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endure diversifying crop protection

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European project "Pesticide Use-and-risk Reduction in European farming systems with Integrated Pest Management" – PURE

in collaboration with:

Ministry of Agriculture and Rural Development

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International Organisation for Biological Control of noxious animals and plants (IOBC-WPRS)

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Perspectives and challenges on IPM implementation

PERSPECTIVES ON THE IMPLEMENTATION OF IPM IN EU: THE CONTRIBUTION OF PURE

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The FP7 PURE project aimed (i) to provide practical IPM solutions – combinations of tactics and strategies – to reduce reliance on pesticides, based on integrative research; and (ii) to deliver scientific knowledge to design future IPM solutions, based on innovative research in challenging fields: pest evolution, plant-pest-enemy interactions, soil and landscape ecology and emerging technologies. To reach these objectives, the PURE team (22 partners distributed all over Europe) studied various pests (pathogenic agents, animal pests, weeds) in key European farming systems: annual arable farming systems (wheat-based and maize-based, field vegetables with cabbage as a model crop), perennial systems (pome fruit and grapevine) and protected crops, with tomato as a model crop. The design of IPM solutions relied on a wide variety of tactics such as biocontrol products in field vegetables, apple or grapevine, and strategies such as diversified crop sequences in wheat- and maize-based farming systems. On three case studies, a co-innovation approach was applied to improve the involvement of stakeholders in the design process. IPM solutions were tested and compared to current practices on-station and on-farm and assessed by several tools developed or adapted during the project, which include DEXiPM to assess sustainability on a multi-criteria basis, SYNOPS, a multi-level pesticide risk assessment tool, and a cost-benefit analysis. Efficient alternatives to pesticides, i.e. biological, cultural, physical (e.g. mechanical weeding), and genetic (e.g. cultivar mixtures) control methods and their combination were identified. Promising results were obtained even if the IPM systems did not always allow the best outcome for all sustainability criteria simultaneously. Newly identified IPM systems achieved better environmental performances compared to current systems, with efficient pest control, but their costs were often higher even if it was not systematic. In addition, significant methodological breakthroughs were achieved with regards to the modelling for sustainable management of crop health. Pest evolution studies warned against reliance on a single biocontrol agent and suggested pathways for durable plant resistance, in particular the use of single gene strategies that can act as “stepping stones” for breaking the resistance provided by pyramiding strategies. The works on plant-pest-enemy interactions enabled progress in the identification of biocontrol products and in means to make them more effective. Ecological engineering strategies showed potential, leading to shifts in pathogen suppressing components of the soil community at the field scale and the suppression of pest populations in response to crop and land use patterns at the landscape scale. A wide range of technological tools to help implement IPM was designed or adapted in relation to the activities on farming systems, from monitoring systems at different scales to precision spraying techniques to reduce the amount of pesticides. On the whole, the PURE project provided promising results, models, knowledge, and practical tools and approaches to help implement IPM. In addition to their applications, the PURE results suggest various prospects such as designing public policies to encourage IPM adoption, fostering the design of IPM as a system approach, promoting both ecological and technological knowledge and tools for pest control, or developing co-innovation approaches and tools to facilitate the implementation of IPM with stakeholders.

INTEGRATED PEST MANAGEMENT IN GREENHOUSE CROPS IN POLAND

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In Poland the total area of greenhouse crops ranges from 6500–7000 ha, depending on the fluctuation in the area of crops under plastic-covered greenhouses over several years. The crops under plastic-covered greenhouses occupy 65% of the total area of greenhouse crops. Greenhouses occupy 2000 ha, including: 1000 ha of greenhouse grown tomato; 500 ha of cucumbers and ornamental plants; 500 ha of other crops. In the majority of cases, integrated plant protection (IPM) is used on large areas of vegetable crops, especially in modern greenhouse farms, as well as on tomato and cucumber crops grown in older types of greenhouses or plastic-covered greenhouses. In addition, IPM is used partially in ornamental plants, herbs and seedlings' production. At present 20–30% of the area of greenhouse crops is protected with the use of integrated methods including multiple treatments with biological control agents, as well as other non-chemical methods. Many plant pests such as: whiteflies, spider mites, trips, aphids leaf miners, butterfly caterpillars (including *Tuta absoluta*), dark-winged fungus gnats and pathogens causing root rot are controlled through the use of bio-control agents. All of the natural enemies which are used as bio-control agents in other European countries are authorized and registered for the protection of Polish crops. However, for the control of plant pathogens the only registered bio-products are–ones which contain the antagonist fungi *Phytium oligandrum* and *Coniothyrium minitans.* The wide availability of entomopathogenic agents is due to the fact that their registration as bio-control agents is not required. The required registration of micro bio-products (fungi, bacteria and viruses) and of plant extract products, definitely limits their use in Poland. The level of knowledge of Polish food producers regarding integrated plant protection is especially noteworthy. Apart from the professional advice from experts representing trade companies involved in the distribution of bio-products and specialists from government-institutions such as the Institute of Plant Protection – National Research Institute in Poznan, larger horticultural farms employ experts or expert teams on plant protection including biological and integrated control.

