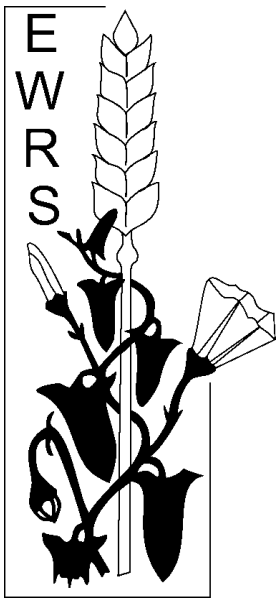

EUROPEAN WEED RESEARCH SOCIETY

2nd WORKSHOP OF THE EWRS WORKING GROUP:

WEED MAPPING

Jokioinen, Finland
21-23 September 2011

Proceedings

edited by
Terho Hyvönen and Marjo Segerstedt

MTT Agrifood Research Finland

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Scientific programme

Thursday, September 22nd

08:30 Departure from the Scandic hotel by bus

09:15 Welcome and organisational announcements, **T. Hyvönen & J. Salonen**
09:30 Status on Weed Mapping Activities / European Survey Projects, **H. Krähmer**

National and regional surveys
Chair: J. Salonen
09:45 Weed surveys in Nordic and Baltic countries, **T. Hyvönen & O. Auskalnienė**
10:00 Weed surveys in agricultural fields in Latvia, **I. Vanaga**
10:15 Weed surveys in Sweden, **L. Andersson**
10:30 Weed surveys in Czech Republic, Slovenia, Slovakia and Austria, **M. Kolářová**

10:45 *Coffee Break*

11:00 γ -diversity of arable weeds in the Czech Republik, **M. Kolářová**
11:15 A new geodatabase software for the management and interpretation of data from weed surveys, **P. Hamouz**
11:30 Weed surveys in Germany, Benelux, Great Britain, Switzerland, **B. Gerowitt**
11:45 Multivariate analysis of weed survey data from German oilseed rape fields, **B. Gerowitt**
12:00 Surveying arable vegetation in Germany - a geobotanical perspective, **S. Meyer**
12:15 Weed surveys in cotton fields in the Eastern Mediterranean countries, **G. Economou & A. Uludag**

12:30 *Lunch*

13:30 The Grasses of Greece: Records of occurrence and geographical distribution using GIS, **G. Economou**
13:45 Vegetation mapping in Italy: an overview, **G. Bocci**
14:15 National weed surveys in Hungary, **R. Novák**

Spatial weed distribution and methodology
Chair: T. Hyvönen
14:30 Exploring farmers spatial knowledge of within-field variation of soil and weed abundance: incentives for participatory weed mapping, **S. Heijting**
14:45 Spatial weed distribution in the major cotton area of Central Greece using Ordered Weighted Averaging (OWA) method, **D.P. Kalivas**
15:00 GIS analysis of spatial structure in annual and perennial weed populations, **D.P. Kalivas**
15:15 Understanding the present distribution of parasitic weeds of the genus *Striga* and predicting its potential future geographic distribution in the light of climate and land use change, **M. Cotter**

15:30 *Coffee Break*

World Cafe **Chair: H. Krähmer & T. Hyvönen**
16:00 Two World-Cafe-Rounds on the following themes:
1) Why do we map weeds and what do we want to achieve with the results?
2) What are the databases for our maps, how do we validate and document our data and how do we finally map weeds independent of national borders?

18:00 Departure to hotels
20:00 *Harvest Dinner*
22:30 Departure to hotels

Friday, September 23rd

08:30 Departure from the Scandic hotel by bus

Weed resistance mapping
Chair: H. Krähmer

09:00 Mapping of herbicide resistant weeds in Italy, **S. Panozzo**
09:15 Mapping of herbicide resistant weeds in Great Britain Germany and France, **J. Ruiz-Santaella**
09:30 Using citizen science for invasive alien plants mapping, **A. Uludag**
09:45 Weed mapping in Serbia, **M. Meseldzija**

Poster session

09:45 Poster Display
An example of field vegetation survey from Lithuania, **V. Rašomavicius**
First weed mapping in oilseed crops in Finland, **J. Salonen & P. Laitinen**
Weed abundance documentation in winter wheat - The emergence of blackgrass (*Alopecurus myosuroides* Huds.) with and without weed control measures and the resulting variation of biodiversity parameters for arable land, **I. Meiners**
Weed composition in German maize fields 2002–2004 and its determining factors, **F. de Mol**
Spatial and temporal changes of invasive weeds in Northeast Croatian arable fields, **E. Stefanic**

10:30 *Coffee Break*

11:00 Presentation of World-Café-Results
12:30 Concluding remarks – actions, next meetings

12:45 *Lunch*

Transport to Forssa (to the bus station)
Connection from Forssa to the Helsinki airport at hourly intervals.

Foreword

The working group on Weed Mapping is one of the youngest working groups of the European Weed Research Society (EWRS). The kick-off of activities took place in the 1st Workshop arranged in Prague, Czech Republic in 2009. In 2010, there was a "promo-evening" with short presentations of on-going weed mapping activities for the participants of the EWRS Symposium in Kaposvár, Hungary. And now, some 30 participants gather together in Jokioinen, Finland for the 2nd Workshop. You all are cordially welcome.

The aim of the workshop is to learn about the latest weed mapping activities in Europe. This includes both micro- (plots, small areas) and macro-mapping projects (regions, countries). Methodology will be emphasized as we would like to find tools to allow us to combine data for an European overview of weed distribution and to derive conclusions and trends from our existing data. There will be three sessions for oral presentations. In addition, we have chosen relevant subjects for the "world café" discussion session and allocated some time and space for Posters.

