras, E. Weiss, P. Kefalas, I. Țaranu, V.S. Chedea. Romania and Greece

(47) Cloning and sequencing of virus inhibiting gene encoding an antiviral protein from the leaves of pokeweed (*Phytolacca americana* L.). H.M. Sipahioglu, I. Kaya Yagmur, M. Usta, S. Samsun. Turkey

(48) Habitat suitability and spectral heterogeneity models. C. Fotiou, J. Dalmayne, K. Hall. Sweden

(49) Breaking dormancy at seeds of *Cuscuta approximata* Bab. R. Yergin Özkan, D. Işık, Tepe, Turkey

(50) Determination of the frequencies and densities of broomrape and other weed species occurring in field tomato, sunflower and tobacco fields in Denizli Province of Turkey. Ö. Boz., M.N. Doğan, D. Öğüt Yavuz. Turkey

(51) Mowing as a key method against herbicide-resistant weeds. I.S. Travlos, J. Costa I. Brants, D. Chachalis. Greece

(52) Comparison of the germination biology and growth stage of resistant and sensitive wild oats (*Avena sterilis* L.) to ACCase inhibitor herbicides. P. Molaei, Y. Nemli. Turkey

(53) Genetic variation and phonological characteristics of ACCase inhibitor resistant and sensitive populations of *Avena sterilis* L. P. Molaei, Y. Nemli. Turkey

(54) First report on herbicides resistance of wild oat (*Avena fatua* L.) in Turkey. S. Türkseven, Y. Nemli. Turkey

(55) Detection and degradation of linuron in soils and its uptake by carrots. A. Alev Burçak, E. Cönger M. Selçuk Başaran, A.T. Serim. Turkey

(56) Determination of the effect of nitrogen on critical period for weed control in cotton (*Gossypium hirsutum* L.). N. Tursun, E. Tunçel. Turkey

(57) Determination of weed emergence in sunflower. K. Kaçan, N. Tursun, A. Uludağ. Turkey

(58) Weed seed bank as affected by weed and crop management. S. Babaei, P. Hosseini, H. Karimi H., H. Alizadeh, H. Rahimian. Iran

(59) Studies on the interaction of seed vigor with weed competition. D. Chachalis, E. I. Khah, P. Georgiadi and P. Terzopoulos. Greece

(60) Seedling emergence of *Convolvulus arvensis* affected by moisture regimes and soil depths. A. Taab, A. Sangin Abadi. Iran

(61) Physical, cultural and chemical weed control in direct seeded rice (*Oryza sativa* L.). K. Jabran, M.I. Tabassum, M. Ehsanullah, N. Dogan. Turkey

(62) Soil-applied herbicides for weed control in chickpea (*Cicer arietinum* L.) under a dryland cropping system. T.K. Gitsopoulos, C.A. Damalas, I. Georgoulas. Greece

(63) Weed Science Society of Greece (WSSG): actions and collaborations. D. Chachalis, A. Afentouli, I. Travlos, A. Kazantzidou, G. Economou, S. Zannopoulos, T. Gitsopoulos. Greece

(64) Determination of the effect of different additives on the performance of 2,4-D amine. D. Öğüt-Yavuz, Ö. Boz, M.N. Doğan. Turkey

(65) The sensitivity of some sunflower cultivars to residue of mesosulfuron methyl + iodosulfuron methyl sodium under growth chamber conditions. A.T. Serim, S. Maden. Turkey

(66) Field studies to control the invasive weed species *Euphorbia heterophylla* in cotton. D. Chachalis, I.S. Travlos. Greece

(67) Investigation of planting date, fertilizer and herbicide effects on Egyptian broomrape. M. G. Mohammadabadi, M. Bazoubandi, M. Ghorbani, M. Zafarian. Iran

(68) Investigation of planting date, manure, cultivar on Egyptian Broomrape. M. G. Mohammadabadi, M. Bazoubandi, M. Nasirpour, M. Zafarian. Iran

(69) Effects of sulfosulfuron, aclonifen, foramsulfuron and metribuzin herbicides on tomato production (*Lycopersicon esculentum* L.). M. G. Mohammadabadi, M. A. Mehdi Nasirpour, M. Zafarian. Iran

(70) Effectiveness and selectivity of herbicides in stevia. P. Lolas, S.P. Souipas. Greece

(1) Water management and crop-weed interactions under a changing climate in the Mediterranean basin

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All climate change scenarios predict significant alterations in the major climatic variables near the tropics and in the Mediterranean basin within the coming decades. According to moderate predictions for Greece, by the end of this century CO_2-concentration will increase by 63-125%, air temperature by 3-4^{o}C, solar irradiance by 2.3-4.5 W m^{-2}, whereas precipitation will be reduced by 5-19% followed by an increase in potential evaporation at the same time. Such changes will inevitably affect the physiology, growth and development of both crops and weeds to a different extent depending on their carbon assimilation path, thermal requirements and drought resistance with an overall alteration in crop-weed interactions. A recent study in Greece has predicted 0-20% increases and 0-20% decreases in the productivity of warm-season and cool-season crops respectively with the more negative effects located in the driest parts of the country. The interactions between crops and weeds are discussed on the basis of crop physiology principles and research findings. Special attention will be paid on the adopted irrigation techniques with emphasis on deficit irrigation, a technique suitable for areas where water is a limiting factor.

(2) Weed mapping as a tool for control of weed resistance and invasive species: experience from Nebraska

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Weed mapping is an important component of an integrated weed management program. Examples of how weed maps are being utilized for the control of weed resistance and invasive species in the USA will be discussed. Managing weeds in Midwestern crops of the USA is becoming challenging due to the increase in weed resistance. In addition to the "old" type of resistance (triazine, and ALS), there are "new" resistance types emerging, which includes HPPD, PPO, 2,4D and glyphosate resistance. There are 12 weed species that have developed resistance to glyphosate due to the repeated use of glyphosate based products in widely spread Roundup- Ready crops (corn, soybean, cotton), which are grown on almost 100 million hectares. For example, in Nebraska we confirmed glyphosate resistance in four weed species: marestail *(Conyza canadensis)*, waterhemp (*Amaranthus tuberculatus syn. rudis*), giant ragweed (*Ambrosia trifida*) and Kochia (*Kochia scoparia*). Maps of disturbance of various weed resistance types will be presented and discussed. In addition, various mapping tools (GIS and GSP) are also utilized for developing weed management programs for the control of invasive species in non-crop areas such as rangeland, pasture, and wetlands. The introduction and spread of invasive plant species is one of the most serious threats to biodiversity. Purple loosestrife (*Lythrum salicaria*) is one such species that is currently invading wetlands and waterways in mid-Western states, including an estimated 12,000 acres in Nebraska. Examples of how purple loosestrife distribution maps were utilized for developing weed management programs will be discussed.

(3) **Where do weed maps lead us?**

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Weed maps represent science based information on the occurrence of plants or vegetation interfering with the interests of people. The distribution of weeds can be represented in different ways such as point-raster-maps, chloropleth maps or ARCGIS based maps with built in diagrams for example. Every map visualizes limited information. Most national weed surveys are based on the relative frequencies of weeds. This is why the first maps for the EWRS Weed Mapping Working Group try to represent frequencies of weeds instead of just an occurrence indicated by points. Global maps allow a synopsis of similar weed associations. These maps provide information different from catalogues of plant associations. Global catalogues of weed associations do not exist yet. They are primarily restricted to Europe. These catalogues do not contain information on the proportion of weeds within a syntaxonomic group. My contribution to the workshop will demonstrate that typical weed patterns can be documented and visualized globally. They demonstrate that crop cultivation and climate lead to very similar weed constellations in very different areas of the world. They also proof that weeds adapted to a wide range of environmental conditions are dominating on every continent. Specialists seem to be doomed to fail.

(4) **Parasitic weed mapping to improve management: the case of broomrape in tomato crops**

[1]Cohen Y., [1,2]I. Roei and [3]H. Eizenberg

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Broomrapes are parasitic weeds that cause severe damage to field crops. A regional survey was conducted to collect the history of 97 tomato fields to investigate the major factors that affect the infection of tomatoes by broomrape, over a two year period. In addition, broomrape infection levels were intensively mapped (40 samples/ha) in 29 tomato fields. Data from the intensively mapped fields were interpolated to characterize the spatial patterns of infection, and to postulate relationships with field histories. Chi-tests based on the regional data showed that the history of broomrape infection and of a tomato crop in the crop rotation significantly increased the risk of infection. The interpolated maps of broomrape infection patterns revealed four major spatial patterns: directional, elongated and small clusters and random patterns. A spatial analysis indicated that the proximity of infected plots was a main contributor to the incidence of infection. In plots with low and medium infection severity or with no infection record, infection levels decreased with increasing distance from a neighboring infected plot, which could indicate that infected neighboring plots may serve as the initial infection sources for relatively new plots. The in-field variability explained by the proximity to infected plots may optimize sampling patterns for better estimations of the infection level. It would also enable a site-specific control strategy for alleviating broomrape damage and seed dispersal.

(5) An interactive web-based application for weed resistance mapping

[1]Panozzo S., [2]M. Colauzzi, [1]L. Scarabel, [1]A. Collavo, [1]V. Rosan and [1]M. Sattin

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The Italian herbicide resistance working group (GIRE) is an informal group which includes several stakeholders: public research, academia, advisors and agrochemical industry. The major goals of GIRE are to build and update resistance maps and efficiently communicate resistance management strategies improved cooperation and communication between public and private researchers as well as all involved stakeholders. To facilitate communication, GIRE created a website (www.resistenzaerbicidi.it) in 2009 that reports the updated situation of herbicide resistance in Italy (generally based on a complaint monitoring), resistance management guidelines, information on the main biological traits of the weeds involved and news. The daily no. of contacts is increasing constantly and has been over a hundred per day in the last three months. Among the most visited pages are those containing maps of the resistant cases. A web-based application was recently developed to facilitate the updating and visualization of the maps. In the previous system, the data were stored in Excel sheets and weed resistance maps were generated using ArcExplorer2 software. The generated maps were then transferred onto the website. This system was static, difficult to update, error-prone and soon became obsolete. With the new system, data are uploaded directly into an online database where every resistant weed population is represented by a string that includes all needed information (pop. code, municipality where the population was sampled, pattern of resistance tested in greenhouse experiments). At least four herbicides having different mode of action are usually included in the resistance tests. A drop-down hierarchical menu guides the users to generate the requested map by selecting the cropping system, weed species and type of resistance (e.g. ACCase resistance, ALS resistance). The complexity of the Italian situation where many resistant biotypes are diffuse in several cropping systems (i.e. 15 weed species are involved with different cases of resistance also including multiple resistant biotypes) led to the need for further improvement of the system by means of a dynamic approach. This is being implemented using a multiple flexible query, i.e. an "advanced search", which allows users to build any kind of map they wish by choosing the desired features such as weed species, cropping system and type(s) of resistance. With this approach maps of multiple resistant biotypes can also be generated. The interactive mapping system implemented in the GIRE website allows automatic, easy and frequent updating of the maps when new resistant cases are added to the database; it is also cheap because the maps are built using open source software tools. The maps, which are publicly accessible, now provide important and frequently updated

information for an efficient herbicide resistance management in Italy to all stakeholders, including policy- and decision-makers at national and regional level.

(6) Weed mapping in Finland – information from field to web

[1]Salonen J., [2]M. Kolářová, [2]P. Hamouz and [2]J. Soukup

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Weed surveys yield valuable information on weed populations both in terms of spatial and temporal variation. New knowledge from weed surveys is published in journals and proceedings for scientific purposes. Moreover, information is disseminated to authorities, extension service and farmers in various kinds of magazines and seminars. Efforts to bring weed occurrence data available for public eye via internet is currently going on in a WEED MAP co-operation. The WEED MAP software has been developed by the Geocentrum company in cooperation with the University of Life Sciences in Prague, CZ (Hamouz et al. 2011). The objective of the database is to collect, administrate and disseminate information on the occurrence of weeds and allow users in a web service to view maps of weed species distribution in selected countries and regions. So far, information from the Czech Republic has been included but a wider exploitation of software calls for a joint project in European countries. Recently, efforts to bring weed data and maps from Finland have been taken and the outcome will be presented in a workshop. Comprehensive national weed surveys in spring cereals have been carried out in four decades in Finland. The most recent weed survey was conducted in southern and central Finland in 2007-2009 (Salonen *et al*., 2011 & 2013). A total of 595 fields were investigated by counting all weed species from 10 randomly established 0.1 m^2 sample quadrats in mid July – early August. Data were collected both from conventionally and organically cropped fields in 16 regions. Temporal and spatial changes in weed incidence are of interest and related to changes in cropping practices. One of the major challenges in including the Finnish data into the WEED MAP was a different method of weed assessment. Namely, in the WEED MAP, the standard unit of weed abundance is percentage cover but such data were not available in the Finnish data set. Consequently, the weed density records were adjusted to follow the Braun-Blanquet type 6-step scale. In addition to actual weed data, information on the site and the cropping practices were more easily fitted to the database standard. Need for harmonizing the weed survey protocols in European countries is apparent but challenging as most of the national weed surveys aim at repeating the monitoring in a same way as done previously to maintain the comparability of findings over time.

(7) The weed science society of Israel weed mapping project

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The rapid advance and availability of GIS including web based software and map systems and the rapid spread of GPS devices and smartphones enables mass collection, saving, processing and distribution of spatial geographic data. The data collected in shared databases enable its distribution to internet network maps and can easily be downloaded to professional GIS software for advanced processing, development and application of scientific purposes including agricultural models. The Weed Science Society of Israel has initiated a project for creating weed distribution maps which up to date include two groups of weeds- parasitic weeds and herbicide resistant weeds. The next weed category to be mapped will be invasive weeds. The project is based on surveys and reports conducted by farmers, extension personnel and researchers in the field of weed science. For each group of weeds a coordinator who is a specialist in the specific weed group was appointed and he checks and approves the information from the field and inserts the coordinates and relevant information according to a pre-devised fixed format of the weed infestation. The collected data is uploaded by a GIS specialist on to an ESRI platform and the maps are stored and available through ESRI cloud service (arcgis.com). The final maps and data are linked to the WSSI website. Thus this is a mass information system but is supervised by professional experts to insure geographic precision and botanical accuracy. For each group of weeds there is a map layer with a legend that includes a color coded point for each species, severity of infestation and the weed species name in Hebrew and Latin,. The weed point on the map is linked to a data table showing input details: ID number, name of reporter, date, farm name, plot name and remarks. In addition the table includes links to photos of the plant and a link to a weed identification website. The project has just been initiated and its potential as a tool for farmers, extension personnel and researchers will be evaluated once a critical amount of data will be uploaded.

(8) Are results obtained by different sampling methods comparable?

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When assessing plant occurrence in the field, questions are bound to come up about how to conduct the measurements. The number of different approaches which can be used to quantify the floristic components at a vegetation sample site is so great that a comprehensive comparative study of their individual properties would often require a multifactorial exercise of immense dimensions. The measures used to assess the relative importance of different species in vegetation studies reveals that they are all based on concepts which use one or more of four parameters: i) number of individuals (density), ii) frequency of occurrence, iii) area occupied (cover), and iv) weight of plant material. Cover is one of the most common measures of community composition because it equalizes the contribution of species that are very small, but abundant, and species that are very large, but few. Of the three measures density, frequency, and cover, cover is most directly related to biomass. A key advantage of cover as a vegetation measure is that it does not require the identification of the individual (as e.g. density does), yet it is an easily visualized and intuitive measure. A disadvantage of cover measures (especially canopy cover) is that they can change dramatically over the course of a growing season, while both frequency and density measures seem to be more stable after species emergence. It is sometimes difficult to accurately estimate cover, especially if the plants are at or above eye level. Canopy overlap can further complicate cover measurements. The main objective of our study is the comparability of results obtained by different assessment techniques in various crops (cereals, maize, sunflower, sugar beet) and under various climatic conditions (Central and South-Eastern Europe). The experiment with two different assessment methods (density and cover estimation) applied to weed communities in the Czech Republic (Central Bohemia) and in Croatia (Baranja county) has been conducted from May to October 2013. Results from the experiment can serve as a material for discussion during the workshop. They will provide an idea which methods give the best results under certain conditions and how comparable / transformable data are. We will especially focus on their statistical processing and on the creation of maps. It would be highly desirable for the future to find a common assessment and evaluation approach within the Working Group.