PERSPECTIVES ON THE IMPLEMENTATION OF IPM IN EU – THE ADVISORY PERSPECTIVE

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Some major drivers for IPM in European countries are:

1. availability of pesticides: certain old actives are being phased out over the coming years and only few new actives are introduced,
2. increased problems with pest, disease and weed resistance to pesticides,
3. availability of well-documented thresholds and monitoring, forecasting and decision support systems,
4. new developments in non-chemical IPM tools, and
5. requirements from markets and consumers

As neither of the above-mentioned factors are constant, the process of implementation of IPM will be dynamic, where farmers/growers will continually strive to adopt those tools that are relevant and cost effective on their farm. Advisers will be instrumental in that process.

Many IPM tools are more variable in efficacy than chemical pesticides, and therefore it is important that advisers and farmers engage into a learning process in order to ensure that the transition goes smoothly without crop failures etc. Also, it is important to ensure that overall there will be something in IPM for the farmers, otherwise adoption will be slow, and the job of advisers impossible.

Education and extension are important activities to build awareness of IPM tools. Many advisers will need better technical skills ("train the trainer") as well as new non-technical skills in order to support IPM implementation at the farm level. Experiences from e.g. the EU Leonardo project confirm these statements and outline new roles and tools for advisers. One common tendency is for the role of advisers to change from being "experts giving a prescription" towards acting as "facilitators of innovation and learning processes".

In Denmark, we have based IPM implementation on a central information system, IPM demonstration farms and focused IPM-advisory packages offered a large number of farms. Other EU member states are backing IPM adoption in other ways. Experiences from the Danish activities regarding IPM implementation suggest that even though IPM is about systems thinking, it is still important to be concrete in advisory activities, and to identify which tools in the IPM toolbox are relevant on a certain farm. The chance of a successful implementation of IPM increases when growers and advisers engage with other stakeholders in a process where the cropping system is gradually improved, and where limitations can be identified and corrected. Small-scale on-farm experimentation is very useful in that respect. We have also experienced that an increased grower awareness of IPM is a requirement for successful implementation, and that it can sometimes be difficult to measure changes in IPM implementation on the short term. However, so far we have not seen farmers that could not improve their practices to some extent.

A major concern for many advisers regarding IPM is liability. When advising about integrated solutions that are less certain than pesticides, communicating uncertainty to farmers, and making sure that farmers will accept solutions that are more variable will become an important aspect.
IPM implementation calls for a better collaboration between farmers, advisers, stakeholders and scientists to ensure an efficient development of new IPM tools for future farming. The need for innovation-oriented IPM research will continue to be great in the years to come.

THE POLICY PERSPECTIVE – HOW EU MEMBER STATES PROMOTE IPM IMPLEMENTATION

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The Directive on the Sustainable use of pesticides (2009/128/EC) requires Member States to promote Integrated Pest Management (IPM) and low pesticide-input pest management. They shall describe in their National Action Plans how they ensure that the general principles of integrated pest management are implemented by all professional users.

The National Action Plans of a broad number of countries were analysed as to how the goals and measures contribute and actively promote IPM implementation at farm level. Several MS have set up networks of demonstration farms, initiated specific training courses on IPM for advisors and included IPM and information on biological and non-chemical alternatives in their professional training curricula. An analysis of national research programmes indicates future priorities which address research which will be conducive to IPM implementation such as breeding for resistance and resistance management, cropping system research, adaptation of threshold models, advanced decision support systems and biological control.

The presentation will describe in detail selected national initiatives to foster IPM uptake.

FIRST EXPERIENCES FROM PRACTICAL IMPLEMENTATION OF THE NATIONAL ACTION PLAN IN POLAND

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On 6th May 2013, Poland adopted the National Action plan to reduce the risk associated with the use of plant protection products (NAP), to fulfill the obligations of the Directive 2009/128/EC. Prior to the adoption of the Directive 2009/128/EC, legislation of the European Union had not set detailed rules for the application of plant protection products, leaving considerable freedom in this area to individual Member States. However, many Member States of the European Union, including Poland, introduced national legal solutions, as well as non-legislative measures, to reduce the risk associated with the use of plant protection, including those regarding:

1) compliance with the requirements of integrated pest management by professional users of plant protection products,
2) promoting the use of non-chemical methods of pest management and reducing the dependency of crop production on the use of chemical plant protection products,
3) dissemination of knowledge regarding the safe use of plant protection products.

Analysis of actions taken so far in this area, with particular focus on the food safety and balance between the social, economic and environmental needs allow to establish two main objectives of the NAP:

1) **dissemination of general principles of integrated pest management,**
2) **prevention of risks associated with the use of plant protection products.**

A key objective for Poland in the implementation of the National Action Plan is to promote the general principles of integrated pest management. Full implementation of these principles, in particular by promoting non-chemical plant protection methods, will reduce the dependence of crop production on chemical plant protection products. As a result of the application of best practices on the use of plant protection products, the risks associated with their use will be limited to a minimum.

In order to achieve the main objectives of the National Action Plan, the measures to reduce the risks associated with the use of plant protection products will continue, although some of them will be modified. Accordingly new measures will be taken, in the scope shown later in this document. All measures have separate targets and timetables for their implementation, as well as indicators to monitor their implementation.