This Book of Abstracts is distributed only to the workshop delegates to help you to follow oral presentations and to give additional information about the posters. The workshop Proceedings will be published in electronic form which will be publicly available at the working group's web site: http://www.ewrs.org/weedmapping/default.asp

There is a long tradition of national weed surveys in Finland. The first extensive survey of weed flora in spring cereals was carried out in the early 1960s by MTT Agrifood Research Finland. Similar studies have taken place in the early 1980s, in the late 1990s and most recently in 2007-2009. Repeated surveys on the occurrence of weeds yield valuable information for various purposes, including for instance exploring the scientific questions regarding weed distribution and agro-biodiversity, advisory services for farmers and product development at chemical industry.

We want to acknowledge all the participants for your contribution to the workshop. We all are grateful to our working group chairman Dr. Hansjörg Krähmer who has made a tremendous effort in reviewing the Abstracts and in keeping contacts with research scientists all over Europe and other continents. The financial support from the EWRS for the workshop is highly appreciated.

Jokioinen, September 12th, 2011

Jerho Hyvönen, Regional coordinator of the Working Group in the Nordic and Baltic countries

Jukka Salonen, EWRS National representative in Finland

Weed surveys in agricultural fields in Latvia

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Periodic surveys of the weed flora of agricultural fields in Latvia began in 1947; they were organised by the botanist Alfreds Rasins. The assessments were made in winter cereals in one region of central Latvian by evaluating the occurrence of individual weed species (recorded as percentage prevalence). Investigations were continued between 1972 and 1979 in 23 monitoring fields with 4 crop rotation systems in 4 districts of western, southern, south-eastern and central Latvia. The assessments were made by counting the plant numbers of each individual weed species within each field with the aid of a 0.02 m^2 frame once during the growing season.

Weed surveys have been carried out from 1980 to 1982 in cereals in 4 districts of southern, western and central Latvia. The occurrence of each weed species within a 0.02 m^2 frame was recorded at 50 points in each field. Plant densities (plants m^{-2}) were calculated from the frequency percentage for each species using a formula based on the negative binomial distribution given by Rasiņš and Tauriņa (1982).

In 1994 to 1996 a joint programme investigated the distribution of weeds in Latvia, their botanical composition, dynamics and harmfulness, and optimisation of weed control and limiting measures in cereals, potato, sugar beet, flax, pastures and meadows, grass crops and fallow. The crop rotations and the crop husbandry, including weed control measures, were determined by the individual farmers in accordance with their commercial interests. Annual counts of weeds were made in 21 of the 26 regions of Latvia according to the method of Rasiņš and Tauriņa.

Assessments by the same method were continued in the south-eastern part of Latvia between 1997 and 1999. In the central and western part of the country observations in monitoring areas were made every year from 1996 to 2010. In the north-eastern part of Latvia counts of weeds in the actual flora (1994 to 2002) and in the seedbank (1997 to 2002) were carried out in the same fields each year in five districts to determine the abundance of weed species and their groups and the dynamics of their occurrence.

There were no sharp differences in the spectrum of dominant weed species during 1994 to 2002 in the monitoring areas of the north-eastern part of Latvia compared with other regions of Latvia. However, compared with the results of the assessments in 1947, it was established that in winter cereals some individual species were not recorded in the crop: *Bromus secalinus*, *Agrostemma githago*; the occurrence of some species had decreased remarkably: *Achillea millefolium*, *Tussilago farfara*, *Rumex acetosella*, *Equisetum arvense* and *Galeopsis* spp.; and others had increased: *Tripleurospermum inodorum*.

None of the results of any of these surveys have been mapped so far.

Reference

Rasiņš, A. & Tauriņa, M. (1982) Nezāļu kvantitatīvās uzskaites metodika Latvijas PSR apstākļos. Ieteikumi; Rīga: LM ZTIP, 24 pp.

γ -diversity of arable weeds in the Czech Republic

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Our three-year phytocoenological survey was conducted in the Czech Republic from 2006 to 2008. Totally, 27 conventional and 35 organic farms were chosen. Winter cereals, spring cereals and root crops fields were selected for a sampling. At each field, one phytocoenological relevé of standard size of 100 m² was recorded in the field center. The coverage of species was estimated using nine-degree Braun-Blanquet cover-abundance scale. Monitoring was performed during the period of fully developed vegetation. Total **γ**-diversity was expressed as total number of weed species recorded, and then **γ**-diversity of different types of farming, in different altitudes and crops was stated. Totally, 172 weed species have been found. In conventional and organic farming 123 and 162 species have been recorded, respectively. *Chenopodium album* was found as the species with the highest constancy in both types of farming. In the conventional farming, *Viola arvensis*, *Fallopia convolvulus*, *Polygonum aviculare* etc. were also found with very high constancy. In the organic farming, *Fallopia convolvulus*, *Cirsium arvense*, *Tripleurospermum inodorum* etc. were very frequent. Differences in **γ**-diversity in individual crops and in different altitudes have been found.

A new geodatabase software for the management and interpretation of data from weed surveys

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A software for the collection and management of data from weed surveys (relevés or single species data) was developed. The software allows imports of data, a general overview of weed species occurrence in selected regions, and the definition of weed species importance in individual crops under various management systems. Changes in the weed flora can also be analysed. The software is based on Document Management System. Internet interface with multilevel access authorisation ensures the availability of defined modules of the system for the administrator, for competent regional scientists and also for the public. Beyond the standard header data the crop, forecrop, the management system, herbicides applied etc. can be recorded for each relevé. An effective searching tool is involved that allows many types of analytical outputs. Data exchange with other applications is ensured via import/export capabilities (XML and CSV formats). The system is able to create maps of relevé positions and also summary maps of the species occurrence in defined regions.