(9) Weed mapping as a tool for developing an economical and environmentally friendly weed management practice in cotton

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Cotton (*Gossypium* spp.) is an important crop in the rotation in Israel. In many cases, high cost of weed management have a significant impact on the crop profitability. Weed management, as an integral part of the crop management has not changed significantly since the 1980's. The traditional strategy is based on pre- and post-emergence herbicide applications, intra row cultivation and hand weeding. Herbicides are usually applied without considering the spatial variation in weed distribution in the field. Hence, redundant herbicides are applied without a real necessity, artificially increasing the selection pressure and shifting the structure of the weed population. The purpose of this research is using the principles of precision agriculture to develop a cost-effective and environmentally friendly weed management in cotton, without a negative impact on the crop productivity and seed bank. In field studies conducted in 2011 and 2012 weed infestations were mapped in commercial cotton fields using two methods: i. Scanning frequently the field over the drip irrigation pipes intra rows with green seeker, a sensors that measures and computes 'normalized difference vegetation index' (NDVI) values. It provides weed infestation data close to the canopy. A high correlation was found between the NDVI as recorded by the green seeker and that recorded manually by scouting. ii. Taking high resolution (1 cm per pixel) RGB images by a small UAV (Unmanned Aerial Vehicle) – VTOL aircraft (Vertical Take Off and Landing) equipped with an RGB conventional digital camera. The images were analyzed to differentiate the cotton rows from the weeds. The rate of weeds coverage was measured in order to establish a weed infestation map. Mapping the weed patches may allow us to predict the future infestation in the field and may enable us to apply pre-planting and pre-emergence treatment on these patches only.

(10) Weed mapping using high resolution imaging from a tetracopter drone

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Recent developments in unmanned drones (UAVs or unmanned aerial vehicles) have enabled the possibility of acquiring high resolution images of relatively wide areas. Resolutions of as high as 1 cm per pixel and less, open the possibility of detecting small weeds in the early stage of their development. This study, reports an attempt to use high resolution imagery in the visible range, for automatic mapping of weeds. Two aerial imaging campaigns were conducted with a tetracopter drone, carrying a RGB camera above a cotton field. The images were acquired a few days after crop emergence (first campaign) and a few weeks after emergence, just before the crop canopy covered the entire field. The images were processed using custom image processing software. The level of weed infestation in each part of the image was estimated by the automatic image processing algorithms, and then manually evaluated by an expert. The performance of the system was evaluated by comparing the manual evaluation of the infestation level, to the estimated infestation level using the image processing algorithms. Results show that in the early stage of crop development, the weeds are accurately detected, while in the advanced stage, were the crop cover is high, the weed detection becomes harder and less accurate. This study shows the potential in the use of unmanned drones for quantitative analysis of the weed infestation for improved management.

(11) Weed patchiness, providing the necessary data for a potential site-specific weed management

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Barley is one of the major crop species of the world which is widely used for stock feed, human food, malting, brewing and distilling. As a crop characterized by high allelopathic potential, however, weeds in some cases are strong competitors which may lead to reduced yield and malt quality particularly in the case of barley used for brewery. The understanding of spatial dynamics of weed populations and the rate in which they spread within fields has an increasingly important impact on the methods used for the site-specific weed management. A field site (1000 m^2) of barley crop free of herbicide application has been selected in order to investigate the weeds' continuous appearance or patchiness in relation to that allelopathic crop. The experiment has been carried out in the experimental station of AUA(Spata) for two years. Intensive surveys of weeds were conducted over the course of 15 days during the growing period in order to assess the weeds' growth in terms of their spatial distribution. The amount of weeds was counted within 48 sampling units of $1m^2$, following a grid sampling pattern with a cell size of 5m. We also recorded meteorological data such as total precipitation, mean temperature and wind direction. The weed density and spatial distribution varied widely within the field between the two subsequent years, 2012 and 2013. Taking into account the occurrence of weeds in the sampling units of the field we recorded the following weeds, *Malva sylvestris*, *Sinapis arvensis, Chamomilla recutita*, *Cardaria draba*, *Gallium aparine*, *Silybum marianum*, *Calendula arvensis* and *Chrysanthemum coronarium* in frequencies of 92, 48, 48, 46, 23, 23 21% and 15% respectively. Furthermore, the mean weed densities (weeds / m^2) were as follows in a diminished rank: *M. sylvestris* (6.4), *S. arvensis* (4.5), *C. draba* (4.2), *S. marianum* (3.1), *C.recutita* (2.5), *C. arvensis* (2.3), *G. aparine* (1.7) and *C. coronarium* (1.5). In the second growing period the frequency and density of weeds were as follows in diminished rank: *Avena sterilis*, *S. marianum*, *C. coronarium*, *C. drapa,* C*. recutita* , *M. sylvestris, S. arvensis* and *Papaver rhoeas.*. It is well known that weed populations have a patchy distribution with aggregated weed patches of varying size and density. The data showed that the patchiness was quite similar in both years, indicating that the weed appearance was significantly affected by the seed bank dynamic. However, the differentiation in the rank in terms of the occurrence and density between the 2 cultivated years indicated strong effect of climatic conditions (heavy rainfalls and high temperature) which prevailed during the vegetative stage of the crop. It is obvious that during the 2^{nd} period (2013) the combination of higher soil moisture with the higher temperature favored the emergence of the *A. sterilis*

population and changed the population dynamic of the other weeds. Weed density maps were realized by spatial interpolation procedure determining weed patchiness, providing the necessary data for potential site-specific weed management.

(12) Weed survey project in Latvia

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Weed surveys have been carried out in Latvia for more than sixty years. In recent years, Latvian officials have started to develop recommendations for weed control according to integrated plant protection principles in economically important crops. A project for weed mapping, including research for resistance, was initiated in spring 2013. The project „Weed control in integrated plant protections system in field crops, promoting sustainable environmental and resources for sustainable use" is supported by the European Agricultural Fund for Rural Development and will run until 2014. The aim of the project is the collection of information about weed distribution and abundance in Latvia. Scientists from 5 scientific institutes will contribute to the project in Latvia. This project is comprehensive because no weed surveys have been made since the period of 1994 to 1996 when a joint programme investigated the distribution of weeds in Latvia, their botanical composition, dynamics and harmfulness, optimisation of weed control and limiting measures. Cereals, potato, sugar beet, flax, pastures and meadows, grass crops and fallow were included. Major changes in the crop rotations and the crop husbandry, including the weed control measures, have occurred on farms since that previous period. During weed surveys information about possible herbicide resistance in weeds has been collected. To date, we have no documented cases of herbicide resistance in Latvia, but there have been some investigations. The results from glasshouse trials on *Chenopodium album* gave an inconclusive answer about changes in susceptibility of the next generation of common lambsquarters against applied herbicides Lintur, Grodyl, Starane 180, Granstar and Duplosan Super. No resistance was found in *Avena fatua* samples to fenoxaprop-P, tralkoxydim or pinoxaden. The survey for weed resistance will be carried out by the questionnaire method to record observed possible cases of resistance of the most widespread weed species in cereals, oilseed rape, maize. Then samples will be collected from farms where the resistance could be possible and tests for resistance will be made in the laboratories by applying the herbicide active ingredients to plants. Our aim is to develop recommendations for the avoidance of resistance development. It is important to extend the research on weed resistance to the whole country because to control weeds including *Apera spica-venti*, our farmers usually apply herbicides from the ALS group in the spring. The weather in the autumn is not always suitable for the application of herbicides, but if the weather conditions are favourable, farmers will spray in the autumn. Usually because of the small size of the weeds, the herbicides of the ALS group are applied at low doses. In spring a new generation of weeds germinates and herbicides from the ALS group are applied again. The project includes both weed surveys and field trials for weed-crop competition with *Avena fatua*. This weed is a very dangerous and aggressive species on seed-growing farms. It will thus be important to develop measures for the control of *Avena fatua* based on the critical density of weeds and

on its influence on spring wheat. The yield loss calculations will take into account the dynamics of *Avena fatua* germination during the crop growing season, based on periodic population assessments.

(13) Advanced technologies for tempo-spatial modeling of broomrapes (*Orobanche* and *Phelipanche* spp.) and herbicide application

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The broomrapes (*Orobanche* and *Phelipanche* spp.) are obligate root parasites. Most of their life cycle takes place in the soil subsurface, including seed germination, attachment to the host root, penetration and establishment in the host tissue. Towards the end of their life cycle they emerge from the soil and produce inflorescences bearing hundreds of thousands of seeds. In the underground stages of their life cycle, the root parasitic weeds are more sensitive to herbicides than in the aboveground developmental stages. Thus, knowledge of the parasitism stage is essential to effectively control the parasite using the appropriate herbicides, optimizing their delivery to the parasite in the soil sub-surface. Data on their infestation level or phenological stage are therefore essential for effective control. In this presentation two approaches for enhanced broomrape control efficacy will be discussed: a) quantification of the temporal variation and prediction of broomrape parasitism by a thermal time model; (b) estimation of the spatial variation of broomrape infestation within a field and between fields. During the last 12 years models for the parasitism dynamics have been developed for small broomrape (*O. minor*) in red clover, sunflower broomrape (*O. cumana*) in sunflower and Egyptian broomrape (*P. aegyptiaca*) in tomato, sunflower and carrot. The parasitism dynamics of all parasites-host systems is strongly temperature related and therefore enables us to use the thermal time (growing degree days, GDD) approach for predicting the parasitism dynamics. Since the four mentioned crops are grown during different seasons and therefore are exposed to a wide-range of temperature regimes, the classical calculation of GDD cannot estimate accurately the parasitism dynamics. To overcome this inaccuracy, two GDD calculation methodologies, the linear and the beta-function equations are presented. The variation of the spatial broomrape infestation was analyzed within a field and between fields by the use of Geographical Information Systems (GIS), allowing mapping of the spatial distribution of broomrape in the field and utilizing this data for preparing a Site Specific Weed Management (SSWM). Special attention is given to the development of an integrative management approach. An example of a decision support system 'PICKIT' for a rational management of Egyptian broomrape in processing tomato, using various herbicide application methodologies will be presented.

(14) Aspects of glyphosate mechanism in Egyptian broomrape control

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Egyptian broomrape (*Phelipanche aegyptiaca*) is an obligate root parasite that poses a severe threat in the Mediterranean agriculture. *P. aegyptiaca* tubercles function as a strong sink and draw all of their nutritional requirements from the host plant. Glyphosate is a non-selective herbicide that inhibits 5-enolpyruvylshikimate-3-phosphate synthase (EPSPS), a key enzyme in the shikimate pathway and in aromatic amino acids (AAA) biosynthesis. *P. aegyptiaca* is efficiently controlled by glyphosate when applied on the foliage of its host plant e.g. carrot or parsley. The general notion suggests that glyphosate controls plants in general by AAA deficiency. However, since the parasite receives all of its nutritional requirements from the host, the mechanism for its control is not clear. The objective of the current study is to elucidate glyphosate mechanism of control in *P. aegyptiaca*. In order to isolate glyphosate effect on the parasite from its effect on the host, glyphosate resistant tomato (GRT) have been used as host plants. We have detected high accumulation of shikimate in *P. aegyptiaca* tubercles following glyphosate application. Conversely, the GRT host sink tissues did not present with high levels of shikimate. Shikimate is known to accumulate in response to EPSPS inhibition, thus indicating that *P. aegyptiaca* possesses an active EPSPS. In another study we have crossed the GRT line with a tomato plant expressing GFP under an *At*SUC2 promoter. The hybrid host was transporting a fluorescent protein in the phloem as well as expressing resistance to glyphosate. *P. aegyptiaca* tubercles exhibited fluorescence once attached to the host root vascular system. The GFP fluorescence levels intensified during the early period of parasitism. A short while after glyphosate application fluorescence intensity gradually decreased and eventually diminished. These findings imply that glyphosate weakened the sink strength of the parasite and actually prevented its supply of solutes. We hypothesize that glyphosate disrupts carbon metabolism in the parasite by inhibiting EPSPS, weakening the parasite sink strength and therefore interrupts with solutes transport that eventually leads to its death. The line of events that starts from inhibiting EPSPS and leading to sink weakening will be further examined.

(15) Effects of salt stress (NaCl) and broomrape (*Phelipanche aegyptiaca)* on superoxide dismutase and peroxidase activities of two tomato varieties

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Salinity is a major stress factor for plant development and reduces the yield especially in agricultural areas. Salinity problems occur on more than 800 million hectares of the terrestrial area in the world. Broomrapes (*Phelipanche* and *Orobanche* spp.) are root parasitic plants and they are biotic stress factor for important agricultural plants such as tomato, potato, tobacco, sunflower or eggplant. Stress factors, salinity and parasitism are often found at the same time. As a result of many stress factors, oxidative stress may occur in all aerobic organisms. The plants have more effective antioxidative defence mechanism against the factors because stress can cause oxidative damages in DNA, lipids and proteins in a plant cell. The aim of this study was to investigate the effects of *P. aegyptiaca* and salt stress on lipid peroxidation and antioxidant enzyme activities (SOD, POX) in two tomato varieties which are cultivated in Çanakkale, Turkey (*Lycopersicon esculentum* cv. Rio Grande and Troy F1). Our results showed that broomrape stress increased in antioxidant enzymes (SOD and POX activities) in the root tissues of cv. Rio Grande. Otherwise, salt stress induced these enzyme activities in cv. Troy F1. Salt stress and broomrape did not induce antioxidative defence system in both the varieties. SOD and POX activities were increased by broomrape and salt stress separately and together in the leaf tissues of cv. Troy F1 and Rio Grande. SOD and POX activities of cv. Rio Grande increased more quickly than Troy F1. Consequently, both root and leaf tissue of cv. Troy F1 was found more effective antioxidant defence against broomrape and salt stresses as compared to cv. Rio Grande.