Presently, we expect to harmonize within the EU control procedures in integrated pest management, what have to be understandable to farmers and advisors.

EUROPEAN CROP PROTECTION ASSOCIATION (ECPA) FULLY COMMITTED TO IPM THANKS TO INNOVATION AND THE ENGAGEMENT OF ITS MEMBERS

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ECPA (European Crop Protection Association) and its member companies and associations support sustainable agriculture to produce sufficient, affordable food and fiber in an environmentally and socially sensitive manner. We are committed to Integrated Pest Management (IPM) – an economically viable ,environmentally sound and socially acceptable approach to crop protection – as defined by the international Code of Conduct on pesticides management and the annex 3 of the sustainable use directive 128/2009/CE.

Our members companies, investing an average of 10% of their turnover in the research and development of new solutions – chemical based, macro organisms, microorganisms, natural substances, semiochemicals, decision making tools, services – which provide tools to farmers to combine cultural, biological and chemical measures to manage diseases, insects, weeds and other pests. Company members, national associations and ECPA are cooperating with partners in order to develop programs as well as training on the sustainable use of crop protection solutions, in order to get the require competence in the 3 steps of IPM: prevention, monitoring, intervention.

On top of that, significant progress has been made on the products (products more specific, safer formulations, mode of action/resistance management, application techniques) and the use phase/stewardship. The Hungry for change initiative, launch in 2011, which consist of the implementation of 12 projects related to Food, Water, Health and Biodiversity, involving partners – technical advisors, farmers, distributors, government and non-government organizations, scientist,… -is also targeting the impact and risk reduction of the crop protection activity, answering the objective of the IPM principle. Among those projects, the Safe and Sustainable Use Initiative is running in 16 countries and provide farmers and operators with tools for the safe us of crop protection products.

ECPA is convince that IPM is part of the solution to produce more crops on existing farmland, improves farmer livelihoods and conserves nonrenewable resources; so IPM provides multiple benefits for society and environment.

MANDATORY INTEGRATED PEST MANAGEMENT IN THE EUROPEAN UNION: EXPERIMENTAL INSIGHTS ON CONSUMERS' REACTIONS

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An experiment was conducted to analyse consumers' reaction to the transition towards Integrated Pest Management (IPM) as the standard in European farming. Preferences for fresh tomatoes produced by three different production systems of 189 French consumers were analysed: IPM, conventional and organic. Results indicate the existence of strong substitution opportunities between IPM and organic tomatoes. IPM sales will benefit from the withdrawal of conventional produces from the market only if there is a significant reduction in the price of IPM compared to organic and/or an important increase in the shelf space dedicated to IPM. Raising awareness on the impact of consumption choices on future prices of the produces has only a limited impact in this context. While information on IPM guidelines increases IPM products purchases, providing extra information on residue levels in IPM tomatoes has no further impact on consumers' choices.

IPM IN CORPORATE SUSTAINABILITY INITIATIVES: WHAT DO SYSCO, MCDONALD'S, WHOLE FOODS MARKET AND WALMART HAVE TO DO WITH IPM?

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IPM has earned a key role in corporate sustainability initiatives, including in major corporate initiatives by several US-based food giants. The IPM Institute is an independent non-profit organization working to leverage the power of the marketplace to improve health, environment and economics in agriculture and communities through IPM and other best practices. Since its founding in 1998, he Institute has partnered with food companies and others to create performance measurement and recognition systems incorporating IPM. With Sysco, a food service distributor with $45 billion in annual sales, and its processed fruit and vegetable suppliers, we have documented IPM and other best practices on more than 400,000 hectares worldwide. With McDonald's, ConAgra Lamb Weston, McCain's, Simplot, Cavendish, Heinz and Basic American Foods, the National Potato Council, the Canadian Horticultural Council and technology company FoodLogiQ, we have developed a new on-line facility for potato growers to assess, track and report IPM and other sustainability practices in potatoes grown in the US and Canada. This year, Whole Foods Market recently launched its Responsibly Grown rating system for fresh produce and flowers, where we incorporated several IPM elements into a comprehensive set of requirements for good, better and best ratings which are displayed on store shelves. Walmart has demonstrated the potential to greatly reduce pesticide use in distribution facilities by careful assessment of pest pressure, exclusion and sanitation. These programs are incorporating systems which encourage and document IPM and other best practice adoption, and also measure and report performance metrics including pesticide use and risk reduction. Food Alliance, Rainforest Alliance, the Forest Stewardship Council, Eco Apple, US Green Buildings Council LEED, Green Shield Certified and others are expanding opportunities for IPM users in agriculture and communities to earn recognition and market incentives for adopting and improving IPM. Currently, more than 16 million hectares are involved in these programs which include IPM as a required element in the US, and more than 152 million hectares worldwide.

NEW CHALLENGES FOR IPM RESEARCH IN HORTICULTURE

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In current IPM research, including PURE, the main targets are development of knowledge and tools for integrated pest/disease control and reduction of the environmental impact of chemical pesticides. Up to now the demands and ambitions of value chain partners and producers played a minor role in the planning of IPM research. As a result the implementation of IPM depends on technology push rather than on demand pull. From the farmers' and economic point of view it seems worthwhile to take the value chain perspective as a new challenge for IPM in horticulture.