Multivariate analysis of weed survey data from German oilseed rape fields

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Data on the occurrence of weed species in 1463 German oilseed rape (OSR) fields were used to investigate the interactions of management practices and ecological processes with weed species composition.The relative contribution of 25 characteristics of climate, site and crop to weed species composition was analysed by partial canonical correspondence analysis (pCCA). According to pCCA the considerable differences in weed species composition of OSR fields were mainly associated with the crop preceding OSR; the tillage intensity and soil quality. Precipitation was the most important environmental parameter. Factors driving the occurrence of weed species differed for the categories ‘common’, ‘frequent’ and ‘rare’. Common weed species showed the strongest response to factors acting at the field scale such as crop sowing date or soil quality. Frequent species were affected by local environment; and the occurrence of rare weeds depended on large-scale geographical position as well as cropping intensity. Partitional clustering of thematically grouped explanatory variables resulted in the identification of four farming systems with different soil properties and management. Two farming systems differed in OSR cropping intensity; and five ecoregions each with characteristic and statistically verified OSR weed communities.

Surveying arable vegetation in Germany - a geobotanical perspective

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In Germany, the first descriptions of arable plants can be found in several famous herbal books of the Renaissance. This was also the time, when the descriptions of plant became formalized, and when the first herbarium collections were established. In the early 18th century, the first special reports on "weeds and agriculture" were published. These historical sources are essential tools for vegetation ecologists to understand the development of the arable flora over time; they do, however, hardly provide quantitative data.

Up to the early 20th century, all studies about plants occurring in fields focused on a species level. Subsequently, new methods of describing plant communities and thus also measuring changes were introduced. The aim of phytosociological approaches has been to get more precise data that are collected with standardized methods allowing a formal analysis of the vegetation (qualitative and quantitative data). Phytosociology is still commonly applied, not least in Germany, where ≥30,000 relevés are available for the purposes of comparison. Projects have been initiated that aim at digitalizing these data and compile them in databases. These databases can then be used to analyze changes in the abundance/occurrence of arable plants over several decades, and also over large landscape areas.

In comparison to weed flora surveys conducted under an agricultural-economic point of view, there are some differences in phytosociological mapping techniques such as:

1. Sampling period
   In most cases phytosociological relevé sampling is carried out shortly before the time of harvest, because this is the time of the year when arable communities are fully developed. In special cases, sampling could also be done in spring (to detect spring-flowering plants) or in late summer (to detect stubble-flowering plants).

2. Sampling technique
   In former times, relevé sizes between 5m² and 50m² were used, and samples were mostly placed in the field center. Today, due to the generally lower individual numbers, relevé sizes have to be enlarged to 100m² in order to capture the full species spectrum. Relevés are today still taken in the field center but also on field margins. Transect studies are used to measure the effects of adjacent habitats on the floristic composition of segetal communities.

Up to now it has been difficult to combine arable vegetation data from an ecological and agronomic background, because of differences in mapping techniques. In the future new mapping schemes should be discussed with the aim to develop standard approaches.

Weed surveys in cotton fields in the Eastern Mediterranean countries

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The current work of our sub regional working group has the purpose to provide shared data standards on cotton weed mapping, so that different data sets will be compatible. The further aim is to provide "how to" instructional information on mapping techniques to help those working on weed issues to develop mapping systems that will support project goals on both a local and regional level. In particular, by this initial work we give emphasis to cotton crop weed surveys taking into account the major importance of the crop for the most of the countries surrounding the Mediterranean basin. Thus, maps and inventory information will also be a critical point to enable weed managers to prioritize their efforts for weed control selecting the most effective and safe method at a given location. On the regional level, local groups might share their maps and inventory data to inform coordinated control efforts. Furthermore, on an inter country level, the collective data from all local groups can help assess the extent of particular weed problems. To facilitate this type of interaction between different data sets, weed mappers need "shared data standards" which will be developed during the progress of our work.

This effort is not intended to create a single master database, but rather to create many databases throughout the regional countries with minimum standards so that all information being collected to be compatible. Actually, there will be many ongoing needs and opportunities to bring together, local data for statewide, national, or even Mediterranean and other "cotton producing countries" maps. In terms to the audience, country commissioners, state legislators, congressmen, expert interest groups, or the general public, will be able to tie the problem back to their geographic area of interest increasing the possibilities for a sustainable weed management.

According to information derived from our preliminary work based on regional surveys of dominant weeds in cotton we can assume that certain species exist in troublesome populations in a great geographical distribution from the Mediterranean zone to Far East. In particular, *Solanum nigrum, Amaranthus retroflexus, Convolvulus arvensis, Cyperus rotundus, Cynodon dactylon* and *Sorghum halepense* are common at an inter regional level, while the rank of weed abundance is different due to the particular climatic and edafic conditions in each region. It is worth noticing that the invasive weed *Solanum eleagnifolium* consists a major "difficult- to control" weed for all the Mediterranean countries, an issue that reinforces the need for monitoring and taking measures to eradicate the extended populations of the weed.