(16) Variation in response of a resistant sunflower cultivar to *Phelipanche aegyptiaca* and *Orobanche cumana*

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The broomrapes (*Orobanche* and *Phelipanche* spp.) are obligatory chlorophyll-lacking root parasites, which parasitizes broad leaf vegetables and field crops worldwide. Confectionary sunflower is an important economical crop parasitized by *O. cumana* and *P. aegyptiaca*. High infestation level causes heavy damage that may reach total yield loss. Growing sunflower in a crop rotation that includes other *P. aegyptiaca* hosts e.g. chickpea, vetch, potato and tomato enrich the seed-bank of the soil with broomrape seeds. Sunflower cultivars grown for oil production that exhibit high level of resistance to broomrapes are grown in Europe during the last decades. Similarly, several confectionary sunflower varieties that were introduced in Israel exhibited high level of resistance to *O. cumana* and to *P. aegyptiaca*. Recently, a new resistant confectionary sunflower cultivar 'Emeq 3' was developed based on a trait taken from a Spanish oil sunflower. The objective of the current study was to characterize the variation in the response of 'Emeq 3' to *P. aegyptiaca* and *O. cumana.* Resistant sunflower 'Emeq 3' and sensitive sunflower D.Y.3 (Shaar Ha'amaqim, Israel), were grown in polyethylene bags (PEB) under temperature-controlled conditions. The PEB were artificially infested with seeds of *O. cumana* or *P. aegyptiaca,* monitored on a weekly basis and imaged using a stereoscopic binocular. Parasitism dynamics for germination, attachments and tubercles production were monitored for both sunflower varieties for each broomrape species. Seeds of two broomrape species germinated 21-28 days after planting, at the same rate for both sunflower varieties. The sensitive sunflower D.Y.3, showed higher sensitivity to the parasite *O. cumana* compared to *P. aegyptiaca* in terms of attachment number and tubercles production. However, 'Emeq 3' was absolutely resistant to *O. cumana* but sensitive to *P. aegyptiaca* similarly to 'D.Y.3'. The incompatibility between 'Emeq 3' and *O. cumana* was expressed in the attachment and during the penetration stage. It was clearly indicated that *O. cumana* seedlings failed to penetrate into the resistant 'Emeq 3' sunflower roots. The results of a field study that was conducted in a naturally infested field with *O. cumana* seeds, showed absolute resistance of 'Emaq 3' to *O. cumana.* It could be postulated that 'Emeq 3' sunflower that was bred for resistance to *O. cumana* in Spain is resistant only to *O. cumana* in Israel but not to *P. aegyptiaca*. Interestingly, no such differences in response to *O*. *cumana* and *P*. *aegyptiaca* were reported earlier in Israel for a local resistant sunflower cultivars 'Ambar'. Further study is in progress to confirm the resistance mechanism of 'Emeq 3' to *O. cumana*.

(17) Development of molecular markers based on *its* and *rbcl* genes to identify and distinguish between broomrape species in a soil sample

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Broomrape seeds are extremely small (dust-like seeds), averaging 200 to 300 µm in size and because of their miniscule seed size it is difficult to detect and confirm them via conventional methods. In this study our aim was to develop a PCR-based assay specific for broomrape seeds and tissues, enough sensitive to detect and distinguish between broomrape species in a soil sample. We used complementary polymerase chain reaction (PCR) primers based upon: 1. unique sequences in the internal transcribed spacer (ITS) regions of the nuclear ribosomal DNA of *Phelipanche aegyptiaca* . 2. unique sequences in the photosynthetic gene *rbcL* of *O. crenata* to distinguish between three broomrape species (*Phelipanche aegyptiaca* Pers.*, Orobanche Cumana* Wallr. and *Orobanche crenata* Forsk.). Genomic DNA was extracted from soil samples artificially infested with broomrape seeds or tissue of *P. aegyptiaca, O .Cumana* and *P. crenata* and subjected to PCR analysis. Using ITS-350 primers, a specific PCR product (350 bp) was amplified and detected in all samples containing broomrape species, but it was not detected in soil sample free of broomrape seeds or tissues. *rbcL* primers were able to distinguish between the above three species according to differences in PCR products. Additionally, the PCR-based assay was sensitive enough to detect even a single broomrape seed in the soil. As expected the universal internal control primers amplified a PCR product (555 bp) of genomic DNA extracted from soil samples with or without broomrape tissues or seeds. This diagnostic method is simple, reliable and rapid and could help for assessment of broomrape seed contamination in a crop field.

(18) Modeling imazapic movement applied by drip irrigation to maximize broomrape control

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Drip irrigation is a standard practice in the arid and semi-arid agriculture in Israel. The use of drip irrigation systems enables application of pesticides through the water (herbigation), thus reducing potential environmental hazards. Herbigation with imazapic has been tested in tomato and sunflower in order to control the parasitic weed broomrape (*Orobanche* spp. and *Phelipanche* spp.) but has yielded inconsistent results. In recent studies we examined the efficiency of imazapic herbigation in tomato pot and field experiments. HYDRUS-2D/3D is a model that predicts water flow and chemical movement in soils under various irrigation regimes. The aim of this study was to determine the parameters required for the model to predict the movement of imazapic in soil when applied via drip irrigation in order to maximize *P. aegyptiaca* control in tomato. We analyzed the concentrations of imazapic found in soil and plant tissues following drench application of imazapic in pots in the greenhouse. The same parameters where tested in a split root experiment to test the movement of imazapic throughout tomato roots. Imazapic soil sorption and dissipation curves were determined in the lab. In the field experiments we sampled and analyzed imazapic from the injection point to the dripper and its resulting spatial distribution in the soil. Imazapic in irrigation water and soil was analyzed by LC/MSMS. Greenhouse and field studies revealed that imazapic controlled the parasite at concentrations as low as 4 ppb. We found that the movement of imazapic in the soil is limited and its half-live ($t_{1/2}$) value under field conditions was 7-9 days. A split root experiment revealed that there is limited herbicide translocation from treated roots to untreated roots. The 'Retardation Factor' of the herbicide was 2.19 in the heavy soil where sorption of the herbicide was significant (Kd= 0.23). The differential sorption and movement parameter can explain the various control results in different experimental sites in Israel. In this study we defined and determined the parameters required for the HYDRUS-2D/3D model enabling us to use it for improved broomrape control by imazapic herbigation.

(19) Proposed glyphosate resistance mechanism in *Conyza bonariensis*

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The mechanism of glyphosate resistance (GR) in *Conyza* spp., a world wide troublesome weed, is extensively investigated. We collected and examined numerous *Conyza bonariensis* populations and among them several populations were confirmed to be glyphosate resistant. These populations are highly resistant (34-37 fold) to glyphosate when compared to glyphosate sensitive (GS) populations., No altered EPSPS, however, was detected. Furthermore, shikimate analyses of GR population revealed glyphosate – target-site interaction activity (although with lower shikimate levels), indicating the presence of a sensitive EPSPS. ^{14}C-glyphosate experiments demonstrated an expected (GS like) 'source to sinks' translocation pattern in GR plants with a slight delayed export from treated leaf compared with GS plants. These results support the hypothesis that GR mechanism is related to sequestration of glyphosate in vacuoles. We propose that the herbicide loaded on the assimilate flow, moves from cell to cell but does not enter the chloroplasts in appropriate amounts, therefore EPSPS is not sufficiently inhibited. Another observation of higher (2 to 5 fold) accumulation of anthocyanin in GR plants versus GS plants, particularly when grown under cold stress (16/10°C) and combined with glyphosate treatment, may support the assumption that glyphosate is abnormally sequestered in the vacuoles due to an overexpression of ABC transporters and of anthocyanin's ABC transporters. Cross breeding of GS plants with GR plants will clarify a possible linkage or connection between these characteristics. In addition a quantitative determination by qRT-PCR of the ABC and anthocyanin transporters will shed light on this assumption.

(20) Absorption and translocation of ^{14}C-glyphosate in the glyphosate resistant *Conyza sumatrensis* under two different temperature regimes

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Conyza sumatrensis is an important weed in undisturbed soils and perennial crops such as citrus orchards and vineyards. Biotypes of this species have been reported as glyphosate resistant. With the aim to elucidate the role of different temperatures on the absorption and translocation of ^{14}C glyphosate an experiment was performed under two different temperature regimes: 28 ºC and 10 ºC. In both temperature regimes, the absorption and translocation of ^{14}C-glyphosate was measured at different time intervals using both a resistant and susceptible biotypes to glyphosate. Results obtained showed a different pattern in absorption between R and S populations at 28 ºC, with the R biotype absorbing lesser amounts of herbicide through the time study; however, at 10 ºC the absorption was similar between both biotypes. Translocation of ^{14}C-glyphosate at 28 ºC between both biotypes from the treated leaf to roots was also different, with the S biotype showing better herbicide movement. Nevertheless, this pattern of translocation at 10 ºC between biotypes was not observed. Results indicated that the low temperatures would improve the efficacy of glyphosate herbicide.

(21) New and dangerous evolution of ALS-resistant Brassicaceae weed species

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Diplotaxis erucoides and *Erucaria hispanica* are common weeds widely spread at the Mediterranean region. Both species are members of the Brassicaceae family and share some interesting characteristics. Both species are allogamous and confer high fecundity and allelopathic activity. Outcrossing pollination may enhance the dissemination of a resistance trait especially when it is caused by an altered target site. In Israel we have been witnessing an increased ALS resistance in those two species especially in wheat fields where ALS inhibiting herbicides have been overused throughout the years. Populations of *D. erucoides* from Kibbutz Re'em (DR) and *E. hispanica* from Kibbutz Magen (SM) have been reported by the farmers to be resistant to different ALS inhibitors. Seeds from surviving plants were collected and tested under laboratory conditions. DR and SM plants showed different levels of resistance to tribenuron-methyl, imazamox and florasulam + flumetsulam. In the SM population, an alteration of Pro197 to Ser was detected in the ALS amino acid sequence, whereas in the DR population Trp574 was substituted with Leu. The first mutation confers resistance to sulfonylurea herbicide only whereas the latter endows resistance to all ALS inhibiting herbicides. In bBoth populations homozygous and heterozygous individuals were detected. ALS sequences indicated the transitional status of these weed populations. We conclude that drastic changes in the current weed management are needed in order to prevent further distribution of these weeds in wheat and other crops.

(22) Screening for glyphosate-resistant *Conyza* spp. In Greece and mechanism of resistance

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It is well known that a number of factors were implicated on the development of glyphosate resistant *Conyza spp*. biotypes in perennial crops in Mediterranean region. Among those are the long history (more than 30 years) of single glyphosate, the limited application of herbicides with a different mode of action, use of suboptimal glyphosate application rates, and little alternative integrated weed management approaches (such as crop rotation and use of mechanical weed control). The problems are especially focused mainly on horseweed (*Conyza canadensis*), secondly to tall fleabane (*C. bonariensis*), and to a lesser extent on *C. albida*. This presentation will provide data under development regarding: 1) characterization of seed germination patterns of large number of populations; 2) the level of resistance on a large number of field collected biotypes from 11 regions and different perennial crops in Greece; and 3) molecular studies to understand the mechanism of glyphosate resistance. *Conyza spp.* populations, raised in a common environment under similar conditions, exhibited a varying degree of germination (0-100%), seed dormancy (0-55%) and after-ripening (0-45%) status as affected by various seed pre-treatments. In *C. Canadensis*, most resistant populations had GR90 values from 2.4 to 7 Kg a.i./ha with only 2 populations with high GR90 (14.6 and 19.5 Kg a.i./ha) values. In *C. bonariensis*, similar GR values with only 1 population with high GR90 (11 Kg a.i./ha) value. Sequence analysis did not reveal mutation in the R cDNA at the Pro106. In contrary, quantitative expression analysis experiments of candidate genes (ABC-transporters) have shown significant expression on the R-populations compared to S-populations. Based on these molecular data, these genes are believed to participate in glyphosate resistance mechanisms. Results from these studies could help to develop preventive strategies of glyphosate resistant in perennial crops in South Europe.

(23) BRIFAR: a comprehensive resource for functional characterization of herbicide resistance mechanism in grass weeds

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Winter annual grasses, such as annual ryegrass (*Lolium* spp.), are the most difficult weeds to control in cereal-crops, causing a significant yield reduction in Israel and worldwide. *Lolium* spp. are self-incompatibility species, thus, herbicide resistance can spread very fast among field populations. The nature of *Lolium* spp. reproduction does not allow the use of homozygous plants for the molecular analysis of the herbicide resistance mechanism. Mis-application and overuse of herbicides from different modes of action (MOA) had caused a wide geographical distribution of herbicide-resistant *Lolium* spp. all over Israel. Here we present the BrIFAR: a new model system for the integrative functional study of herbicide resistance mechanisms in grass weeds. *Brachypodium distachyon* (L.) Beauv. (hereafter referred to as *Brachypodium*) is a temperate wild grass possessing many characteristics required for a tractable model system including compact genome size (272 Mb), small stature (20 cm), short growth cycle (2-3 months), self-fertility, simple growth requirements, availability of a complete genome sequence and efficient transformation. Recently we have developed a unique collection of more than 1000 accessions ("***The BrI collection***") which represents a wide range of habitats in Israel, including agricultural fields and road-sides (i.e. long history of herbicide applications) and natural reserves (i.e. without herbicide history). Screening of the *Brachypodium* lines for response to four groups of herbicides (PSII, ACCase, ALS and EPSPS), representing different MOA, revealed several candidate lines showing resistance to one (or more) MOA. These lines were characterized molecularly, physiologically and biochemically to reveal their herbicide resistant mechanism. Using DNA sequencing we identified several candidate lines possessing point mutations endowing resistance to different MOA (i.e. target site resistance). In additions, several lines were found to confer resistance that is not related to the target gene (i.e. non-target resistance). The efficient transformation system that we had developed enables us to examine the differences between those lines and understand the fitness cost of each mutation. We demonstrate the potential of using the BrIFAR, as a powerful tool in achieving better understanding of the mechanisms that endow resistance to herbicides in grass weeds. Our results, enables the better management of those resistance mechanisms and solutions that would help the farmers to maintain sustainable agriculture.

(24) Weed Research in Serbia

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The development of weed science as a scientific and expertise discipline dates back to the first half of the 20th century both in the world and in Serbia (our country). The discovery of β-naphthalene acetic acid (Irvin, 1938) and the synthesis of 2.4-dichlorphenoxy acetic acid (Pokorni, 1941) have contributed to a brisk development of this scientific discipline. In 1955 the Yugoslav Weed Commission was established as part of the Federal Chamber of Commerce. This Commission initiated the first congress dedicated to weed management. This was followed by a substantial number of congresses and symposia focused on general issues but also on topics of major concern. From 1980 onward weed congresses were held every four years. In 1992 the activities of the Weed Science Society were transfered to the Weed Science Society of Serbia. Nine congresses on weeds and a few national and international symposia have been organized so far. For those interested in publishing scientific and expertise papers related to weeds there are a few domestic journals at disposal: Pesticides and phytomedicine, Plant protection, Acta herbologica and Plant doctor. In Serbia scientific and expertise weed research activities are financially supported by the Ministry for Education, Science and Techn. Development of Serbia and the Ministry of Agric. Forestry and Water Management of Serbia. Currently our researchers are involved in a couple of international Projects as well such as: FP7 – REGPOT, COST Action and bilateral projects in the field of plant protection dealing with weed research.

At the universities weed research courses are offered in the following programs: Undergraduate Academic Studies – Bachelor (8 semesters, 4 academic years, 240 ECTS), Graduate Academic Studies – Master (2 semesters, 1 academic year, 60 ECTS) and Doctoral Academic Studies (6 semesters, 3 academic years, 180 ECTS). Recently a number of doctoral theses were defended in the fields of plant-weed interaction, herbicide selectivity, behavior and resistance, biology and management of invasive weed species, etc.

Weed research in Serbia should focus on the following items: investigations in the field of weed biology, diversity and ecology with the aim of preserving the gene fund and developing new biotechnologies in weed management; weed mapping and software developing in order to forecast weed incidence; multidisciplinary approach in analyzing and understanding crop and weed resistance to herbicides and their effect on global food production; crop-weed interaction and thresholds; improvement of the system of weed management in organic farming contributing to environmental protection; rationalization of herbicide application and use, improvement of formulations concerned with the high-quality and safe food production; improvement of integrated weed management in conventional plant production.

This research was supported by the Ministry for Education, Science and Technological Development of the Republic of Serbia, Project III 46008 and EU project FP7-REGPOT-AREA 316004.