The objective of our research within PURE was valorisation of IPM knowledge and technology in the market. In other words: to make application of IPM attractive for growers and IPM grown horticultural products attractive for retailers and wholesalers. As horticultural economists we had the task to draw attention for market pull innovation and, by doing so, promote the implementation of IPM in practice.

Our work was embedded in ex-ante and ex-post assessments of innovative IPM systems in PURE. The main elements of our methodology were exploratory surveys with value chain partners in Spain, Italy, France and the Netherlands and analyses of export statistics (volumes, values and prices over the period 2000–2013) of Eurostat. The value chain partners visited were: input suppliers, growers and trade companies in Spain, Italy and the Netherlands. The crops and products studied were: tomatoes, sweet peppers, cucumbers, apples and pears.

During the exploratory surveys in Spain and Italy the growers and trade companies collectively condemned the extreme pesticide residue requirements of German retail companies. Triggered by these complaints we compared the product prices for exports from Italy, Spain, France, Belgium and the Netherlands to Germany with the product prices for exports from Italy, Spain, France, Belgium and the Netherlands to other countries. The comparison showed considerable price premiums for exports to Germany. The price premiums were bigger for products with much product differentiation (tomatoes, sweet peppers and apples) than for products with little product differentiation (cucumbers and pears).

From these results we concluded that the top-segment in the market (German retailers) is willing to pay premium prices for top-quality horticultural products. Top-quality includes attributes like improved cultivars, good taste, nice colour, attractive packing and low pesticide residue. Application of IPM tools and knowledge is a key to achieving low residue levels. Consequently the new challenge for IPM research in horticulture is participating in product development together with plant breeders, agronomists and trade companies and retailers. This participation in product development will help growers and traders in fetching higher product prices and, simultaneously, making them enthusiastic for the implementation of IPM tools and knowledge in practice.

A SOCIO-ECONOMIC ANALYSIS OF BIOCONTROL IN PEST MANAGEMENT: A REVIEW OF THE EFFECTS OF UNCERTAINTY, IRREVERSIBILITY AND FLEXIBILITY (UIF) 1

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The Economic evaluation of integrated pest management strategy (IPM) is predominantly done through cost-benefit analysis. From a social welfare perspective uncertainty over benefits and costs, irreversibility effects and externalities need to be considered as well. We introduce the maximum incremental social tolerable irreversible costs (MISTICs), *I**, as a tool for such consideration. Only when the incremental benefits of an IPM strategy outweigh possible irreversible costs should the IPM strategy be introduced. The approach allows differentiating between an assessment of an IPM strategy from a private sectors point of view (excluding external effects) as well as from a societal point of view (including external effects).

The MISTICs, *I**, is estimated based on the option value and net present value calculation using Mcdonald-Siegel approach. European data (Eurostat) on conventional maize and potato production as well as secondary literature data on the efficacy of biocontrol against western corn rootworm (WCR) (*Diabrotica virgifera virgifera LeConte*) in maize and wireworm (*Coleoptera: Elateridae*) in potato are variables used in estimating the MISTICs.

The farm-level MISTICs per hectare for biocontrol of WCR in maize in a number of selected countries (Germany, France, Austria, Spain and Italy) was estimated at less than €150/ha while for potatoes was above €200/ha. This result therefore suggests that the introduction of biocontrol against wireworms in potatoes, given its higher MISTICs values, is more likely compared to the control of WCR in maize.

The model can be extended to include other factors such as regulatory hurdles which may delay introduction of an IPM strategy from a private sectors point of view, whereas the technologies that can be applied for effective IPM systems are delayed due to strict regulatory frameworks or unclear paths for registration.

KAP SURVEY IN IDENTIFICATION OF FARMERS' NEEDS AND RESEARCH PRIORITES 2

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In spite of numerous definitions on Integrated Pest Management (IPM), IPM can best be described as a farmer's knowledge and use of an optimal mix of pest control techniques and tools, taking into account a variety of other factors as: yield, profits, risk, sustainability and safety for consumers, farmers and environment. Thirty year experience in developed as well developing countries demonstrated that a FARMER should be the focal point in wide implementation of pro-ecological methods of plant protection against pests, weeds and diseases. This approach has been recently confirmed by obligatory implementation of the EU Directive 2009/128/EC.

Since 2002 the academic staff and M.Sc. students of Department of Applied Entomology of WULS-SGGW collected more that 1150 questionnaires on farmers' knowledge, attitude and actual production and plant protection practices (KAP survey), mainly from the fruit and vegetable growers. The major obstacles expressed by farmers in the common acceptance of IMP recommendations was related to the quality of training (to much teaching, not enough practices in field) and the negligence of marketing scheme for products of Integrated Crop and Pest Management (ICPM) programs. Independently of crop cultivated, the farmers' express the same shortcomings of the present access to knowledge: (a) still problems in the proper diagnosis of pest species and damage symptoms caused by abiotic and biotic factors; (b) optimization of economic use of biological control agents; (c) revised economic damage levels under multi-pest infestation; (d) prevention of pest, disease and weed resistance to the reduced pesticide options; (e) easier access to specialised professional extension service; (f) more publications and field guidebooks showing coloured pictures of various development stages of pests and pathogen infestation symptoms; (g) illustrations distinguishing some physiological disorders and mechanical damages from pathogen infection; (h) access to the Polish version of computer decision support systems for major crops.