The Grasses of Greece: Records of occurrence and geographical distribution using GIS

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Many representatives of the Poaceae are very important weeds in cereals. Some of them occur in pastures and in cereal crops. Grasses can be components of agroecosystems also. Therefore, the recording of their distribution in Greece, is of particular interest from a systematic, an ecological and an economical point of view. There is evidence that the weed flora has changed over the past century with some species declining in abundance whereas others have increased. There is also some evidence for a decline in the size of arable weed seedbanks. Some of these changes reflect improved agricultural efficiency, changes towards more winter-sown crops in arable rotations and the use of more broad-spectrum herbicide combinations. Also, climatic change seems to be a "key factor" in the spectrum variation. Weeds have, however, a role within agroecosystems in supporting biodiversity. In this study a geodatabase was developed in order to store all the available information on Greek grasses. Since the initial information the geographical distribution of single species was not based on GPS data the investigated territory was divided into 133 areas following mainly the province-eparchy administrative division (which is a subdivision of the NUTS 3 prefecture level). The data recorded came from approximately 5000 grass specimens which have been collected all over Greece. Additionally, data came from the following Herbaria: UPA Herbarium of the University of Patra, HUTH Herbarium of the University of Thessaloniki, ATH Herbarium of Goulandris Natural History Museum as well as from the ATHU Herbarium of the University of Athens. For each species the following information was stored: scientific name; area; geographical unit; specific habitat and information's source. Based on these data, the ten most important grass species of Greece in decreasing order are the following: *Lolium rigidum, Dactylis glomerata, Bromus madritensis, Avena barbata, Hordeum murinum, Lophochloa ristata, Desmazeria rigida Bromus intermedius, Hyparrhenia hirta and Cynosurus echinatus.* For each species, the number of records ranged between 100 and 178. The grass species which are considered weeds in terms of their occurrence in Greek agricultural crops are the following in decreasing rank: *Lolium rigidum, Hordeum murinum, Poa bulbosa, Cynodon dactylon, Avena sterilis, Poa trivialis, Bromus sterilis, Phalaris paradoxa, Bromus tectorum, Phalaris minor, Lolium temulentum, Sorghum halepense, Alopecurus myosuroides, Lolium perenne*. This ranking is derived from 52 to 178 records each. Other grass species such as *Echinochloa crus galli, Phalaris brachystachys* and *Avena fatua* can create serious problems at a regional and local level particularly in terms of their resistance to herbicides. One of the objectives of this survey is to bring together a selection of standardized vegetation data in a computerised databank. Such a databank will provide information on the floristic composition and geographical distribution of plant communities which will serve as a source for various applications. The information derived from the database will provide a scientific basis for a European vegetation classification by documentation of vegetation types (syntaxa) from an ecological point of view. It may also contribute to a European survey and management of grasses which could become problems as invasive species.

Vegetation mapping in Italy: an overview

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Italy has a very complex climate and orography and, as a result, an extremely high number of habitats and plant species: mapping this richness is a huge task which has not been accomplished yet. To our knowledge, in Italy no comprehensive mapping activity exists on weeds. Vegetation mapping efforts are especially focussed on the distribution of invasive alien species and endangered (e.g. red list) species, but much less work has been done on common agricultural weed species. Occasional papers, usually published in extension magazines, are produced when a new species or biotype (e.g. a herbicide resistant one) is found in a given area. Although a vast 'grey' literature and datasets (often as result of scattered research projects) exist, there is no coordinated effort to summarise the already existing knowledge and data in a common database. Furthermore, a dedicated research project on this theme has never been funded, despite the apparent interest at the Ministry level (Lucci, pers. comm.). There are also technical difficulties, since the already existing data are fragmented and the used mapping grids are not uniform (two different gridding systems are used by botanists: MTB and UTM). As such, the homogenisation of data would require additional work. In a recent work, Prosser (2005) depicted the present situation of vegetation mapping activities for all the 21 Italian administrative regions. His results showed that only one region of North Italy (Friuli Venezia Giulia) has succeeded in building a complete geographic atlas of its flora and only one province outside this region (Cremona, Region Lombardy) has built a similar atlas.

Even though a complete atlas of Italian flora does not yet exist, whenever a general overview of the distribution of a single species is needed, the Italian flora (Flora d'Italia; Pignatti, 1982) is a very useful reference. Description of each species, including agricultural weeds, is accompanied by a general description of its areal of distribution and a map of the country reporting a dot for each region where the species has been found.

In 2005 a team of researchers has published the updates to the Italian Flora (Conti et al., 2005) and an electronic database (at the moment still in alpha version) containing this information is freely available on the web.

References

Prosser, F. (2005) Progetti di cartografia floristica in Italia: un tentativo di sintesi. In A. Scoppola & C. Blasi (eds) *Stato delle conoscenze sulla flora vascolare d'Italia*. Palombi Editori, Roma (IT), 29-36.
Pignatti, S. (1982) Flora d'Italia, 3 vol. Ed. Agricole, Bologna (IT).
Conti, F., Abbate, G., Alessandrini, A. & Blasi, C. (2005). An annotated checklist of the Italian vascular flora. Palombi Editori, Roma.

National weed surveys in Hungary

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The change of weed flora has been continuously followed in Hungary for more than 60 years. The purposes of weed surveys are to determine the most important weeds and to examine the spreading of weeds. The First National Weed Survey was carried out by Miklós Ujvárosi between 1947 and 1953. The weed flora of winter wheat, maize, rye, barley, oat, potato, beet, sunflower and stubble was mainly studied. The Second National Weed Survey was performed by weed biologist trained by Miklós Ujvárosi. The Third National Weed Survey took place in 1987-1988, in large-scale farming systems, when herbicides had been in general use for two decades. The Fourth National Weed Survey was carried out in 1996-97, when small land ownership prevailed again, due to the privatization and compensation processes. During the last two decades Hungarian agriculture has undergone an immense transformation which made necessary new national weed surveys. The Fifth National Weed Survey in the fields was carried out in Hungary in 2007-2008.