(25) Effects of cover crops and their residues on weed suppression and subsequent composite cross populations of maize in organic cropping system

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In organic cropping systems cover crops have the potential to develop into a crucial factor of an ecological weed management strategy. To determine the effects of various cover crop species and their residues on the weed suppression and agronomic performance of composite cross populations (CCPs) of maize (*Zea mays L.*), the field experiment was set up under suboptimal climatic conditions in the period from September 2011 to October 2012. The following three cover crop types were grown between cash crop: (1*) Brassica juncea (L.) Czern. cv. ISCI 20*; (2) *Vicia villosa Roth cv. Latigo*; and (3) a mix of seven cover crop species *(Fagopyrum esculentum Moench, Lupinus albus L., Phacelia tanacetifolia Benth., Pisum sativum L., Trifolium alexandrinum L., Trifolium incarnatum L. and V. villosa*). The results obtained were compared with no-cover crop plots and two maize hybrids, conventional and organic. *V. villosa* in pure stand was the most productive and stable cover crop (509,43 gm^{-2}), with the highest weed suppressive effect (63,24% weed reduction). Consequently as a leguminous species, residues of *V. villosa* significantly increased development and growth of the maize cultivars (2,102 tha^{-1}) compared to the control plots (1,85 tha^{-1}). The lowest weed suppression effect (only 23% weed reduction) and total maize biomass production (1,42 tha^{-1}) was observed under Mix 7 treatment, as a result of poor establishment and adaptation of that cover crop type (188,75 gm^{-2}). Multiple comparisons of the different maize cultivars showed that CCPs and organic hybrid achieved similar dry grain production value, while the conventional hybrid had the best agronomic performance. The whole-grain analysis indicated that the choice of cultivar and not the green manure treatment, had the high significance on the quality of the final product. These findings showed that weed suppression and green manure effects of the cover crops under abiotic stress conditions are greatly influenced by individual species adaptation, agronomic management and within system compatibility of the subsequent maize genotype.

(26) Cover crops as a tool for prevention of soil erosion and weed management in potatoes

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Cover crops are grown before and between the main crops for weed suppression, prevention of soil erosion, improving soil texture, addition of organic matter and minerals and promoting beneficial organisms for biological control. Cover crops suppress weeds by competition, shading and allelopathy. Potatoes are commonly grown on light soils which are vulnerable to soil erosion. The aims of this study are to examine the efficacy of several cover crops in preventing soil erosion and decreasing weed infestation while the potatoes under no till conditions, namely, are seeded into the mulch of the cover crops. On the first year of the experiment the cover crops: clover (*Trifolium* spp.), triticale (*Triticale secale*), oat (*Avena sativa*), oat+vetch (*Vicia atropurpurea*) and canola (*Brassica napus*) were seeded in a sandy soil field in Mishmeret in the Sharon region in Israel. In the oats +vetch treatment there was no runoff at all, while in the herbicide-treated control there were 90.7 m^3ha^{-1} runoff. On the first year of the experiment the treatments oats+vetch and oats alone decreased the number of weeds 18 fold as compared to a non sprayed control. On the second year, 2 months after seeding the potatoes, there was no significant difference in the weed infestation between the oat treatment and the control although the control was cultivated twice. The grass cover crops closed the canopy quickly, competed better with weeds and decreased soil erosion. The potato yield was not significantly different among the treatments during the 2 years of the study. We concluded that growing potatoes on cover crops mulch is an efficient and sustainable method for reducing herbicide use and soil preservation.

(27) An analıtıcal approach to evaluate the effect of ımported outdoor ornamentals on flora ın Turkey

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Whole world become a global village due to virtually loss of physical borders among countries resulted in increasing effect of globalization. In spite of positive considerations of this situation from the view of economics, unexpected hazards might bear due to enlarging productions via removing limits for consumption. One's expectations can reach limitless points in parallel to increasing personal prosperities. Human being was contended with nature around them, which did not have any make up; now, they would like to see the plants they never seen and was not able to pronounce names of those exotic plants. They do not care about future problems; enjoy the words they heard such as "exotic", "alien", "invasive", "parasitic" without giving attention to their meaning. All places such as parks, gardens , sportive fields, play grounds, streets, holiday resorts, city forests, cemeteries, and university campuses are being covered by alien plant species, which resulting in expanding import. Unfortunately, there has been no enough information on imported plants, especially outdoor ones in Turkey. Species originated from Anatolia was mainly produced before 1980; after economic liberalization exotic species were imported and propagated by not only private sector but also public institutions such as municipalities. In the course of this study, imported outdoor species in Turkey will be determined, their features, historical backgrounds, reasons being preferred and planted places will be searched. Using those data, the current situation in flora due to those species and their probable negative effects will be elaborated. In addition, a vision, policy and projection will be discussed.

(28) Distribution and control of *Ambrosia* (ragweed) spp. In Israel

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In recent years *Ambrosia* spp. (ragweed) invaded vast areas in Israel. The species that are prevalent in Israel are perennial plants: (1) *A. confertiflora,* first identified in 1990 near Alexander river banks covering small areas, which is now widespread mostly in central Israel. It can also be found in limited places in northern Israel as well as in the east and south; and (2) *A. tenuifolia* that is found less frequently. A new, updated distribution map of these species will be presented. The annual species *A. artemisiifolia* that is widely spread in North America and Europe, appears only sometimes in Israel but does not seem to be established, probably due to the dry summer. The species differ in their life cycle, flowering season, propagule morphology and flower structure. It appears that *Ambrosia* species invaded Israel in contaminated food grain shipments, spread along roads, streams and railway tracks and by the movement of infested soil. The rapid spread of the perennial *Ambrosia* species in Israel is attributed to their efficient vegetative reproduction by rhizomes. In a controlled experiment, one plant of *A. tenuifolia creat*ed 145 blooming shoots after 14 weeks. Seed germination is 8% for *A. confertiflora,* and 30% for *A. tenuifolia* (N>1000). Ragweed is a problematic weed in agriculture, especially in orchards and in row crops such as cotton, sunflower, maize, and chickpeas. *Ambrosia* control experiments with various herbicides were conducted at the greenhouse and in fields. Preliminary results indicate that time of application and type of herbicides are crucial for an effective control of *Ambrosia* spp.. The *Ambrosia* pollen is known to be highly allergenic. Preliminary results of allergy tests conducted in two hospitals show that 30% of the atopic participants are sensitive. The sensitivity to various species seems to be different, with *A. confertiflora* pollen more allergenic than *A. tenuifolia* pollen.

(29) Seedling emergence of *Echinochloa crus-galli* affected by soil depth

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Echinochloa crus-galli is one of the most problematic weeds in many crops e.g. rice, bean, soybean, tomato and sugar beet. It is also frequently found in ornamental plantation areas. Information on seedling emergence behavior of the species in soil profile is helpful for weed management strategies. A greenhouse experiment was conducted to study the effect of soil depth on seedling emergence of *E. crus-galli* populations. Three seed populations including i) from a rice field (population 1) in Amol, north of Iran, ii) from a field rotationally under rice and other crops e.g. maize and tomato cultivation (population 2) and iii) one from an ornamental area (population 3) in Ilam, west of Iran were collected in November 2012. Seed portions (100) were buried at soil depths of 0, 2, 4, 6, 8, 10 and 12 cm in pots for 48 days. The pots were kept in a greenhouse at a temperature of 19.5±2.5 ºC and watered every second day. The experiment was conducted in a strip plot design with four replicates. Four pots were also left without sowing seeds as control to check for possible *E. crus-galli* seed infestation in the soil before the experiment. The number of emerged seedlings were counted and removed regularly until end of the experiment when no more seedlings were emerged. The data were subjected to analysis of variances. For the calculation of the emergence lag-time a cumulative emergence curve for each population at each depth was modeled by the Weibull function. There was a significant difference among depths and populations in total seedling emergences. For population 1, the total seedling emergence was 62.3 % for seeds placed at soil surface, increased in seeds buried at 2 cm depth (87 %) followed by a decrease at the rest of the depth. Emergence reached its minimum (9.3 %) at the depths of 10 and 12 cm. For population 2, the total seedling emergences were 26.8 and 29 %, respectively, for seeds placed at soil surface and in seeds buried at 2 cm depth followed by a decrease at the rest of the depth. It reached its minimum (1.8 %) at the depth of 12 cm. For population 3, the total seedling emergence was 16 % for seeds placed at the soil surface followed by a decrease at the rest of the depth. Its minimum (1.3 %) was reached at the depth of 12 cm. Time of seedling emergence was slightly delayed with depth in population 1. However, time of seedling emergence was more delayed for seeds placed at soil surface than seeds buried at all depths in populations 2 and 3. The higher numbers of emerged seedlings were observed in population 1 indicating lower levels of seed dormancy in this population. In contrast, the lower numbers of emerged seedlings were observed in populations 2 and 3 indicating higher levels of seed dormancy in these populations. Therefore, the differences between populations from the two regions could be due to the adaptation characteristics of the populations. Seed populations from dryer areas like west of Iran may present higher levels of dormancy than seeds from moist environment like north of Iran when moisture is less likely to become a limiting factor for seedling establishment.

(30) Possible use of cover crops in weed control on kiwi orchards in black sea region of Turkey

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Kiwifruit was first introduced to Turkey in 1988. During the last few years significant progress has been achieved. Several experiments have been conducted at different agro-ecological zones; mainly in the Black Sea, Marmara, Aegean and Mediterranean Regions, and considerable information have been collected on plant-climate and plant-soil relations. Now it appears that the area suitable for kiwifruit cultivation in Turkey is plentiful. Kiwi is now one of the most favored fruit in the market among the 35 commercially grown fruit species in Turkey. The kiwi production was 15,000 tons in 2009, to 19,000 tons in 2010 and 35,000 tons in 2012 with expected yield of 50.000 tons for 2013.There are a lot of factors (weeds, pests, plant nutrition, pruning and cultural practices etc.) affecting the yield in kiwi orchards. One of the most important is weeds. Weed control in fruit orchard in Turkey is carried out using herbicides and mechanical control. Alternative weed control methods are needed because of the various side effects of herbicides; causing injury to the plant, high labor cost and effect organic matter on the soil with mechanical control. Using cover crops for weed control in fruits orchards is one of these alternative methods. In this study conducted in the middle Black Sea Region, we examine the usability of cover crops as weed control tool in kiwi fruit orchards.. *Trifolium repens* L., *Festuca rubra rubra* L., *Festuca arundinacea*, *Vicia villosa* Roth. and *Trifolium meneghinianum* Celm have been used as cover crops in the experiment. Cover crops treatments were arranged in a randomized complete block design with four replications, and all cover crop were grown on the same plot during experimental periods. Untreated control plots such as weedy control, herbicide control and mechanical control were included to evaluate weed effects. Cover crops and weed biomass has been determined by drying plants from 3-0.25 m^2 frame per plot in the flowerings periods of cover crops. Weed density has been evaluated just before cutting cover crops. As a result of experiment the lowest weed dry biomass was obtained from mixed cover crops parcels (40% *T. repens*, 30% *F. rubra rubra*., *F arundinacea*) the highest weed dry biomass was obtained from weedy control parcels. The highest cover crop dry biomass was measured in the *F. arundinacea* plots. Regarding the effect of cover crops on kiwi fruit yields the lowest yield derived from weedy control plots while the highest yield obtained from *F. arundinacea* plots. This research indicates that cover crops could be used as living mulch in integrated weed management programs to manage weeds in the kiwi fruit orchards.

(31) The benefits of using a pre-emergence herbicide (pendimethalin) for weed control in crops of southern Europe

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Farmers in Europe have mostly turned to multiple applications of post-emergence herbicides to replace residual pre-emergence herbicides that were withdrawn in the EU during the recent years. The benefits of using a residual herbicide however can be very important in many cases by minimizing the risk of resistance and/or securing efficiency in weed control. Pendimethalin is one of the residual herbicides still available to European farmers and used in many crops particularly in Southern Europe. With field trials in Greece, Italy and Spain the profitability of using pendimethalin for weed control in selected crops was measured and compared to that of using alternative methods. The trials were conducted in transplanted processing tomatoes, direct-seeded onions (for dry bulb production), cotton and broccoli (for the fresh vegetable market) considered as four of the crops depended on efficient weed control for their profitability. The treatments included pendimethalin, alternative herbicides and recommended combinations along with untreated and hand-weeded controls. Each treatment was applied in randomized duplicate plots, one with and one without supplemental hand weeding of escaping weeds and the time and cost of required supplemental hand weeding were recorded. Based on yield data and actual farmer's prices for costs and products, the expected weed control benefit/cost ratio was determined when pendimethalin, alternative herbicides, hand weeding or a combination was used. In all cases pendimethalin, usually being sufficiently effective as a single treatment, provided the most favorable benefit/cost ratio, ranging from 11.5 to 47.1 depending on the crop, which was by far better than the ratio obtained with hand weeding or most of the herbicide combinations. Evidence is also provided that alternative weed control methods, like inter-row cultivations and on the row polyethylene mulching, which were not used in this study, can by no means provide a ratio equivalent to that of pendimethalin. The labor return value analysis further revealed that hand weeding, often used as a yield rescue method by farmers, becomes economically justifiable in most cases when combined with pendimethalin although it is never justifiable when used alone.

(32) Response of some weed species to nicosulfuron

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In Serbia, nicosulfuron is often used for weed control in corn, due to the fact that *Sorghum halepense* L. (Pers.) is one of the most dominant weeds in many corn fields and it is well known that this herbicide effectively controls this weed. Except *S. halepense*, species *Abutilon theophrasti* Medik., *Helianthus annuus* L., *Panicum crus-galli* L., *Solanum nigrum* L. and *Xanthium strumarium* L. are present in high abundance in corn fields. So, the aims of this study were to determine the response of the above listed species to nicosulfuron and to check if the history of repeated herbicide applications (acetolactate synthase inhibitors have an impact on the present response to nicosulfuro. The response of populations (including susceptible and presumable resistant) of six weed species listed above to nicosulfuron was investigated in controlled conditions. Based on results of dose-response experiments, GR_{50} values for presumably resistant and susceptible populations were similar for *A. theophrasti*, *P. crus-galli* and *S. nigrum*, while only some presumable resistant *H. annuus* (2 populations), *S. halepense* (1 population) and *X. strumarium* (1 population) populations exhibited lower susceptibility than corresponding susceptible populations. The response of selected populations to nicosulfuron based on plant height, fresh weight and leaf area in field dose-response experiments was studied in 2008 and 2009. Nicosulfuron was applied in the amounts of 0, 10, 20, 40, 60 and 80 g a.i. ha^{-1}. ALS enzyme activity in the presence of the range of nicosulfuron concentrations (0; 0.01; 0.1; 1; 10; 100 µM) was recorded *in vitro*. The statistical analyses were carried out using the statistical environment R with the extension package *drc.* The response of studied populations to nicosulfuron depended on weed species, population and measured parameters. Ratios between GR_{50} values for presumable resistant and susceptible populations of *H. annuus* ranged from 2 - 37 depending on population, year and parameter, while for *X. strumarium* it was in a range from 1.2 - 3.6. Based on ALS enzyme activity differences between presumably resistant and susceptible populations of *H. annuus* we confirmed ratios between I_{50} values of 3.8 and 6, while for *X. strumarium* the ratio amounted to 1.3. High level of resistance was not confirmed for any population, but some populations showed decreased susceptibility to nicosulfuron.