The owners of larger farms and under higher external input implemented much more recommendations of IPM than in the farms under moderate and low input. Therefore a special attention during the IPM implementation period under the National Action Program of the EU 2009 Directive should be given to regions characterized by majority of commercial lower input in agriculture production, especially growing field crops. At the same time, a number of orchard owners and vegetable producers following the IPM principles may serve as the examples and demonstration that it is possible combine pro-ecological pest control methods with economic profits in a longer time frame by following strict ICPM principles.

The development and activity in training farmers in the GlobalGap and Integrated Production by the newly established private extension and consulting firms may support the governmental institutions in the specialized training of farmers and contribute to meeting conditions of the EU Directive on sustainable pesticide usage and IPM implementation in Poland.

THE REGPOT PROJECT – WARSAW PLANT HEALTH INITIATIVE'S CONTRIBUTION TO THE INSTITUTIONAL BUILDING AND HUMAN RESOURCE DEVELOPMENT FOR IPM

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Both the UNCED Agenda 21 (Chapter 14: Promoting sustainable agriculture and rural development) (Rio de Janeiro, 3–14.06.1999) and the Directive 2009/128/EC of the European Parliament and of the Council emphasized that IPM is a key component of sustainable farming with the objective to produce healthy crops. It is based on an understanding of ecology and the relations between crops and their pests (including pathogens and weeds), as well as an understanding of the environment in which the antagonistic organisms operate. It should be considered as an approach based on interdisciplinary collaboration between agronomists, plant geneticists and breeders, plant protection specialists, economists and sociologists.

Therefore the scientists of the Faculty of Horticulture, Biotechnology and Landscape Architecture of Warsaw University of Life Sciences – SGGW since 2001 undertook a number of initiatives to integrate expertise of different departments into coherent research and development project on plant health and IPM. Finally with the assistance of EC Directorate-General for Research & Innovation the Warsaw Plant Health Initiative (WPHI) project could start in 2011 to enhance both the research and networking capacity of academia in five key areas such as: entomology, plant pathology, crop production, plants-microorganisms interactions, and functional genomics. Project objectives are realized through, inter alia, staff exchange (15 long term training of young scientists and 47 short term visits by senior researchers to date), establishing two new laboratories, participation in 62 international conferences (21 oral and 42 poster presentations) and organisation of mini-symposia and workshops under a generic title "Frontiers of Plant Health" (19 in total).

In 2013 and 2014 the following mini-symposia took place: "Updated policy on plant protection research in response to new pathogens, pests and weeds emerging the European Union area", "Opportunities for enhancement of Integrated Pest Management", "Quality of fresh produce, herbs and vegetables – from field to fork", "Resistance to acetolactate synthase inhibiting herbicides: mechanisms, epidemiology and prevention", "Plant-associated microorganisms: an important key to a successful application of phytoremediation", "Classical and molecular approaches in plant pathogen taxonomy" and WPHI special sessions during 11th International Conference on Reactive Oxygen and Nitrogen Species in Plants.

CHALLENGES OF MARKET PLACEMENT OF PRODUCTS CONTAINING MICROORGANISMS AND THEIR UTILIZATION AS A PREVENTION OR INTERVENTION METHODS OF PEST CONTROL

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Following the general principles of integrated pest management set in the Directive 2009/128/EC establishing a framework for Community action to achieve the sustainable use of pesticides sustainable biological, physical and other non-chemical methods must be preferred to chemical methods if they provide satisfactory pest control. The use of numerous prevention methods of pest control is also recommended.

Products containing microorganisms can be used as prevention as well as intervention measures of pest control and therefore constitute a valuable tool from the point of view of integrated pest management. However their market placement raises some challenges like: shelf-life, proper application method and time, temperature of storage, transport and use, proper choice for particular use, overall safety and satisfactory effectiveness.

The market placement rules of products containing microorganisms differ in European Union depending on their intended use. From legal point of view microorganism used as intervention method of pest control are plant protection products and should be registered as such. The common rules for registration of plant protection products in EU have been in force since 1991. On the other hand so far there are no common rules as regards market placement of other products containing microorganisms.