The weed flora was investigated with the same method and from the Second National Weed Survey in the same vicinities of 202 settlements. Miklós Ujvárosi elaborated the methods of national weed surveys. The surveyed settlements were selected out of the main soil types (17 soil types or sub-types) on the basis of the genetic soil map of Hungary. Surveys had to be done in winter wheat and maize crops (wheat was replaced by rye in sandy soils) and on wheat/rye stubbles. At all selected vicinities 10-10 sample quadrates were indicated in winter wheat and maize, respectively. Marked and surveyed quadrats were excluded from weed control. The surveys were carried out in early summer (in wheat and in young maize between 15 May and 30 June) and in late summer (in older maize and on wheat stubbles between 15 July and 31 August). To reduce the effects of extreme weather conditions the surveys were made for two years. Hungarian National Weed Surveys were done using the Balázs-Ujvárosi quadrate method.

Based on the data of weed surveys the following results were obtained: *Tripleurospermum perforatum* (Mérat) M. Laínz kept its first place in the dominance order of weeds in winter wheat as compared to previous years. The importance of *Ambrosia artemisiifolia* L. increased, it is believed to be the second most important weed in winter wheat. Intensive spreading of *Apera spica-venti* (L.) P. Beauv. could be observed, its cover percent almost doubled in the last 20 years. At the same time the cover percent of *Galium aparine* L. considerably reduced due to the effective weed control technologies. Although its average cover is very high and it is the fifth most important weed species of winter wheat. The dominance of the main perennial weeds is high. Cover percent of *Cirsium arvense* (L.) Scop. decreased, while that of *Convolvulus arvensis* L. and *Elymus repens* (L.) gould increased in the last 10 years.

Echinochloa crus-galli (L.) P. Beauv., *Ambrosia artemisiifolia* L. and *Chenopodium album* L. are the three most important weeds in maize fields. *E. crus-galli* was the first weed in early summer, while *A. artemisiifolia* had the greatest value of cover in maize at the end of summer. The rapid spreading of more annual grasses – *Setaria pumila* (Poir.) Schult., *S. viridis* (L.) P. Beauv., *Panicum miliaceum* L. and *Digitaria sanguinalis* (L.) Scop. could be observed. Among perennials the cover percent of *Elymus repens* (L.) Gould, *Cirsium arvense* (L.) Scop. and *Cynodon dactylon* (L.) Pers. increased, while the reduction in cover percent of *Convolvulus arvensis* L. continued. In the last 20 years the intensive spreading of *Abutilon theophrasti* Medik. and *Helianthus annuus* L. could be observed on maize fields in Hungary. *Cyperus esculentus* L. var. *leptostachyus* Boeck. and *Asclepias syriaca* L. are spreading in the country, which are hardly controlled weeds.

Exploring farmers spatial knowledge of within-field variation of soil and weed abundance: incentives for participatory weed mapping

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Arable farmers have considerable spatial knowledge of their fields. They apply this knowledge intuitively during various field management activities such as soil tillage, weed management and fertilizer application (Heijting *et al*. 2011). The aim of the current study was to further investigate farmers' knowledge on within-field variation of weed abundance and to explore possible causes of weed spatial patterns. In addition, possibilities for participatory weed mapping are discussed. In winter and spring 2010, arable farmers in the north of the Netherlands in an area of reclaimed peat land were met at their farms using semi-structured interviews. Field visits were made to investigate and discuss their knowledge concerning within-field variation in general. Special attention was paid to their knowledge regarding weed spatial and temporal behaviour on their fields and whether they applied their knowledge actively during weed control. Results of this study show that the arable farmers interviewed demonstrated extensive spatial knowledge which they took into account during field management as far as they regarded it economically and practically feasible. This confirms findings of Heijting *et al*. (2011). They all mentioned patchiness of specific weed species on their fields. According to the farmers, spatial variation of weed species occurrence and density was often related to differences in soil characteristics and land use history. Distinct features of fields on reclaimed peat land such as height differences and variation in texture and organic matter were mentioned by the farmers. Besides variability in soil characteristics, other causes of weed patchiness according to the farmers were introduction of weed seeds with slurry (for example *Echinochloa crus-galli*) and poor crop performance in previous years. Adjusting weed management practices to spatial variable weed patterns occurred intuitively, for example by slowing down the tractor speed during herbicide application in areas of high weed density. The level of knowledge on weed spatial patterns varied between farmers and was related to differences in their personal interest. These findings suggest that knowledge of farmers on within-field variation is a valuable source for refining spatial variable weed management and can be a starting point for further research into causes of weed spatial variation. A regional approach could ameliorate weed management practices because spatial patterns in weed occurrences appear to be linked to landscape features and land use history. We propose a participatory method in which farmers share their local knowledge to facilitate such a regional approach.

References

Heijting, S., De Bruin, S. & Bregt, AK. (2011) The arable farmer as the assessor of within-field soil variation. Precision Agriculture 12(4) 488-507, Open Access: http://dx.doi.org/10.1007/s11119-010-9197-y.

Spatial weed distribution in the major cotton area of central Greece using Ordered Weighted Averaging (OWA) method

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Risk assessment of weed occurrence in agricultural ecosystems, is particularly useful in designing weed management strategies. Among several factors that affect the weed appearance, soil, cultivation and environmental parameters play an important role in weed flora composition.

The above factors were recorded and evaluated through a 4 year survey, during which weed populations and abiotic factors were sampled at a regional scale. The results showed that clay and carbonate content were the most significant factors that affected the weed occurrence.