(33) Sensitivity of different *Zea mays* (shrunken endosperm type) cultivars to the herbicide foramsulfuron

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The aim of this research is to study the mechanism involved in sensitivity of some maize cultivars to the herbicide foramsulfuron, and to examine its heredity. Foramsulfuron is a sulfonylurea herbicide for post emergence use in maize to control grasses and some broadleaf weeds. Foramsulfuron is commonly formulated with the safener isoxadifen-ethyl (ratio 1:1). Two homozygous maize inbred lines ('IBER001' and 'IBER002') and their hybrid ('ER00X') were planted in pots and sprayed, at 2-4 visible collars, with several commercially available ALS inhibitors, with or without a safener, including 'foramsulfuron + isoxadifen-ethyl', rimsulfuron, 'iodosulfuron + mefenpyr' and 'foramsulfuron+ cyprosulfamid + iodosulfuron + thiencarbazon-methyl'. Tembotrione (HPPD inhibitor) formulated with the safener isoxadifen-ethyl was tested too. 'IBER001' was found highly sensitive to sub doses of all herbicides examined, while 'IBER002' and the hybrid 'ER00X' were tolerant to recommended doses. Seeds were planted in small pots filled with a sandy soil drenched pre emergence with a wide range of 'foramsulfuron+isoxadifen' doses. Shoots length was measured 1 week after plating. A dose response curve was plotted, using the log logistic equation, and ED_{50} (dose causing 50% inhibition of shoot length) values extracted. ED_{50} value for susceptible inbred (IBER001) was 77 ppb, while for the tolerant inbred (IBER002) and the hybrid (ER00X) the ED_{50} values were higher, 1440 ppb and 630 ppb, respectively. Susceptibility of 'IBER001' to a wide range of herbicide suggests a general mechanism, such as P450 and GSH detoxification processes, may be impaired rendering plants sensitive. Other possible explanations are now investigated. The results indicate that corn inbred response to herbicides might be different from that of their hybrids

(34) Molecular techniques for discrimination of *Echinochloa oryzicola* and *E. oryzoides* species and their distribution in Turkish rice production areas

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The genus *Echinochloa* includes a number of the most important weeds occurring in rice throughout the world. It has about 50 species (including subspecies and varieties) and most of them are adapted to grow in water throughout their life cycle. *Echinochloa* taxa are identified on the basis of their spikelet morphology features and ecological habits. The primary distinguishing characteristics are length and width of spikelets. However, conventional identification of this genus is sometimes difficult because of the morphological diversity shown by the genus. The taxonomic complexity of *Echinochloa* species in many countries has led to different classifications. Molecular techniques are useful tools for solving taxonomic confusion among species. Polymerase chain reaction (PCR) and polymerase chain reaction restriction fragment length polymorphism (PCR-RFLP) methods were applied for the identification of *Echinochloa crus-galli*, *E. oryzicola* and *E. oryzoides*. Total DNA was extracted from 266 accessions, which were collected from different rice growing areas of Turkey. The two primer sets (trn-a and trn-b1, and trn-c and trn-d) specific to a target region of the intergenic spacer between trnT (UGU) and trnL (UAA) and the entire intron region of trnL (UAA), respectively, were used in PCR amplifications. Of the 266 accessions of *Echinochloa* spp., only eight accessions gave a similar fragment size, which was slightly shorter than 495 bp. The PCR product obtained with the primers trn-a and trn-b1 gave two fragments when EcoRI restriction enzyme was used in *E. crus-galli* and *E. oryzoides*. However, not all accessions of E. oryzicola were digested with this enzyme. In contrast to EcoRI, the PCR product obtained using the trnc and trn-d primer set was digested into two fragments by using AluI restriction enzyme in all accessions of *E. oryzicola*; whereas, it was not digested in *E. crus-galli* and *E. oryzoides*. This molecular differentiation among *E. crus-galli*, *E. oryzicola* and *E. oryzoides* supports the hypothesis that *E. oryzoides* is not a synonym of *E. oryzicola* in Turkish accessions. Weed mapping is useful at a range of scales and is one of the keys to operating a successful herbicides resistance weed management program. The authenticity of weed distribution maps prepared by the geostatistical estimation after identification of species.

(35) Some thoughts on strategies for management of *Solanum elaeagnifolium*

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Solanum elaeagnifolium is an invasive plant species in many Mediterranean and arid climate areas in temperate zones throughout the world. The plant is native to south-central USA and northern Mexico, where it is a problem weed in crop production. It is thought to have been introduced unintentionally into Greece and other Mediterranean countries sometime in the mid-twentieth century. *Solanum elaeagnifolium* has spread considerably in the intervening decades and now is a common invasive weed throughout the region in crops, urbanized landscapes and natural habitats. This weed has many characteristics that make it difficult to manage. It is a drought tolerant perennial plant with an extensive root system, possesses abundant spines on foliage and stems, is toxic and unpalatable to livestock, and produces large numbers of viable seed annually. Examples of successful management of this weed are hard to find. Only a strategic, coordinated effort has the chance of significantly reducing or eliminating *Solanum elaeagnifolium* from Mediterranean countries. A strategy must incorporate many factors in order to have a chance for success. These factors include: organizing local organizations that include individuals, organizations and public agencies to direct or influence implementation of the strategy; policy decisions that facilitate control practices; the development of funding mechanisms for education, research and control; broad-scale and targeted educational programs on the weed, its movement in the region and its management; coordinated applied research into the biology/ecology of the weed and control methods; demonstrations of control methods with cooperating land owners; developing standards and protocols to limit movement of *Solanum elaeagnifolium* in the region; and support for international biological control efforts. No weed is beyond management if people and organizations can work together.

(36) The possible impact of a 2°C air temperature increase on the weed flora and an arable crop in Greece. Studying the case of wild oat (*Avena sterilis* l.) and wheat (*Triticum durum* l.)

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The predictions of the last IPCC's report (2007) present the environmental sensitive South-East Mediterranean Basin as a region of a high risk, regarding the impacts of Climate Change on crop yields. In order to create an integrated image of the future trends in crop yields it is necessary to comprehend the basic factors affecting the agroecosystems evolution. The weeds are more resilient under extreme conditions, and seem to be benefiting from climate change, while regular crops suffer. In order to adapt and mitigate the negative impacts of weeds on crop yields, under future climatic change, it is very crucial to develop mechanisms that will predict weed vulnerable cropping zones. In this study we develop a methodology of modeling the effect of a 2˚C global warming until 2050 in wild oat, one of the most common weeds in Greece, mainly in wheat a crop of high financial importance. The FAO's crop growth model AquaCrop (AC) was used as the basic simulation tool. According to our methodology, we selected seven study cases in Greece, representative of the arable zone, in order to evaluate the effect of temperature increase on the arable crops. Two time periods were compared in order to derive measurable results. The time period 1961-1990 was used as a baseline while the period 2021-2050 was used for future estimation. The following climatic figures were implemented in daily basis i) minimum and maximum temperature, ii) relative humidity, iii) wind speed, iv) solar radiation and v) precipitation. The necessary climatic figures were extracted by four climatic models (DMI, ETHZ, C4I, HadRM3) describing the A1B IPPC Scenario which approximately predicts a 2˚C global warming, a 12% decrease in precipitation and an increase in CO_2 concentration from 354ppm (1990) to 532ppm until 2050. A combination of field data, a crop growth model, current climatic data and future climatic scenarios are the necessary components conducting this research. In this study, we established a) a wheat field experiment in the area of Yliki (Central-Southern Greece) during 2010-11 b) a wild oat growth monitoring in Agricultural University of Athens in 2012-13. We measured phenological and physiological parameters, such as growth stage, canopy cover, plant height, root depth and stomatal resistance in five plots 30x30 cm^2 a) in the wheat crop experiment and b) in sparsely plots with a natural population of wild oat at a density of 10 plants/m^2. Furthermore, climatic data were collected from a meteorological station in order to calculate the evapotranspiration. At the end of the growing period fresh and dry biomass and number of seeds/plant were measured. The data derived from both cases were used for AC calibration which was statisticaly validated under the RMSE and Model Efficiency method. A comparison of the trends of wheat and wild oat productivity among the seven study areas was the final output.

(37) Creation of national program to manage *Ambrosia confertiflora* in Israel

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The current status of the invasion of Ambrosia confertiflora (burr ragweed) in Israel according to the latest survey showed that the plant first established in the area of Shekhem (Nablus) in Samaria. From there the plant spread, westwards, along the banks of the Shekhem stream down to the banks of the Alexander River in the area of Heffer valley. Few years later the plant spread eastwards along wadi Tirza, where large stands were formed. Recently the weed reached the Jordan Valley as well. A survey conducted during 2004/5 by the Sharon Drainage Authority and Heffer regional council found that the plant had infested more than 480 ha along the banks of the Shekhem stream and the Alexander River, and from there, it spread to nearby field crops, orchards and right of roads. At the end of 2008, A. confertiflora was found in wadi Qana Reserve. Since 2009, several new small foci were reported in the central coastal plain, on the banks of the Dror stream, along roadsides of highways No. 3, No. 4. At the end of summer 2009, another infestation was found in the Petza'el Reserve in the eastern Samaria region. During spring 2011, a small foci were reported for the first time in a site adjacent to the Kishon River, near Haifa, as well as other were found near Jerusalem (highway No 1), Gedera, Ramla and Gezer emphasizes that the spreading might influence a great areas endangering biodiversity. The burr ragweed spreading rate is the fastest among land invasive plants in Israel. A. confertiflora forms very dense units that displace all other plant species, so that the understory at infested sites is almost completely lacking native species. This massive spread causes elaboration of government authorities along with the nature & parks authority to create a nationwide program established for monitoring and mapping all infected places in Israel, and create an eradicate program and/or central managing activities in order to prevent its continues spreading towards the lake of Galilee and the upper Jordan River. The management activities consist on preventing seed production and application of selected herbicides.

(38) Imazapyr is a best solution for non-selective management of *Ambrosia confertiflora* in Israel

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The invasive weed Ambrosia confertiflora (burr ragweed) is a troublesome perennial weed found in Israel. The use of auxin type herbicides such as 2, 4-D or fluroxypyr tank mixed with glyphosate was found to be very efficient against this weed. These combinations however, caused non-reversible damages to ornamentals and tree plantations such as orchards and avocado. In order to combat high infestations of A. confertiflora along the banks of the Alexander River, a field experiments were carried out in early summer of 2012. More than one year after 'Shotgun' (240ml L-1 imazapyr), a new formulation of imazapyr produced by 'Agan Chemicals Manufacturers' LTD) application, the plots that were treated post-emergence with 3% of imazapyr, are still perfectly clean with no vegetation what so ever. Our observations show that imazapyr is much safer for the neighboring aquatics than other herbicides available on the market, and it also safer compared to auxins or pyridines regarding volatility or drift considerations. Further studies with 'Shotgun' and other residual herbicides are in progress at present and will be reported.

(39) The vegetation in archaeological sites. An approach of integrated weed management to protect the historical landscape - Thalis project

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The native vegetation, an integral part of archaeological sites (AS), contributes to their character and beauty. However, in many cases, the historic sites had fallen prey to the abundant wild species that grow uncontrolled in the semi-arid climate particularly in the Mediterranean zone. Conventional methods of weed control often cause additional deterioration to the monument and the environment. In the frame of the an EU project for the vegetation management in the archaeological sites we will develop a system to control the undesired vegetation with methods friendly to the environment and monuments and secondly to enhance the historic feature of the site. According to the methodology the following working packages (WP) are included: 1st WP: Seven AS selected based on their geographic location were surveyed to record species and density of spontaneous vegetation and associated problems to the sites, A log of plant species and types of inert material surfaces associated to problems caused to the AS will be developed, as well as a compiled GIS database of the above log suitable for mapping and spatial analyses of AS which allows to calculate and assess the spread and the effect of spontaneous vegetation. 2nd WP: Alternative methods are developed and assessed *in situ* to manage unwanted vegetation, such as weed flaming, soil solarization, use of appropriate aggregates for surfaces to accommodate visitor access, burial of mosaics not-displayed and selective use of herbicides and plant growth regulators. 3rd WP: Native herbaceous and shrubby species will be assessed for potential use in AS and protocols developed for their propagation and cultivation. Mixtures of these species will be evaluated in laboratory plots and *in situ* as for the potential to establish a groundcover that prevents growth of destructive weeds and enhances the landscape. 4th WP: Guidelines that integrate methods friendly to the environment and ruins to control unwanted vegetation with design principles will give new space, function and semantic structure to AS. So far 355 plant specimens were collected, 230 different taxa were identified, while 53 more plant specimens are under identification. The species are divided among 38 plant families: in declining order of participation are *Fabaceae* (23%), *Poaceae* (17%), *Asteraceae* (16%), *Plantaginaceae* (5%) and other families with less than 3% participation. The only species that appears in all six sites is *Avena sterilis* L., whereas 21,7% of the species appear in two to seven sites and 77,9% of the species appear in only one site. The richness of each site in plant species is expressed as the percentage of species that appear only in that site over the whole. By this criterion, in declining order the richness, in the 7 the sites is : Amfiareio, Oropos 33%, Ancient Messini,

19%, Nekromanteion Acheron, 17%, Kolona Aegina, 10%, Ancient Agora of Athens, 10%, Early Christian Amfipolis, 9% and Forum of Thessaloniki, 5%. Additionally, we applied propane flaming control in three selected sites with the aim to optimize a) the use of flaming as a weed control tool and the b) the biologically effective dose (ED) for the tolerant weeds.

(40) The effect of a long-term irrigation with treated wastewater on the fate of ALS inhibiting herbicide in the soil

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Treated wastewater is the main source of water for irrigation of field crops in Israel. Long-term irrigation with treated wastewater (TWW) is known to affect the physical, chemical and biological properties of the soil. The sulfonylurea herbicide trifloxysulfuron-sodium (TFX) is commonly used for POST application in cotton to control various weeds including purple nutsedge (*Cyperus rotundus*).TFX is an ALS inhibitor which is stable in the Israeli soils for several months and can carry over to rotational crops; however, we observed that its residual activity in TWW-irrigated soils is much shorter when compared to that recorded in fresh water (FW)-irrigated soil. In this study we investigated the activity/dissipation of TFX applied on TWW-irrigated soil as compared to FW-irrigated soil. Dose response curves for TFX were performed in soils with different irrigation history (TWW and FW). TFX was applied in soils sterilized with γ-radiation, and its activity was determined using *Sorghum bicolor* bioassay. Dose response curves for TFX were performed in perlite to examine irrigation water effect on TFX activity. The TFX dissipation rate in soils with different irrigation history was evaluated using a *S. bicolor* bioassay. The *S. bicolor* response to TFX in TWW irrigated soil was significantly lower than that grown in the FW-irrigated soil. Sterilized TWW irrigated-soil exhibited higher TFX activity versus non-sterilized soil. The TFX effect on plants irrigated with FW was significantly higher than its effect on plants irrigated with TWW. TFX applied in TWW irrigated soil lost its soil activity after 24 days while remaining viable in FW irrigated soil. These data imply that TFX activity in TWW-irrigated soil declines faster due to microbial activity and the presence of high levels of dissolved organic matter (DOM).

(41) The usage of PELMO model to estimate the influence of the climate change on the pollution of the groundwater: the case for terbuthylazine

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Much work has been done so far, concerning the factors which regulate the fate and behavior of pesticides in the environment. The published work has clarified issues related to adsorption-/desorption, movement, persistence and run-off phenomena of the pesticides. However while satisfactory work has been reported in the literature concerning the influence of the climate change on fungi, insects and weeds, little reports exist relatively to the influence of the climate change on the fate and behavior of pesticides. In an effort to approach this issue by using real data, we used the values of the nine European scenarios which have been approved in the European Union for the evaluation of the risk assessment of pesticides according to the directive 91/414, which has been replaced by the regulation 1107/2009. The verified PELMO model, which simulates the leaching of the pesticides to the ground water, was used to calculate PEC values in the ground water. Terbuthylazine and its relative metabolites, desethyl-terbuthylazine and hydroxyl-terbuthylazine, was used as a reference herbicide. The results showed the following: a) possible increase of the temperature by 1.7^{o}C in Greece without change in the annual rainfall minimizes the danger of pollution of the groundwater, b) reduction of the temperature by 3^{o}C results in increased risk of the groundwater pollution, c) comparison of the Mediterranean scenarios (Porto and Thiva) revealed that the organic matter content of the soil compensates the possible negative effect of the reduction of the temperature up to 1.4^{o}C concerning the pollution of the groundwater. These preliminary results are discussed in the context of the agro-environmental conditions of Greece.