PHYTOSANITARY PORTAL NEW TOOL FOR CZECH FARMERS TO ENCOURAGE IPM UPTAKE

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In order to ensure obligations arising from EU legislation (Directive 2009/128/EC), the Central Institute for Supervising and Testing in Agriculture (CYSTA) has developed a new tool serving as an important resource of information for implementing of IPM in the Czech Republic. Phytosanitary portal includes theoretical data – general information about main grown crops (field crops, permanent cultures and vegetables) and varieties, recommended agrotechnology, pest, diseases, weeds and abiotic disorders. Except of general data, there is information about thresholds, monitoring methods, prognosis and recommended preventive and direct measures, non chemical included. The most helpful part represents red-yellow-green list of registered pesticides. This list is generated from existing regularly updated list of pesticides according to the eco-toxicological characteristic that represents risks for water organisms and environment, soil organisms, bees, non-target organisms, birds, mammals, non-target plants and humans. The red-yellow-green list of pesticides is automatically generated for each indication (crop/pest combination). Another useful part of portal represents photo gallery – photos of crops, pest and diseases, weeds and abiotic disorders that serves as a diagnostic key. Phytosanitary portal is being under further development. Regular reports of state monitoring of harmful organisms have been attached recently. Famers can use also current prognostic tools for occurrence of aphids, forecast system for Potato late blight, Septoria leaf blotch, Cercospora of beet and SET´s for main insect pest. For now, there are data about 40 crops, 138 insect pests, 131 diseases and 45 abiotic disorders. Look into the future, except of feeding system by additional data, Phytosanitary portal will be interlinking outcomes of research projects on resistance or prognosis of biotic and abiotic disorders with functions helping to farmers with decision. The future idea is that farmers will have registered access into the system free of charge. This registration will bring benefits representing data of actual local occurrence of harmful organisms, early warning system (via email or SMS) included. Additionally, each user might insert own data into the online prognostic programs to get back concrete results or put his own observation of actual occurrence of harmful organisms to extend monitoring network. Phytosanitary portal represents robust tool for Czech farmers that will contain comprehensive information about agronomic methods, pest and diseases, DSS, usage of pesticides and resistance to chosen active ingredients.

VIPS – AN OPEN SOURCE TECHNOLOGY PLATFORM AIMED AT INTERNATIONAL COLLABORATION ON IPM

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VIPS is a technology platform for IPM, where results from forecasting models can be distributed to users anywhere. The model output views are flexible and simple to incorporate in existing web sites or distribute on smart phones and tablets. Worldwide cooperation on development, implementation, testing and validation of forecasting models is made easy in VIPS. The source code for the platform is released under an Open Source License, guaranteeing partners that their efforts will be mutually shared and beneficial. The VIPS system is based on 14 years of experience with a web based forecasting and information service for integrated management of pests and diseases in cereals, vegetables, and fruit crops in Norway. A totally reconstructed and internationally adaptable version of VIPS is tested internationally in 2014. The system allows for local adaptations, including language, incorporation of models and other services. Our aim is to create a technology platform for international collaboration on IPM.

Through VIPS, all available IPM-tools for pests and diseases within a cropping system can be implemented. This provides flexibility for further development, validation of models and implementation of new tools, where the end-users do not have to relate to several different platforms. VIPS can thus be used for research, development and extension, all by use of one system. This enables a quick release of new tools, without any delays or reprogramming of models when research and development is completed.

We are interested in cooperation on developing the system, for example through joint R & D projects that include implementation of forecasting models and development of applications. The forecasting system will also be available as a cloud service. Bioforsk's researchers and ICT personnel will assist collaborators in configuring existing, relevant forecasting models and distribution of the model output.

CURRENT SITUATION AND FUTURE PLANS FOR IPM IN TURKEY 26

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Turkey produces more than 60 kind of agricultural crops including cold, warm and subtropical crops. Approximately up to 400 harmful organisms are present and some of them have economic importance.

The first IPM study was conducted in 1970 based on crop (cotton) and continued on apple and hazelnut in 1972. In the following years, IPM studies on wheat, tobacco, grapevine, citrus, peach and cabbage were carried out. By additional of potato, vegetables and ornamental plants (grown undercover), maize, olive, cherry, pistachio and apricot, the number of IPM programmes have reached to 16 in 1995. They were updated and published in 2011.

Apple is the most widespread crop in conducted IPM studies in the country. Forecasting studies against Codling moth and Apple scab have been carried out in all apple cultivation areas of Turkey for thirty years. These studies are being carried on 6.7 million on apple trees by 154 stations in 31 provinces. The other important crop is grapevine, carried out in IPM programmes. Forecasting studies against grapevine berry moth and downy mildew have been carried out in all vineyard cultivated areas of Turkey for thirty years. These studies are being carried on 1.5 million decares vineyard by 49 stations in 20 provinces.

IPM Programmes are carried out with the cooperation of the Research Institutes, extension services, farmer unions and farmers. They mainly cover alternative control measures. Rather than chemical control methods, alternative control measurements such as biological control, biotechnical methods, resistant varieties, genetically control, mechanical and physical control and the cultural measurements have priority in the IPM technical guides. Success of IPM is evaluated by mitigation of pesticide uses.

Future plans for IPM in Turkey; Development of chemical-alternative methods, development of control methods suitable to IPM, improvement of forecasting methods, improvement of present forecasting methods by simulation, development of biological control methods against key pests, number of IPM programme is planned to be increased.

SUSTAINABLE PESTICIDE USAGE IN TURKEY 27

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Crop production products have the potential harm to the environment and human health if not used safely and correctly. Use of pesticides without risking food production and reduction of pesticide risks seem only possible by making innovations in the agricultural production systems. Several strategies are in force in Turkey for mitigation pesticide use.