The application of multi-criteria methods achieves the combination of several (the most important) factors. In this study, it was attempted to develop a methodology that takes into account the key factors, in order to identify the high risk areas concerning the weed occurrence in cotton fields situated in central Greece. Thus, the methods of multi Analytic Hierarchy Process (AHP) and Ordered Weighted Averaging (OWA) were combined with Geographic Information Systems.

The high risk areas regarding specific weed species, were determined based on soil properties (soil texture, carbonate content, etc.) that significantly affect weed occurrence (Kalivas et al. 2010). Relative weights based on the aforementioned criteria were added through the Analytic Hierarchy Process. Furthermore a set of ordered weights were determined, using the method of Ordered Weighted Average, through a group of fuzzy linguistic quantifiers. The above procedure was accomplished, using the friendly and easy to use F.L.O.W.A. software. Finally, annual and perennial risk maps of occurrence were created based on the OWA methodology using interpolated maps of analytical soil data.

GIS analysis of spatial structure in annual and perennial weed populations

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Weeds constitute a major problem in Greek cotton fields. Pre- emergence herbicide applications during the last decade resulted in a significant decrease of annual weed populations mainly at the early phenological stages of the crop before the canopy closes. On the other hand perennial weeds proved to be persistent in cotton mostly due to extensive mechanical soil cultivation which favors their high regrowth.

The assessment of weeds' importance has been stated in previous studies based mainly on weed density and frequency. Uniformity (U) that indicates the percentage of quadrats infested by a species per sampling site was also used in order to evaluate the weed appearance. The spatial distribution of the weed densities and uniformities were evaluated using Moran's I spatial autocorrelation and Getis-Ord General G high/low clustering using the inverse distance squared option in a G.I.S. environment. Also spatial outliers were detected using local Moran's I indicator.

The samplings were conducted from 2007 to 2010 in one of the most important cotton areas in Greece. On each sampling site, weed density and uniformity per species were recorded. Soil analytical data from each sampling site were also included in the developed geodatabase. Correlation analysis was used over the sampling years in order to assess the stability of weed occurrence in the sampling sites.

Cyperus rotundus, *Convolvulus arvensis* and *Cynodon dactylon* had a stable occurrence since their uniformities were highly positively correlated. *C. rotundus*, *C. arvensis*, *Portulaca oleracea* and *C. dactylon* were the most abundant among the fourteen recorded species. *C. arvensis* was the only weed that was steadily affected by the soil properties and more specifically by the soil clay content. Spatial analysis indicated that only 1-3 spatial outliers were indentified in each one of the studied years for the above weeds. Correlograms were computed for the studied soil properties and the most important weeds of each year using their densities. The soil variables and the perennial weeds showed a statistically significant spatial correlation at almost the same distance which indicates the same spatial dependence.

Understanding the present distribution of parasitic weeds of the genus *Striga* and predicting its potential future geographic distribution in the light of climate and land use change

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Striga´s actual and future distribution needs to be estimated urgently as parasitic weeds of this genus within the *Orobanchaceae* are a major constraint to agriculture of the semi-arid regions in Sub-Saharan Africa. Their exact localization is required for efficient target management strategies. Using innovative GIS-based modeling complemented by greenhouse and field studies our research aims to better understand the present geographic distribution of *Striga* species and to predict potential future expansion areas of these dangerous weeds. Parameters determining the presence or absence of *Striga* were analyzed. Available data were complemented by new studies on *Striga* ecology and seed bank dynamics.

Our data resulted from green house and field studies at the University of Hohenheim and ICRISAT, Mali. Different climate and land use projections will be applied to indicate areas that will be(come) susceptible to *Striga* in future. They will be based on the present geographic distribution and the factors affecting it; The outputs of this approach will directly support and target crop improvement research and variety (maize. sorghum, pearl millet) dissemination in *Striga*-affected areas. They will provide important decision support tools for technology development and integrated *Striga* management strategies. The aim of our work presented here is to close the current knowledge gaps in *Striga* research considering the geographic distribution.

Mapping of herbicide resistant weeds in Italy

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In the last three decades, herbicides resistance has become a worldwide problem. In Italy 18 species and the most important herbicide modes of action are involved. The Italian herbicide resistance working group (GIRE- www.resistenzaerbicidi.it) has been active since 1997 with the mission to improve resistance management through the cooperation and the communication between public and private researchers as well as all involved stakeholders. The main aims are: to encourage a responsible use of herbicides, to improve the knowledge about this topic, to devise and communicate resistance management guidelines and strategies. One of the outcomes of the work done by GIRE is the continuous update and mapping of herbicide resistant weeds in Italy.

With the collaboration of the major agro-chemical companies a complaint monitoring of putative resistant populations of different weed species is regularly carried out. Sampled populations were screened in greenhouse experiments with 3-4 specific herbicides. Plant survival in relation to the untreated check was recorded. A population was considered resistant when survival was >20% at the recommended field dose (1x) and highly resistant when survival was >10% at 3x. The data were stored in a database and weed resistance maps were drawn using ArcExplorer2 software.

In northern Italy the most diffuse biotypes found in rice crops belong to *A. plantago-aquatica, C. difformis, S. mucronatus* and *E. crus-galli* resistant to ALS-inhibiting herbicides. Furthermore, *S. halepense* resistant to ACCase-inhibitors and *E. crus-galli* resistant to ALS-inhibitors were found in other summer crops. In the central-southern parts, many cases of *Lolium* spp., *P. paradoxa* and *A. sterilis* resistant to ACCase-inhibitors were found in autumn-winter crops, mainly durum wheat. Resistance maps allowed to analyse the distribution and the evolution of resistant weed biotypes in different Italian regions. The data maps were communicated to regional phytosanitary decision makers and published in the GIRE website.