POSTERS

(42) Phytotoxicity of a medicinal plant, *Hypericum perforatum* against grass and broadleaf weeds of faba bean (*Vicia faba*) and its potential use as natural herbicide

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St. John's Wort (*Hypericum perforatum*) is a perennial plant indigenous in Europe, which has been introduced to many temperate areas and has a wide range of medicinal properties. Although *H. perforatum* is grown commercially in some regions of south Europe and America, in many countries it is listed as a noxious plant which can replace natural vegetation. In the search of new methods of weed management and taking into account the invasiveness and the chemical compounds of St. John's Wort, the objective of this study was to evaluate the potential inhibitory activity of *H. perforatum* against several grass and broadleaf weeds of winter legumes. Very few studies reported to date have assessed the allelopathic potential of *H. perforatum*. and the phytotoxic effects on the growth and nodulation of crops such as faba bean growing in arid and semi-arid environments. One field and one greenhouse experiment were conducted during 2012-2013 at the Agricultural University of Athens. In particular, *H. perforatum* leaf and root powder applied as mulch at 1 $t.ha^{-1}$ resulted to a significant reduction of the emergence and growth of common weeds such as *Lolium multiflorum*, *Alopecurus myosuroides*, *Fumaria officinalis* and *Polygonum aviculare* in faba bean crop. This reduction was similar to the one caused by the treatment involving the herbicide pendimethalin (72-100 % depending on the weed species), without any negative effect on the first growth and the nodulation of the crop. Our study highlights that mulch of the medicinal plant *H. perforatum* holds good promise for use as a natural herbicide for managing weeds in winter legumes. Moreover, the indicated phytotoxic activity of *H. perforatum* could be further exploited in future studies, in order to identify and isolate the allelochemicals, as models for future herbicides or as a useful tool of integrated weed and crop management.

(43) Study of hydrolysate and emulsion bioactivity of two *Origanum onites* biotypes on *Avena sterilis, Echinochloa crus-galli* and *Amaranthus retroflexus* seeds

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The aim of this study was to evaluate hydrolysates and emulsions bioactivity, extracted from two biotypes of *Origanum onites*, on *Avena sterilis, Echinochloa crus-galli* and *Amaranthus retroflexus* seeds. The two oregano biotypes originated from Ikaria and Lesvos, two islands in the North Aegean sea. Oregano plants were harvested in full bloom and were left to dry. Then various parts of each Oregano biotype were distillated by the method of Clevenger hydrodistillation in order to separate hydrolysate and essential oil. Hydrolysates were extracted with diethylether. The essential oil that existed in the hydrolysate was obtained by gas chromatograph connected to a mass spectrometer (GC-MS) and analyzed for qualitative and quantitative features. Then the essential oil from the extraction was emulsified. Both hydrolysates and emulsions were diluted to the following concentrations: 50%, 25%, 12.5%, 6%, 3%, 1.5%, 1%, 0.5%, 0.25%, 0.1%, 0.05%, 0.02% and 0.01%. Each concentration was applied to *Avena sterilis, Echinochloa crus-galli* and *Amaranthus retroflexus* seeds in Petri dishes. All Petri dishes were placed in darkness at 20^{o}C in growth chambers. Measurements of the seed germination percentage and the length of the seed radicle were taken every 2-3 days. The results showed that the higher concentrations of hydrolysates and emulsions prevented the seed germination and the length of the seed radicle, whereas, the lower concentrations amplified both physiological procedures when compared to the control. The hydrolysates derived from Ikaria and Lesvos *O. onites* biotypes exhibited higher bioactivity in low concentrations on *A. sterilis* and *E. crus-galli* seeds respectively. On the other hand, the emulsions derived from the Ikaria- and Lesvos- *O. onites* biotypes demonstrated higher bioactivity on *A. retroflexus* and *A. sterilis* seeds. *A. sterilis* seed and *A. retroflexus* seed radicles exhibited higher elongation when emulsion derived from Lesvos oregano biotype was applied. On the contrary, the *E. crus-galli* seed radicle was elongated in a greater extent when emulsion derived from Lesvos oregano biotype was applied.

(44) The effect of some cultivated plant root exudates and green manure on the germination and growth stages of *Sinapis alba* l. (white mustard)

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Sinapsis alba L. is a typical winter weed in Mediterrannean cereals, It occurs within cereal fields and at field margins.. İn this study, the effect of different cultivated plant root exudates of different crops (barley, wheat, rye, oat, vetch, canola, cabbage, and sunflower) on seed germination of *S. alba* was invastigated. Those experiments were conducted in petri dishes at optimal temperature of this weeds. The germinated seeds were counted and the germination rate was calculated. The effect of green manure of some cultivated plants (barley, wheat, rye, oat, vetch, canola, cabbage, and sunflower) on growth stages of *S. alba* was observed. Those experiment were conducted in pot experiments screen house in İzmir-Bornova. Cotyledons, rosette stage, stem elongation, flowering time, fruiting time were observed and compared

(45) Investigation of the effect of thyme oil on the germination of some crop and weed species

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This study, was carried out with aim to investigate the effect of thyme oil on seed germination percentages of 4 weed species namely redroot pigweed (*Amaranthus retroflexus* L.), black nightshade (*Solanum nigrum* L.,) Heartleaf cocklebur (*Xanthium strumarium* L.,) *and* Jimson weed (*Datura stramonium* L.) and 4 crop species namely cotton (*Gossypium hirsutum* L.), tomato (*Lycopersicon esculentum* Mill.), cucumber (*Cucumis sativus* L.), and corn (*Zea mays* L.). The experiment was set up in petri dishes under laboratory conditions with 0 (control), 2, 4 and 8 µl doses of thymus oil, previosly mixed in 10ml pure water and for each petri experiment 20 seeds of each weed species and 50 seeds of each crop species were used seperatelly and the experiments were set up as a randomized plot experimental design with 4 replicates. The results of the experiment were evaluated as germination of the weeds or crop seeds after the 3rd, 5th, 7th, and 14th day after planting. The result showed that thymus oil application didn't effect the germination level of the seed of the crop species such as corn and cucumber, while the germinations of the seeds of the other two crop species tomato and cotton decreased. All experimented weed species showed decreased germination.

(46) *Oxalis pes-caprae* plant extract reduces negative effects of aflatoxin b1 on oxidative stress and inflammation in swine blood

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Aflatoxin B1 is a very potent carcinogen mycotoxin in humans, birds, swine, fish and rodents. In this study we have investigated the capacity of an extract of the invasive weed *Oxalis pes-caprae* (Ox) in reducing the negative effects of AFB1 on gene expression of several markers of the oxidative stress (catalase - CAT, superoxide dismutase- SOD, glutathione peroxidase-GPx) and inflammation (cytokines: IL-6, IL-4, IL-10 and other markers of inflammation: cyclooxygenase (Cox2) and inducible nitric oxide synthase 2 (iNOS). After a gradient polarity solvent extraction of the plant material, the butanol extract showed important bio-activity. The dry extract was used as suspension in water for the study. Blood samples aseptically collected from healthy pigs, were diluted 1/5 in complete RPMI media, treated with 100 M AFB1 and 1µg/mL Ox and cultivated for 4h at 37°C. After incubation, blood samples were centrifuged and cell pellets were resuspended in 1 mL TriReagent and total RNA was extracted. cDNA were synthesized using 1µg of purified RNA and the evaluation of the effects of AF and TR on genes expression of above mentioned markers was realised through real-time PCR assay. The relative product levels were quantified using the 2(-ΔΔ CT) method. AFB1 induced an increase of the expression of SOD and CAT as genes involved in the oxidative stress and of Cox 2, iNOS as genes involved in the inflammatory response. Also, AFB1 induces an increase of the expression of IL-6 gene, one of the early inflammatory cytokine, and a decrease of the expression of IL-4 and IL-10 genes, as anti-inflammatory cytokines. The Oxalis extract was able to restore the AFB1 altered expression of GPx, SOD, SOD and CAT, near to the control level. Our study shows that Ox extract was efficient in restoring the expression of some genes affected by AFB1 toxicity in the swine blood. In conclusion, other in vivo studies are necessary to see if Ox dietary supplementation can prevent or reduce the effects of aflatoxin in swine fed aflatoxin-contaminated diets.

(47) Cloning and sequencing of virus inhibiting gene encoding an antiviral protein from the leaves of pokeweed *(Phytolacca americana* l.)

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Phytolacca americana (pokeweed) is native to the temperate regions of United States. It also grown in South and Central part of Europe and Cyprus. In Turkey, it is common in Black Sea region. Lately, it has been seen in the field sides as a weed in US. But, the pokeweed itself is an important genetic source. Pokeweed antiviral protein (PAP) is single-chain ribosome-inactivating protein (RIP) of *P. americana* that is characterized by its ability to depurinate ribosomes. In the present study, we cloned and sequenced complete gene of pokeweed antiviral protein type 1 (PAP-I) from the summer leaves of pokeweed collected from Trabzon (Turkey) using a pair of gene specific primers based on the known N- and C-terminal nucleotide sequences of PAP gene. Polymerase chain reaction (PCR) amplification of genomic DNA from *P. americana* was used for the identification of genetic determinants of antiviral protein gene. A product of 942 base pair was purified and inserted into pGEM-T Easy vector (Promega), downstream of the T7 promoter, and transformed into *E. coli* strain, JM 109. The recombinant plasmid clone, carrying PAP-I DNA insert, was sequenced from both directions. The PAP-I cistron of *P. americana* contained 313 amino acid residues. The DNA sequence of 942 base pairs included an open reading frame (ORF). The nucleotide sequences of PAP-I gene contained no introns and the comparison with the PAP-I sequence with the PAP isoform, showed an identity of 80-99%. Sequence analysis of PAP-I revealed that it contains a single point mutation, changing the Leucine (L) at position 273 to Phenylalanine (F) (L273F) at the putative active site.

(48) Habitat suitability and spectral heterogeneity models to predict weed species presences

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The aim of this study is to explain whether the presence of herbicide resistant weed plant species is related to spatial-landscape heterogeneity. Additionally, habitat suitability models are tested so as to evaluate their presence. In this study, weed species, such as *Chenopodium album*, *Conyza canadensis*, *Amaranthus retroflexus,* common in two biogeographical regions of the European area, the Mediterranean, and the Continental, corresponding to the countries Greece and Germany, are selected. These areas share common species, despite the fact that they have differing bioclimatic conditions. Given the difficulties of field-based data collection, the use of remote sensing for estimating spatial heterogeneity seems to be a powerful tool. Moreover, the availability of satellite-derived data, such as those derived from the Landsat makes it possible to study all parts of the globe up to a resolution of 30 m. Alternatively, NDVI index is used as a data source for comparing species presence and spatial hetrogeneitySince many available datasets do not provide reliable information about species absences, the need of presence only based analyses has been developed for the Habitat Suitability (HS). A model that is used to evaluate Habitat Suitability, by using presence only data, without contrasting their predictions with the characteristics of places were species are absent, is BIOMAPPER. Finally, so as to make predictions of species future distribution based on bioclimatic data, Open Modeller software and GARP analysis are used.

(49) Breaking dormancy at seeds of *Cuscuta approximata* bab.

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In order to improve dormancy breaking techniques to use in laboratory conditions, several techniques were compared to break dormancy of *Cuscuta approximata* Bab. *Cuscuta* seeds were collected from alfalfa fields in the Ercis District of the Van Province, Turkey in 2010. The effect of GA3 rates (50 to 300 ppm with 50 pm intervals) on stratified seeds with and without scarification was compared in an experiment which was set in CRD with six replications. Seeds scarified using H_2SO_4. There was no germination at check treatment, when no GA3 was applied. The highest germination rate at non scarified seeds was 3.6%. Scarified seeds germinated from 55.0 to 66.3% in different GA3 applications. It was concluded that stratification sole is not enough to break dormancy, there is a need for GA3 and scarification.

(50) Determination of the frequencies and densities of broomrape and other weed species occurring in tomato, sunflower and tobacco fields in the Denizli province of Turkey

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A survey study has been conducted in 2007 to determine the weed species occurring in field tomato, sunflower and tobacco in the Denizli province of Turkey. With this aim 58 tobacco, 40 sunflower and 32 tomato fields were monitored. Weed assessments were done at 10, 15, and 20 different sites (each $1m^2$ in size) on the areas that were 0.1-0.5, 0.5-1 and more than 1 ha^{-1} respectively. As the result 31 different weed species were found in tobacco fields of which two species were parasitic (*Cuscuta* spp., *Orabanche ramosa (Phelipanche ramosa)*). 14 weed species had a frequency over 20 %. *Convolvulus arvensis* was the most abundant weed species with a frequency of 96,6 % in tobacco followed by *Chenopodium album* (56.9 %). *O. ramosa* was the third frequent weed species with a frequency of 53.4%. Other weeds having frequencies of 20-52 % were *Echinophora spinosa, Chondrilla juncea, Chrozophora tinctoria, Cynodon dactylon, Amaranthus blitoides, Heliothropium* spp, *Tribulus terrestris, Convolvulus althaeoides, Sorghum halepense, Amaranthus albus, Tragopogon* spp. In sunflower fields 32 weed species were determined, two parasitic weeds as in the case of tobacco. 11 species had a frequency over 20 %. *C. album* was the most abundant species with a frequency of 80 %, followed by *Amaranthus retroflexus* (77,5 %) and *C. arvensis* (60 %). Other weeds having over 25-47,5 % frequency were *Chondrilla juncea*, *Centaurea cyanus* and *Orabanche cernua* (45 %), *Setaria verticillata*, *Cynodon dactylon*, *Xanthium strumarium*, *Echinophora spinosa* and *Tribulus terrestris.* In tomato fields 43 weed species were determined including two parasitic weeds (*O. ramosa; Phelipanche ramosa* ve *Cuscuta* spp.). *A. retroflexus* was the most frequent weed (81,3 %), followed by *C. album* (78,1 %), *C. arvensis* and *P. oleracea* (68,8 %). Other weeds having a frequencies between 22-53 % were *T. terrestris*, *Heliotropium* spp., *A. blitoides*, *Sorghum halepense*, *Echinochloa colonum*, *C. tinctoria*, *O. ramosa* (37.5 %), *C. dactylon, E. spinosa, Solanum nigrum*, *Cyperus rotundus*, *C. cyanus* and *X. strumarium*.

(51) Mowing as a key method against herbicide-resistant weeds

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Mowing is one of the most common mechanical methods used against weeds. By cutting the above ground of the weeds and when performed before the weeds are able to set seed the further spread is usually discouraged. In other cases, mowing tends to stimulate additional branching, delay seed production or even harden off the plants, making control with postemergent herbicides more difficult. The aim of the present study was to assess the efficacy of mowing alone or combined with glyphosate against three populations of horseweed (*Conyza canadensis*). In particular, horseweed seedlings at the four- to six-leaf stage were transplanted into individual pots, remained outdoors and when the plants were in the bolting stage, several treatments were imposed: a) mowing, b) mowing 7 days after glyphosate spraying and c) mowing immediately followed by glyphosate spraying over the cut stumps. There were also untreated plants. The sprayings were made with 2,16 kg/ha of glyphosate (Roundup Gold®, Monsanto) using a compressed-air, low pressure flat-fan nozzle experimental sprayer delivering herbicide in 300 L/ha water at 250 kPa. Visual estimations on individual plants were made 15 days after mowing (DAM), while at 30 DAM measurements of the number of inflorescence stems (reproductive) per plant, capitula (flower heads) per stem and achenes per capitula were also taken. Our results showed that the number of stems had a wide range in the untreated populations (from 14 to 40 stems/plant). Mowing, either as a single treatment or combined with glyphosate application resulted to a reduction of stems with inflorescence more than 20 and 36 % compared with the untreated plants, respectively. Overall, mowing gave a good result; however the reduction of stems' number and height was significantly higher in the cases of a combined treatment (mowing plus glyphosate). Especially mowing and immediately glyphosate spraying over the cut stumps (treatment c) was the most effective one, resulting to very few and small stems in almost all populations. Mowing resulted to a reduction ranged from 17 to 61% of the capitula/stem, compared with the untreated plants. Moreover, the treatment of glyphosate resulted to even higher reduction, while no differences caused by mowing on number of achenes per capitula. Concerning the effect of mowing on total seed production of each plant, our results showed a significantly lower seed production (37-78% less than the untreated). In conclusion, mowing can clearly be a crucial part of an integrated management system for *Conyza* spp., while the inclusion of glyphosate, before or immediately after mowing results to a significant reduction of seed number (equal or higher than 50% of the untreated plants), regardless of the susceptibility of the population to glyphosate.