The country gives priority to developing alternative methods to decrease pesticide use projects about integrated pest management (IPM), biotechnical and biological control. The aim of research studies carried out in the country is protection of human health and environment and research on new methods and techniques as alternatives for chemical control. Four hundred sixty projects on plant health in the last decade were finalized. 37% of these projects are on reduction of pesticide use including alternative methods. These projects were on plant protection products excluding pesticides 22%, biological control 18%, IPM 14%, pesticide residues 8%, pesticide equipment 8%, toxicology 5%, biotechnical control 5%, forecasting 3% and others 15%.

Plant protection applications carried out in Turkey is aim to disseminate IPM, biological and biotechnical control. The projects about IPM began in Turkey in the 1970s. At the beginning of 1980s, we started to share the findings of IPM studies with farmers and they started to put them to use. Technical guidelines for IPM have been prepared on 16 crops and have been put into practice.

Biological control has priorities in plant protection policies and strategies in Turkey. The classical biological control studies in Turkey were started in 1912 and an increasing importance has been given to them since 1970s. Plant Protection Research Institute was reorganized as Biological Control Research Station in 2011. Biological Control Centre will be opened under Biological Control Research Station in Adana. Its purposes are; to increase biological control opportunities, to reduce pesticide use, to protect human health, environment and natural balance. Biological and biotechnical control for reducing pesticide use has been promoted for four years.

Many important directives have been put into force to provide reliable food from field to fork, solve pesticide residue problem in fruits and vegetables faced in exporting and also domestic consumption, and to protect flora, fauna, environment and human health. These studies have prevented inflation of pesticide use in the last decade.

DEPHY: A LARGE NETWORK TO DEMONSTRATE CROPPING SYSTEMS WITH A LOW RELIANCE ON PESTICIDE 30

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The DEPHY network was launched in 2010–2012 as a major initiative of the action plan ECOPHYTO, which was put forward by the Ministry of Agriculture to reduce the reliance of the French agriculture upon pesticides. The network is basically based on 1900 farmers who volunteered to be involved in demonstrating cropping systems with low pesticide inputs. It is composed of about 190 groups of farms distributed over the whole national area, representing six agricultural sectors, namely 'arable crops', 'vineyards', 'orchards', 'vegetables', 'horticulture' and 'tropical crops'. Each group is coordinated by a 'Network Engineer' from a professional organization, i.e. either a local agricultural extension service ('Chambre d'Agriculture', 'CIVAM') or an agricultural cooperative. Each Network Engineer is in charge of (i) animating his group, (ii) elaborating a project with each farmer to change cultural practices and reduce pesticide inputs, (iii) accompanying the farmers in their crop management, (iv) organizing local communications towards farmers outside the network , and (v) collect data to describe cropping systems and evaluate their sustainability. In addition to this farm network (DEPHY-Farm), DEPHY also includes 170 experimental sites (DEPHY-Expe), mostly in experimental stations, where research and extension services test cropping systems based on innovative and/or more risky strategies. The whole network is coordinated at the national scale by a group defining the working methods that are shared in the network, and organizing and analyzing the data for a national communication.

The objective of the DEPHY network is to demonstrate that it is possible to use low amounts of pesticides while maintaining a good profitability and overall sustainability, so as to inspire other farmers and drag them toward more sustainable practices. The level of pesticide use is evaluated at the cropping system level and is compared to a local reference of Treatment Frequency Index. About 30% of the farmers already used little amount of pesticide when they joined the network, and therefore already demonstrate that it is possible to produce with reduced use of pesticide, at least in their specific region and agricultural context. The other farmers were more representative of local crop management when they joined the network, but are expected to change significantly their cropping system and their decision making with the help of the network dynamic, and this is considered a powerful pathway to convince that changing is possible also in agricultural contexts where an heavy reliance upon pesticide is currently the standard dominating model.

The network organizes the analysis of the produced data to (i) identify cropping systems combining low pesticide input and high profitability (e.g. 24% of cropping systems at the beginning of the farm network in the sector of 'arable crops'), (ii) describe the details of those interesting systems (context, management options, decision making process, and assessments of a range of sustainability indicators : productivity, profitability, energy efficiency, workload requirements, …), (iii) identify common features of those systems, both in term of production situation and of strategic

management options, (iv) identify production situations where combining low pesticide use with high profitability remains rare in the network. Some early results of this unique and powerful network are presented.
The DEPHY network is driven by the French Ministry of Agriculture and is funded by ONEMA.

THE MODEL PROJECT "DEMONSTRATION FARMS FOR INTEGRATED PEST MANAGEMENT" – A SUITABLE INSTRUMENT FOR IPM IMPLEMENTATION IN GERMANY

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The German model project "Demonstration Farms for Integrated Pest Management" is part of the German National Action Plan on Sustainable Use of Plant Protection Products. Its objective is the implementation and demonstration of integrated pest management (IPM) measures into practice.

Between 2011 and 2014 in total 66 agricultural farms from different growing regions all over Germany have been selected to become demonstration farms and participate in the project for a period of 5 years. The farms represent major production sectors such as apple growing, viticulture, arable cropping, vegetable growing and hop production. The project aims to introduce innovative findings and suitable methods of integrated plant protection into practice, and demonstrate this to other farmers, advisors as well as to the public.