Mapping of herbicide resistant weeds in Great Britain, Germany and France

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Weed resistance has become a major threat in agriculture due to the intensive use of herbicides during the last decades. Some of the most troublesome weeds in Europe [blackgrass (*Alopecurus myosuroides*), ryegrass (*Lolium multiflorum*) and silky-bent grass (*Apera spica-venti*)] have developed resistance to different herbicide mode of action groups including ACCase (lipid synthesis), ALS (branched chain aminoacid synthesis), and PS-II (photosynthesis)-inhibiting herbicides. To help manage the sustainable use of these herbicide classes in the future, Bayer CropScience has developed innovative herbicide resistance diagnosis technologies. The analysis of resistance to acetyl-CoA carboxylase (ACCase)-inhibiting herbicides, the geographic distribution of resistance, the predominant resistance mechanisms, and the target-site resistance-conferring mutations was determined for more than 2500 weed biotypes collected in France, Germany, and Great Britain from fields where herbicide performance was not at expected levels.

Results indicate that ACCase resistance is widely distributed throughout the major cereal-growing areas in Europe. The levels of resistance conferred by TSR depend on the species, the position of the mutation and the aminoacidic substitution. The cross-resistance pattern to several ACCase-inhibiting herbicides is species specific. Mapping of resistant grasses provides a good overview about the distribution of resistance at local- and global-level, the speed of the spread of new biotypes to a given mode of action, the threat of new species to develop resistance and the detection of weed shifts and escapes. Local weed mapping is very useful to plan Integrated Weed Management strategies at local scale. The implementation of IWM strategies (chemical diversity, crop rotation and different cultural practices) will play a key role in the future.

Using citizen science for invasive alien plants mapping

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Invasive alien plants (IAP) can be environmental weeds as well as weeds in managed areas; weeds with native origin are excluded by definition. Non-native weeds can be called exotic also. Weed mapping with broad monitoring programmes is often expensive and time consuming. Citizen science, however, can be an effective and inexpensive way to overcome this problem. It means the public involvement in projects or ongoing programs of science work. Individual volunteers or networks of volunteers, many of whom may have no specific scientific training, perform or manage research-related tasks such as the observation, measurement or computation,. Recent improvements in internet and communication technologies make the involvement of citizens on monitoring and surveillance activities possible. The European Environment Agency has initiated citizen science activities by introducing Eye on Earth (EoE) which is an exploratory web-based IT platform. It allows a user-friendly, two-way sharing of environmental data and other environmental information with the general public and the scientific community. Current applications are Airwatch and Waterwatch. There is also the intention to develop other environmental watch activities including invasive alien species watch as a sub group under Naturewatch, which will be started as a pilot project in 2011. The project aims at monitoring and surveillance of invasive alien species, supporting policy activities in Europe and targets of the Convention on Biological Diversity. It should also raise the awareness of the public in general. An internet based survey for the selection of organisms to be monitored was carried out recently. It was the result of an expert meeting in which the criteria for the species selection were defined. Surveying IAP on managed areas can contribute to the mapping/monitoring of changes in weed spectra. The data obtained through EoE should have a very practical application also: they can be used for an effective weed control management.

An example of field vegetation survey from Lithuania

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A weed species diversity and dynamics monitoring system is proposed. The corresponding survey was performed in rectangular areas of ca 100 sq. km that were calculated geographically (side lengths are 10' latitude and 06' longitude). The survey area was divided into 100 plots (1 sq. km). The weed vegetation inventory was performed in each second plot of this regular pattern grid. The segetal communities were investigated in winter and summer crops. The most abundant and frequent weeds and their dynamics were revealed by the analysis of data obtained on two survey seasons in 2001 and 2007. Five the most common weeds were *Elytrigia repens, Tripleurospermum perforatum, Viola arvensis, Fallopia convolvulus,* and *Capsella bursa-pastoris;* five the most abundant species were *Elytrigia repens, Viola arvensis, Sonchus arvensis, Stellaria media,* and *Tripleurospermum perforatum.* The main succession trends in segetal weed communities are: decline in the number of frequent weed species; relative decrease of weed abundance (coverage); obvious *Artemisia vulgaris* expansion in agricultural land of the country; remaining multitude of grassland, nitrophilous or even forest apophytes.

First weed mapping in oilseed crops in Finland

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The weed flora of oilseed crop fields was surveyed in southern and central Finland from 2007 to 2009. Altogether 429 fields were visited in order to investigate the most abundant weed species occurring in spring-sown turnip rape (*Brassica campestris* ssp. *oleifera*) and oilseed rape (*Brassica napus* ssp. *oleifera*). Information on weed management was recorded by interviewing the farmers.

The occurrence of weeds was assessed in August by walking through the whole field along a W-shape route and recording the 1 to 6 most abundant weed species. The level of infestation by weed species, associated with a visual observation of their biomass production, was categorized into three classes; 1) negligible, 2) moderate (incl. patchy occurrence) or 3) high.

Altogether 38 species ended up in the list of abundant species. *Galium spurium*, *Sonchus arvensis*, *Chenopodium album*, *Galeopsis* spp. and *Tripleurospermum inodorum* were most often rated as abundant species in survey fields with moderate or high weed infestation. *Elymus repens* was the only grass species recorded. As many as 170 fields were categorized to have only negligible weed infestation and no observations were recorded from those fields.

In contrast to the observations of the most typical weeds species, some rare weed species in Finnish arable fields, like *Arabidopsis thaliana*, *Centaurea cyanus* and *Euphorbia helioscopia*, were ranked abundant in 1-2 fields, probably as a result of slow and uneven establishment of crop stand and/or refraining from chemical weed control.