(52) Comparison of the germination biology and growth stages of resistant and sensitive wild oats (*Avena sterilis* L.) biotypes to ACCase ınhibitor herbicides

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Research on relative fitness and biology of susceptible and resistant biotypes of *A. sterilis* can be used for developmentearly estimation and prevention of their resistance. In this study the germination biology of four resistant and eight sensitive biotypes belonging to four locations (Marmara, Akdeniz, North Cyprus, Iran) was compared. The germination of seeds at different temperatures (5, 10, 15, 20, 25, 30 ^{0}C) were counted and the germination rate was calculated. This experiment was conducted in petri dishes. The results indicated that the different temperatures have a significant effect on the germination rate of the *A .sterilis* seeds. The Iranian populations do not germinate at 30 ^{0}C and the germination rate of the Cypriote population significantly decreased (9-25%) at this temperature. However, the germination rate of the Iranian and Cypriote biotypes was very high at 5 ^{0}C, while no germination was seen in Mediterranean biotypes at this temperature. The resistant populations germinate fast and also have a higher germination rate. In this study some phenological characteristics (tillering, flowering, maturity) of wild oats belonging to four different location were compared. There were statistically significant differences among populations in terms of phenological stages. İn Iran sensitive populations the plant height and dry weight were significantly greater than in the other populations. A comparison of the sensitive and resistant biotypes belonging to the same locations revealed that, the flowering and seed maturity stages of the sensitive populations of Iranian and Marmara populations occurred earlier than their resistant biotypes. Also the dry weight of above-ground organs of sensitive biotypes was higher in the Iranian and Marmara populations.

(53) Genetic variation and phenological characteristics of ACCase inhibitor resistant and sensitive populations of *Avena sterilis* L.

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Wild oat (*A. sterilis*) is one of the most important weeds in cereals including Mediterranean countries. In this study the genetic diversity of four resistant and eight sensitive biotypes of *A. sterilis* belonging to four locations (Marmara, Akdeniz, North Cyprus, Iran) were analyzed using 5 Randomly Amplified Polymorphic DNA (RAPD) primer sets and a dendrogram was created. Also some phenological characteristics (shoot dry weight, plant height and panicle height) of wild oat belonging to four different location were compared. Using 5 polymorphic primers against 12 biotypes, a total of 21 fragment were amplified, among which 17 (80.9 %) products were found to be polymorphic. The result of cluster analysis showed that the 12 biotypes classified into 2 groups which could be divided into 4 subgroups further. There were statistically significant differences among populations in terms of phenological characteristics. İn the sensitive populations from Iran, the plant height and dry weight were significantly greater than those of the other populations. A comparison of the sensitive and resistant biotypes belonging to the same locations revealed that the dry weight of above-ground organs of sensitive biotypes was higher in the Iranian and Marmara populations.

(54) First report on herbicides resistance of wild oat (*Avena fatua* L.) in Turkey

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This study was conducted to determine the resistance of wild oat populations to herbicides that have been registered to gramineous weeds in wheat production areas of the Marmara Region of Turkey between 2008 and 2011. Thirty six populations out of 45, which were collected from intensive wheat growing areas of the Marmara Region, were identified as *Avena fatua* L. (Wild oats). Some *A. fatua* populations (AV12, AV13, AV42, AV44) showed resistance to diclofop-methyl and fenoxaprop-p-ethyl, which have been extensively used in the given region, in various degrees. Eight resistant populations underwent further tests to determine the cross and multiple resistance status against herbicides that are recommended. Populations were found resistant to clodinafop-propargyl. Cross-resistance was determined against tralkoxydim in the populations AV12 and AV13. However, no resistance to pinoxaden has been found in any population. There was no multiple resistance in both oat species against mesosulfuron-methyl + iodosulfuron-methyl-sodium and propoxycarbazone-sodium + mesosulfuron-methyl.

(55) Detection and degradation of linuron in soils and its uptake by carrots

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Carrot (*Daucus carota* L.) is rated among the important vegetables grown and consumed in many part of Turkey. Carrot is slow-growing and very sensitive crops to weed competition that can severely reduce its yields. To minimize crop yield reduction, the proper weed control strategies must be determined. Mechanical weed control practices are not applicable due to the high crop plant density. The use of herbicides that control the wide range of weed species is commonly used method for the control of weeds in many carrot plantations. Among the herbicides, used in carrot fields against weed, linuron is one of the most-preferred herbicide applied as both pre-emergence and post-emergence in Turkey. Commercial product of linuron (Afalon Dispersion) was applied both pre-emergence and post-emergence (3 leaf growth stage) at the rate of 1750 and 1500 ml ha^{-1}, respectively. Linuron residue levels in the soil and the crop were measured during 4-6 months after treatments. The soil samples were taken from the top of 20 cm of the soil profile, at different days after the linuron application. Residues were extracted from soil and carrot samples taken from experimental plots with acetone, followed by partition with dichloromethane and ethyl acetate. The instrumental determination was carried out using HPLC. Detection limit was 0,004 mg/kg. The recoveries were 100% for soil and 98% for carrot. Degradation equations were found to be logy=0,323-0,012x (y = mg/kg residue; x = day; r = -0,998) at pre-emergence application, logy= 0,167-0,01x (y = mg/kg residue; x = day; r = -0,995), post-emergence application. The persistence of the linuron and its residues in carrots (root) at harvest time was also studied. The residue in carrot samples collected from the parcel applied at rate 1750 ml ha^{-1}, pre-emergence was found < 0,004 mg/kg. The residue in carrot samples collected from the parcel, applied at rate 1500 ml ha^{-1}, post-emergence was found < 0,004 mg/kg.

(56) Determınatıon the effect of nıtrogen on crıtıcal perıod for weed control in cotton (*Gossypium hirsitum* L.)

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The study was carried out in experimental field of Agricultural Research Institute of Kahramanmaras in the Kahramanmaras province of Turkey in 2012 to determine the effects of nitrogen on critical period for weed control (CPWC) in cotton (*Gossypium hirsutum* L.). The experiments are conducted as 3 replications RCBD according to split plot arrangement. *Sorghum halepense* Pers. was the most common weed out of nine species determined in the field. The relative yield data fitted to logistic and Gompertz equations. The CPWC in cotton was calculated for 10% acceptable yield loss (AYL). The CPWC was determined as 62.64-640.50 ^{0}C under 0 kg/ha N, 158.50-579.68 ^{0}C under 150 kg/ha N and 171.13-540.83 ^{0}C under 300 kg/ha N. Under nitrogen applications, CPWC was shorter, which is started later and ended earlier comparing to no nitrogen added treatment. It is concluded that nitrogen might be used by cotton better than by weeds, which gives the cotton higher competitive ability.

(57) Determination of weed emergence in sunflower

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Sunflower is a major crop in Turkey. Weeds are among main obstacles in sunflower production. The emergence of 12 major weeds in sunflower observed to find out their emergence patterns during the cropping season in 2012. Mean emergence time (MET) and emergence rate index (ERI) were calculated using data from field counting of emerged weeds every other week. Weeds were divided in two groups according to results: Weeds emerging in early cropping season, which are *Alopecurus myosuroides, Amaranthus retroflexus, Chenopodium album, Datura stromonium, Polygonum lapathifolium* and *P. persicaria*; and species emerging during the whole season which are *Abutilon theophrasti, Convolvulus arvensis, Cyperus rotundus, Echinochloa crus-galli, Portulaca oleracea* and *Xanthium strumarium*). The data was based on thermal time (GDD) because GDD are good predictor for weed emergence. It is concluded that modeling weed emergence will help sunflower growers make better crop and weed management decisions.

(58) Weed seed bank as affected by weed and crop management

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Investigations of seed banks and the documentation of weed seed dispersal in different ecosystems are valuable tools for the following reason. Comparing these two, can contribute to long-term weed management strategies and allow predictions of the existence of specific weeds in a given area. Therefore, a study was carried out in autumn 2011 on farmland, in orchards and in pastures at Saqqez city, Kurdistan province, Iran to evaluate seed dominance of different species in different ecosystems. Different crop rotations were randomly selected around the town (approximately 20 km distance from each other). There were 5 different rotations included: two continuous cultivations of wheat (dry and irrigated; ww), wheat – sugar beet (ws), wheat – peas (wp), pasture (p) and orchard (o). Seed bank sampling followed a systematic w pattern which was done in three depths (0 - 5, 5 - 15 and 15 - 25 cm). Then seeds from these samples were isolated and identified. Different soils in this study contained 114 plant species from 24 plant families. Results showed that *Eragrostis cilianensis* (All.) Vign. and *Roemeria refracta* DC. were the most common species among all ecosystems. Disturbance factors seem to have no effect on the mentioned species as they can survive under all ecological conditions. No rotation, but pasture affected the abundance of *Amaranthus chlorostachys* auct.. *Amaranthus* had the highest frequency in ws (50%) . *Salsola ruthenica* L. was only found in wp rotations and was more common in disturbed dry lands. Also, *Sinapis arvensis* L. and *Vaccaria oxydonta* Boiss. had the highest frequency in wp rotations. Dicot species such as *Galium tricornutum* Dandy, *Lamium amplexicaule* L., *Portulaca oleracea* L. were notably abundant. *Avena ludoviciana* Durieu was common in irrigated monocultures of wheat fields as the standard method of weed control was a 2,4-D application which did not affect wild oats. We observed a diverse composition of seed banks with annual broadleaf, winter grass and perennial species (*Lactuca serriola* L., *Avena ludoviciana* Durieu, *Setaria viridis* L. and *Cynodon dactylon* (L.) Pers.) because of suitable growing conditions in orchards. Perennials and annuals such as *Ziziphora capitata* L., *Anthemis cotula* L., *Stipa barbata* Desf., *Aegilops ovata* L. and *Poa bulbosa* L. had the highest frequency in the pasture seed bank. In general, annual species were the prevailing species in the seed bank of most rotations with a higher number of dicot species than monocot species. Despite the rotation background and variability of tillage timing (fall and spring), the lowest monocot/dicot ratio was found in the wp cultivation (1⁄4.8); and the highest monocot/dicot ratio was in both dry and irrigated ww (1⁄2), which was partially the same as in pastures. This high ratio can be affected by the taxonomic similarity of crops and the lack of rotation with other crops. Most of the species in pasture (except a limited number), did not occur in any other rotation, but some of the species were similar to what was seen in orchards. It is concluded that disturbance had the order of pasture> orchard> agricultural land. Also, orchard ecosystem could have the same species as pasture and crop rotations. Therefore, it is possible to predict the presence and abundance of identified weeds and also to develop a comprehensive program to reduce yield losses and prevent seed bank expansion.

(59) Studies on the interaction of seed vigor with weed competition

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Crop seed vigor is perceived as an attribute of a genotype to demonstrate a high rate of germination and emergence and produce vigorous seedlings; having a significant effect on competitive ability of the crop over the weeds. The main hypothesis is that low seed vigor interacts with competition with weeds by two ways: firstly affects the germination, emergence patterns, and secondly modifies growth characteristics of plants derived from high and low vigor seeds. Data will be presented from: 1. Greenhouse experiments on the interaction of germination, emergence patterns of plum tomato seed vigor with weeds [green foxtail (*Setaria viridis*) and jimsonweed (*Datura Stramonium*)]; and 2. Field experiments on the competition of a crop (derived from high and low vigor maize seeds) with weeds (naturally occurring species and population). Final (E_{90}) and uniformity ($U=E_{90} – E_{10}$) of emergence was determined for HV and LV seeds; green foxtail was more competitive than jimsonweed, for most growth characteristics, to the crop regardless of the plum tomato vigor level. In field experiments, LV maize seeds produced plants with lower growth with less suppression of weed dry matter. These results show that seed crop vigour can influence crop competitive ability against weeds, and therefore would be an important tool for integrated weed management systems.

(60) Seedling emergence of *Convolvulus arvensis* affected by moisture regimes and soil depths

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Convolvulus arvensis is a perennial troublesome weed in many crops including wheat, bean, soybean, lentil, chickpea and several other irrigated crops. It is reproduced both by seeds and underground creeping roots. The knowledge of seedling emergence behavior in soil profiles helps to improve the control of the weed species in the cultivation. This information is of important value when an integrated approach is necessary to target a troublesome weed species like *C. arvensis*. A greenhouse experiment was conducted to study the effect of soil depth and irrigation periods on seedling emergence of *C. arvensis*. Seeds of *C. arvensis* were collected and buried at soil depths of 0, 2, 4, 6, 8, 10 and 12 cm in pots. The moisture regimes were applied by irrigation periods of 1-2 (W1), 4 (W4) and 8 (W8) days. The pots were kept in a greenhouse at a temperature of 19.5±2.5 ºC for 3 weeks. The experimental design was factorial based on completely randomized block with four replicates. Four pots were also left without sowing seeds as control to check for possible *C. arvensis* seed infestation in the soil before the experiment. The numbers of emerged seedlings were counted and removed every day until the end of the experiment (21 days) when no more seedlings emerged. The data were subjected to analysis of variances . For the calculation of emergence lag-time a cumulative emergence curve for each irrigation regime at each depth was modeled by the Weibull function. Cumulative emergence was calculated as a dependent variable and time from sowing seeds as an independent variable. There was a significant difference among soil sowing depths and irrigation periods in total seedling emergences. In all irrigation periods, the total seedling emergence was low for seeds placed at soil surface (46% in W1, 38% in W4 and 29% in W8), increased in seeds buried at 2 cm depth (88% in W1, 86% in W4 and 75% in W8) followed by a decrease at the rest of the depth. It reached its minimum (3% in W1 and 17% in W4 and 3% in W8) at 12 cm depth. The eight-day irrigation period yielded the lowest numbers of emerged seedlings. Time of seedling emergence was linearly delayed with increasing of depth in all irrigation periods. Therefore, total number of seedling emergences can either be reduced by delayed irrigation or stimulated and subsequently increased by frequent irrigation. In addition, lower numbers of emerged seedlings with soil depth can be considered in the management of the species by adapting soil cultivation operations. This information could be useful to design a technique to stimulate seedling emergence in *C. arvensis* early in the season to control the seedling before the crop sowing and establishment.

(61) Physical, cultural and chemical weed control in direct seeded rice (*Oryza sativa* L.)

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Cultivating a water saving (direct seeded) rice is inevitable in the wake of the severe water shortage in Pakistan during the recent decade. Weeds badly infest direct seeded rice fields causing 30-75% yield losses in Pakistan and Turkey. Physical, cultural and chemical methods were evaluated for controlling weeds and improving the performance of direct seeded fine rice. The tested weed control methods included hoeing at 25 and 45 days after sowing (DAS), interculture with tine cultivator (15 and 25 DAS), chemical weed control using pendimethalin (1137 g a.i. ha^{-1}; pre-emergence) and penoxsulam (15 g a.i. ha^{1}; post-emergence), mulching with wheat straw (4 t ha^{-1}) and intercropping with *Sesbania*. A control plot was also maintained for comparison. All the weed control measures significantly affected the density and dry weight of weeds over the control treatment. The most effective weed control practices were two hoeings (25 and 45 DAS) and the post-emergence application of penoxulam at 15 g a.i. ha^{-1} which gave 90.72 % and 89.01 % control, respectively. Hoeing, penoxulam, wheat straw mulching and pendimethalin produced grain yield of 3.35, 3.25, 2.73 and 2.65 t ha^{-1}, respectively. It was concluded that post-emergence application of penoxulam and hoeing (25 and 45 DAS) were most effective weed control measures for suppressing weeds and increasing rice yield and economic returns.

(62) Soil-applied Herbicides for Weed Control in Chickpea (*Cicer arietinum* L.) under a Dryland Cropping System

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Chickpea is an important annual grain legume in Greece. It is adapted to arid environments and performs well in low-input production systems, offering a high value alternative to cereal production. However, chickpea production is constrained by the poor competitive ability of the crop against weeds and the limited options of chemical weed control due to few registered herbicides currently available in Greece for use in chickpea. A field trial was conducted at Thermi in northern Greece to study the performance of two herbicides applied alone and a dual mixture, all soil applied at two rates, on two popular Greek chickpea cultivars ('*Amorgos'* and '*Andros'*) that were planted and cultivated in spring under a dryland cropping system. Herbicide treatments consisted of benfluralin applied at 1170 and 1350 g a.i./ha (preplant incorporated), S-metolachlor at 960 and 1920 g a.i./ha (in pre-emergence application), and a dual mixture of S-metolachlor *plus* prosulfocarb at 384+2000 and 576+2000 g a.i./ha (in pre-emergence application). Selectivity of herbicide treatments were assessed visually by assessing possible symptoms of phytotoxicity and by recording the number of plants at full emergence, the plant height and fresh weight at the initiation of flowering, the number of pods and seed yield at harvest, compared with a non-treated (weedy) and a weed-free (hand-weeded) control. Efficacy of the treatments was visually estimated compared to the non-treated control. Shortly after chickpea emergence, some plants of both cultivars in plots treated with the herbicide mixture exhibited minimal (<5%), however transient, phytotoxicity symptoms in the form of slight chlorosis. All herbicide treatments did not affect the plant emergence, the plant height and fresh weight recorded at the beginning of flowering. Plants in plots treated with benfluralin and the mixture of S-metolachlor *plus* prosulfocarb exhibited number of pods and yield similar to those of the weed-free control, whereas, plants in plots treated with S-metolachlor produced fewer pods and lower yield compared to those of the weed-free control. The dominant weed species were silverleaf nightshade (*Solanum elaeagnifolium*) and common lambsquarters (*Chenopodium album*). None of the chemical treatments effectively controlled the former weed; however, the differences in pod number and yield were due to the different control level of common lambsquarters.

(63) Weed Science Society of Greece (WSSG): actions and collaborations

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Weed Science Society of Greece was established in 1982 as a national non-profit professional society aiming to promote and encourage research and technology in all aspects of weed science, herbicides and growth regulators. Members of the WSSG are academics from all agricultural universities and technological institutes, researchers, public and private agriculturists that have a direct involvement on weed science. The website (www.eze.org.gr) is designed to inform WSSG members and interested parties of the activities of the Society, and to disseminate weed science knowledge across Greece and beyond.

WSSG sponsors the following actions:

1. A biennial scientific conference with Greek and English presentations. Frequently, invited speakers (native or foreign ones) are giving presentations on all aspects of weed science. The next scientific conference is due in 2014 (place not announced yet).
2. A number of daily meetings aiming to disseminate all latest developments in weed science, address major problems (invasive/alien/noxious species, resistance) and provide solutions to all stakeholders.
3. Informing scientists, farmers and the public on weed science issues on latest developments on farming practices (for agricultural products and foods) and national action plans (SUD directive).
4. The development of a Greek –English Weed Science Dictionary.
5. Launching working groups based on thematic and geographical areas of interest.

WSSG aims to participate and exchange research and technology experiences with other European weed societies.

(64) Determination of the effect of different additives on the performance of 2,4-D amine

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The purpose of this study is to determine efficiency of effective minimum rates of 2,4-D amine with addition of different additives and to investigate practicability of these doses. The study was conducted under pot conditions between 2011 and 2012 as 5 replications and repeated 3 times. Common chamomille (*Matricaria chamomilla* L., MATCH), yellow sweetclover (*Melilotus officinalis* (L.) Desr., MELOF), wild mustard (*Sinapis arvensis* L., SINAR) and rough bedstraw (*Galium tricornutum* Dandy, GALTR) were used as model weed species which are the most common broad leaved-weeds of wheat field in the region. Sunflower oil, motor oil, and Ammonium sulfate fertilizer at the rate of 1% were added into the herbicide solution prepared for increasing the efficiency of herbicide's low doses. Innogard 309 (100% organic silicone) 25 ml/100 L, which is one of surfectant used as a commercial preparate on the market, was also used. ED_{50}, ED_{90}, and recommended doses (300, 800, 1600 g/ha) of herbicide (Hektafermin, 500 g a.i /L) were applied alone and with additives using 200 L/ha spray volume with flat fan nozzles (11002). Shoot dry weight (% of what?control?) was determined 4 weeks after herbicide applications. Results showed that the herbicide 2,4-D amine was ineffective in *M. chamomilla* control, even with the tested additives. Although sufficient efficacy was not obtained even with recommended dose of herbicide in control of MELOF, an efficacy of 90 % and above was achieved by the ED_{90} dose with ammonium sulfate and Innogard 309. Similarly, it was determined that while the effect obtained in recommended dose of herbicide was at lower levels (70-80%) in SINAR control, the efficiency increased with addition of additives and was 93% and above especially when the dose ED_{90} was applied with ammonium sulfate and Innogard 309. In this case, MELOF and SINAR controls were found to be possible by decreasing herbicide rate to 50%. Efficacy level of herbicide was lower (77%) in control of GALTR. Consequently, it was specified that addition of additives was a very significant factor affecting practicability of minimum doses of herbicide, and varied based on weed species, herbicide and t doses of the same herbicide. While weed species had different susceptibility to the herbicides and it could be possible to control some weed species with even much lower doses of herbicide than recommended, even recommended doses were observed to be insufficient for control of some weeds.

(65) The sensitivity of some sunflower cultivars to residue of mesosulfuron methyl + iodosulfuron methyl sodium under growth chamber conditions

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Mesosulfuron methyl (3%) + iodosulfuron methyl sodium (0.6%) (MM+IMS) is widely used to against some troublesome broadleaved and grassy weeds infesting wheat crops in Turkey. Following to the application, MM+IMS may remain in soil more than one year. After one drought season, severe damage can be observed on the subsequent crops, such as sunflower, lentil, and maize, due to the residual effects of MM+IMS in the soil. The sensitivity of sunflower cultivars to MM+IMS residues in laboratory bioassays that is cost-effective, simple, and sensitive methods for the detection of certain herbicide residue is not well described. A growth chamber bioassay was conducted to determine the sensitivity of sunflower cultivars to MM+IMS residue in the soil. Seventeen sunflower cultivars were examined to assess their sensitivity level and differences in the sensitivity of the sunflower cultivars to MM+IMS soil residue. The bioassay was conducted in the growth chamber (16 h light (100 µE m^{-2} s^{-1}) at 24 ± 1°C], 8 h dark at 15 ± 1°C. Doses of MM+IMS, ranging from 0.0 to 120 µg ai kg^{-1}, was applied to the soil taken from nonagricultural land. One pre-germinated sunflower seedling was then sown in a pot containing artificially contaminated soil and grown for 15 days. The pots were placed in the growth chamber and irrigated with deionized water. The roots were gently washed under tap water and the root lengths were measured. Tolerance levels of sunflower cultivars to MM+IMS and the differences of tolerance levels were calculated according to the log-logistic model and the selectivity index that reduced the root length by 50% (I_{50} [variety a]/I_{50} [variety b]), respectively. Leila was the most sensitive sunflower cultivar to MM+IMS soil residue with an I_{50} value of 0.62 µg ai kg^{-1}. According to the selectivity index values, half of sunflower cultivars were as sensitive to the MM+IMS residue as Leila.

(66) Field studies to control the invasive weed species *Euphorbia heterophylla* in cotton

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Euphorbia heterophylla has been recently documented as a new weed record in cotton and plum tomato, in Viotia region, Greece. Results will be reported on seed germination patterns and field experiments to control this species in cotton. Light had no significant effect on seed germination in the whole range (15 to 40^{o}C) with optimum germination (82 to 90%) occurred at temperatures from 25 to 35 C although some germination was recorded at 15 or 40^{o}C temperature. Initial growth of the weed was smaller than cotton up until the squares (65 DAP) but afterwards the weed was continuously higher than the cotton, and at final balls (125 DAP) was approximately 40% higher than cotton. The species had a short reproductive circle and at cotton growth stage of squares (50 DAP), seeds had a 42% germination capacity; germination was sustained high (>88%) at the cotton growth stage of 1st bloom and subsequent growth stages. Field experiments were conducted to investigate the efficacy of s-metolachlor, fluometuron, acetochlor, and pendimethaline applied either as PPI or PRE alone or in some combinations. In addition, flumioxazin was applied as a POST-directed. All treatments gave minimal control compared to untreated control. The results of this study aimed to provide research information for developing effective control strategies necessary for minimizing its spread to new areas and therefore avoiding the risk of being a highly invasive species for other spring crops in the country.

(67) Investigation of planting date, fertilizer and herbicide effects on Egyptian Broomrape (*Phelipanche aegyptiaca*) control in tomato (*Lycopersicon esculentum* L.)

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In order to evaluate the effectiveness of planting date (May 20th (conventional) and June 10th), different fertilizer and herbicide amounts were applied at both dates. The fertilizer amounts were [1) 350 kg ha-1 of urea (conventional), 2) 550 kg ha-1 of urea (conventional + 200 kg), 3) conventional urea + 400 kg ha-1 ammonium sulfate (N 21% and sulfur 24%). The following herbicide amounts were sprayed: sulfosulfuron 75% WG (commercial material) with 25 g ha-1 twice at 25 and 40 days after transplanting)} and {Glyphosate SL41% (commercial class), (applied dose of 50 ml* per hectare twice at 25 and 40 days after transplanting)} for Phelipanche control in tomato. The experimental design was based on a split factorial randomized complete block arrangement with 18 treatments in three replications in 2012 in the Mazrae Nemouneh of Astan Ghods Razavi of Mashhad. In this study, a weed free and a weedy control (a combination of planting date May 20, urea 350 kgha-1 and zero dose) were also considered. Based on these results, none of the treatments could influence weed and tomato traits significantly. On the other hand, herbicides reduced tomato yield more than the weed infestation. Therefore, we recommend the planting date May 20 only. In high Phelipanche infested plots, a treatment combination of planting date May 20 followed by sulfosulfuron application should result in the best control of Phelipanche in tomato and in highest yields.

(68) Investigation of planting date, manure, cultivar on Egyptian Broomrape (*Orobanche aegyptiaca)* control in tomato (*Lycopersicon esculentum* L.)

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The effects of planting date (May 20th (conventional) and June 10th), animal manure (cow manure at two levels (40 (conventional) and 80 Tha-1) and chicken manure 12/5 Tha-1) were tested with different Orobanche infested tomato cultivars. The cultivars were Sterling (conventional), Khorram and Peto early CH). The experiment was based on a randomized complete block design with a split-factorial arrangement and 18 treatments in the Mazrae Nemouneh of Astan Ghods Razavi of Mashhad in 2012. Results indicated that none of the factors, except cultivar, could influence weed parameters such as number of stems, number of broomrape nodules on the roots of each tomato plant and dry weight of Orobanche significantly. Also with considering the same yield in planting date and cultivar traits and only significant interaction effect between planting date × manure in the other hand. The highest reductions of negative Orobanche effects were achieved in the following plot: May 20th planting date followed by cow manure 80 T ha-1 and or chicken manure 12/5 T ha-1 with the Sterling tomato cultivar.

(69) Effect of sulfosulfuron, aclonifen, foramsulfuron and metribuzin herbicide on tomato production (*Lycopersicon esculentum* L.)

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In order to study the effect of herbicide on weed control and tomato yield, a field experiment based on RCBD with three replications was implemented in Chenaran, Khorasan Razavi 2010. The experiment treatments included sulfosulfuron at 0, 20, 40, 60 and 80 g ha^{-1}, aclonifen (0, 1, 2, 3 and 4 L ha^{-1}), foramsulfuron (0, 1, 1.5 , 2 and 2.5 L ha^{-1}) and metribuzin (0, 100, 200, 300 and 600 g ha^{-1}). Control plots consisted of untreated control and weed control respectively. Sampling was done to measure weed density, dry matter and control percentage and tomato yield in 20 days after herbicide treatment and the end of growth season. Results indicated that aclonifen, sulfosulfuron and foramsulfuron had the lowest weed density and dry matter, and aclonifen and metribuzin provided good and weak weed control, respectively. Totally, foramsulfuron with (1.5 and 2.5 L ha^{-1}), aclonifen with (4 L ha^{-1}), metribuzin with (600 g ha^{-1}) and sulfosulfuron with (20 g ha^{-1}) had provided good weed control and also the highest tomato yield with the lowest crop injuries.

(70) Effectiveness and selectivity of herbicides in Stevia (*Stevia rebaudiana* Bert. Bertoni) Experiments

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Stevia as a crop is still under study in Greece. The first commercial crop, more than 60 ha. is expected in 2013 and it is estimated that the crop acreage will increase significantly the coming years. Research and experience in Greece and other countries showed that stevia is slowly developing during the first month after transplanting in the field and cannot satisfactorily compete with weeds. Studies on weed control in stevia are almost non existing. Herbicide experiments in stevia have been carried out since 2007 in Greece. Three (benfluralin, ethalfluralin and trifluralin) preplant incorporated (PPI) and 10 pretransplanting (PRET) herbicides (aclonifen dimethenamid, flumioxazin, linuron, metribuzin, napropamide oxadiazon, pendimethalin, propyzamide and s-metolachlor) were evaluated in stevia experiments carried out, depending on the herbicide, for 2 to 6 years in 2007-2012 at the Experimental Farm of Univ. of Thessaly at Velestino in Greece. The experimental design used was a RCB with 3 replications. The plot size was 4x6 m, had 5 rows spaced 75 cm apart with plants on the row spaced at 30 cm. Data were obtained at 20 and 40 days after transplanting (DAT) for herbicide weed control and selectivity on stevia and every 15 days for plant height, and at harvest for yield and stevioside concentration. Results showed that benfluralin, ethalfluralin and trifluralin, as PPI and, flumioxazin, linuron, metribuzin, oxadiazon, pendimethalin, propyzamide and s-metolachlor as PRET gave very good weed control, were selective on stevia, and did not affect stevia height, yield, or stevioside concentration in dry stevia leaves. The herbicides aclonifen, dimethenamid, and napropamide also were effective on weeds but showed less selectivity on stevia. The grass herbicides fluazifop-p, propaquizafop and quizalofop were tested in demonstration trials by growers. It is noticed that all the studied herbicides are or were registered for use in some crops in Grecce but none of them in stevia. In conclusion, a number of herbicides either as PPI or as PRET were found effective for weed control and selective on stevia. It is suggested that at least some of the above herbicides found effective and selective on stevia must go through the registration process so that stevia growers have the possibility to control weeds and secure stevia yield in the field.

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