Chemical weed control of broad-leaved weeds was practised on 53% of the fields surveyed. Trifluralin (in 190 fields) was the most frequently applied active ingredient. Napropamide, metazachlor, chlopyralid/picloram and imazamox were the other active ingredients used for the same purpose. They should now replace trifluralin which is no longer registered for use beyond 2009. Grass weeds, *Elymus repens* in particular, were controlled separately with selective graminicides. Glyphosate was used in some fields either in the previous autumn or in connection with direct drilling in spring.

The composition of weed flora is a result of long-term cropping histories, management practices and environmental conditions. The weed species recorded in oilseed crops are characteristic of cereal-dominated rotations in Finland. In fact, spring cereals had been the previous crop in 75% of the oilseed crop fields surveyed. The success of some species, like *Galium spurium*, is well in line with the latest observations from spring cereal fields.

References

Salonen, J., Hyvönen, T. & Jalli, H. 2011. Composition of weed flora in spring cereals in Finland – a fourth survey. *Agricultural and Food Science* 20: 245-261.
Salonen, J., Laitinen, P., Saastamoinen, M. & Salopelto, J. 2011. The main weed species and their control in oilseed crops in Finland. *Agricultural and Food Science* 20: 262-268.

Weed abundance documentation in winter wheat – The emergence of blackgrass (*Alopecurus myosuroides* Huds.) with and without weed control measures and the resulting variation of biodiversity parameters for arable land

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Many ecologists and plant community specialists only assess the biodiversity of agricultural fields shortly before harvest. There are a few prominent exceptions however, such as data provided by the Hungarian National Weed Surveys with assessments in early summer and in late summer. The data received from three sites in Germany will demonstrate results for *Alopecurus myosuroides* Huds., which show that it is essential to analyze fields throughout the season in order to get an impression on plant biodiversity in a field. Using our results at different sites, we were able to document that some weeds such as blackgrass can germinate over a long period of time. We were also able to demonstrate that chemical weed control by different herbicides often leaves newly emerging or insufficiently controlled individuals, which is usually not representative for seed banks in a field. Our results also show that some plants cannot survive frost or drought periods, and that dominating weeds can suppress other species independent of chemical weed control measures. Normally, *Alopecurus myosuroides* Huds. prefers different soil types to *Apera spica-venti*. However, both species can be found in the same fields, which makes it seem apparent that biological adaptation leads to biotypes which have a wider ecological amplitude than their ancestors. Cropping practice also seems to have much more influence on biodiversity than weed control tools.

Weed composition in German maize fields 2002–2004 and its determining factors

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Weeds were recorded in 1720 German maize fields from 2002 until 2004. Additional site information was collected from farmers by questionnaires. Here 1103 complete data sets are analyzed with respect to the factors determining the weed assemblage.

Weeds were counted in 0.1 m² quadrats with 10 replications per field before herbicide treatment, when the maize had 2 to 6 leafs. Fields were situated across the whole country, primarily in regions with high maize cropping density. 14 possibly determining factors were grouped in 5 categories: geografic position (latitude, longitude), climate (temperature, percipitation), soil (sand content, soil quality, humus content), management (tillage, percentage of maize in rotation, maize as preceding crop, percentage of oil seed rape in rotation, liquid manure, seed density) and year. Data were evaluated with partial canonical correspondence analyses. The net effect was used as ranking criterion for the strength of the influencing factors.

The factor, which caused the highest effect on weed composition, was maize as preceding crop, followed by degree of longitude, year and soil sand content. Apart from humus content and liquid fertilizer all factors had a significant effect on weed composition ($\alpha < 0.05$).

We conclude i) that weed composition is determined by a complex interaction between site characteristics, climate and management, ii) that farmers can shape weed composition through agronomic management and iii) that the impact of the factor year in monitoring studies should be considered.

Spatial and temporal changes of invasive weeds in Northeast Croatian arable fields

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Invasive species are non-native organisms that could be found in almost all biological categories. They are capable to change structure and composition of communities, and moreover, they displace native species from their habitats. Agricultural fields are also very much affected with severe biological invasions.

In Croatian flora (*Flora Croatica Database*) 66 invasive plant species are registered so far. Among them, a significant number belongs to the category of weeds. They could be found in various agricultural areas, some of them with high, and some of them with low frequency and density. Since every invasive species has a different period from colonisation to expansion on a new territory, there is a need for continuous monitoring of their biological and ecological characteristics. Mapping invasive weed species on the fields is one of the basic measures in preventing their further invasion.

Continuous monitoring activities on arable fields have been taking place in North-eastern Croatia for collecting different datasets: density of invasive species, their frequency and cover values, crop they infested and damage they can cause.

Based on the current weed survey (2008 - 2010) on the investigated territory, and comparing with past records (Panjković, 1989) an invasive species rank has been assessed, based on the following criteria: 1) influence of the invasive weed on the native flora, habitat and community; 2) biological characteristics and capability of spread; 3) their density and cover values on the investigated territory; 4) problem with their control.

Among 27 non-native weeds, 6 of them with the highest rate of invasiveness have been extracted using multivariate analysis. They are: common ragweed (*Ambrosia artemisiifolia* L.,), velvetleaf (*Abutilon theoprasti* Medic.), Canadian horseweed (*Conyza canadensis* (L. Cronquist), jimson weed (*Datura stramonium* L.), annual fleabane (*Erigeron annuus* (L.) Pers) and gallant soldier (*Galinsoga parviflora* Cav.).

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