Specific requirements of IPM based on the general principles of IPM (Annex III of Directive 2009/128/EC) were defined in project-related IPM guidelines formulated for each production sector. In order to ensure a high standard of IPM implementation, demonstration farms receive intense support and supervision by plant protection experts and hired advisors from the plant protection services of the federal states. They provide for comprehensive assistance when introducing new procedures. Furthermore, they are responsible for monitoring of crops, pests and diseases and data collection. Technical advice, monitoring systems and modeling of plant pathogen/pest systems (prognosis, decision-support-systems) is provided by the Central Institution for Decision Support Systems in Crop Protection (ZEPP). Thus, demonstration farms receive IPM-information and excellent advice tailored to their needs which by far exceeds the usual standard (on average one advisor assists five farms). Additionally, the farms receive small expense allowances and monetary compensation in case of yield reductions due to IPM implementation strategies.

The Julius Kühn-Institute (JKI) as a research institution coordinates the overall network and supports activities of the involved plant protection services. Data processing and analysis (e. g. for treatment frequency, risk indicators, non-chemical measures or expenditures for monitoring) as well as interpretation and discussion of results is also part of JKI's responsibility.

Knowledge transfer and public relation work are key objectives of the project. The demonstration farms are encouraged to organise each year a farm day with field seminars and on-site demonstrations to motivate other farms within their region to adopt the demonstrated IPM procedures. The project website introduces the participating farms and informs about the project in general and its results (http://demo-ips.jki.bund.de/).

The work is financially supported by the German Federal Ministry of Food and Agriculture (BMEL) through the Federal Agency for Agriculture and Food (BLE), grant number 2810MD001.

CROP- OR SECTOR SPECIFIC IPM GUIDELINES USED IN THE MODEL PROJECT "DEMONSTRATION FARMS FOR INTEGRATED PEST MANAGEMENT"

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The German model project "Demonstration Farms for Integrated Pest Management" is part of the German National Action Plan on Sustainable Use of Plant Protection Products. Its objective is the implementation and demonstration of integrated pest management (IPM) measures into practice.
In total 66 agricultural farms representing different production sectors (apple growing, viticulture, arable cropping, vegetable growing, hop production) and growing regions all over Germany participate in the project for a period of 5 years. They implement the latest findings and suitable methods of integrated plant protection into practice and demonstrate them to other farmers and advisors as well as to the public with public relations work (e. g. field seminars, open farm days).
The project-specific requirements of IPM based on the general principles of IPM (Annex III of Directive 2009/128/EC) were defined in IPM guidelines formulated for each production sector. They have been specifically drafted for the demonstration farms in cooperation with experts from the plant protection services of the federal states. So far, project-related IPM guidelines are available for arable crops (sector), apple growing, viticulture and vegetable growing (cabbage, carrots). They can be downloaded from the project website in German language (http://demo-ips.jki.bund.de/).

Each guideline is divided into six chapters:

I. availability and use of professional information on IPM
II. preventive measures
III. protection and enhancement of important beneficial organisms
IV. monitoring, forecasting systems and tools for decision making
V. use of non-chemical and chemical plant protection measures
VI. record keeping and check of success

Within these chapters, which follow the structure of the general principles of IPM, about 20 requirements have been defined. These requirements go beyond the baseline of the eight IPM principles and describe all available and feasible IPM techniques for the specific sector or crop. This includes crop rotation, sowing date, use of resistant varieties, measures for enhancement of natural control, pest monitoring and use of tools for decision-making (threshold values, forecast models) as well as use of non-chemical measures and compliance with the necessary minimum of pesticide use.
Our experiences so far show, the implementation of IPM guidelines on demonstration farms is possible and the farms are able to fulfil the majority of requirements, provided that they are supported by the state advisory service. A checklist and a scoring system have been developed in order to assess the progress of IPM implementation on the basis of IPM guidelines on the

demonstration farms.

The work is financially supported by the German Federal Ministry of Food and Agriculture (BMEL) through the Federal Agency for Agriculture and Food (BLE), grant number 2810MD001.

CHECKLISTS AS A TOOL FOR DETERMINING THE STATE OF IMPLEMENTATION OF JKI-GUIDELINES FOR INTEGRATED PEST MANAGEMENT OF THE PROJECT "DEMONSTRATION FARMS FOR INTEGRATED PEST MANAGEMENT" 38

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Checklists and a scoring system were developed to evaluate the implementation of integrated pest management (IPM) on the demonstration farms for integrated pest management (IPM) in Germany and based on the drafted IPM guidelines developed by JKI for apple, viticulture and arable cropping, which follow the structure of the general principles of IPM published in Annex III of Directive 2009/128/EC.

This poster reports on the approach in arable cropping. First, IPM guidelines containing 20 requirements were developed for arable cropping. The checklist based on these requirements. Each requirement was described in detail to ensure an evaluation in terms of the degree of implementation of this given requirement. The described requirements include the use of professional information on IPM, crop rotation, measures for enhancement of natural control, pest monitoring and compliance with necessary minimum of pesticide use by including data on reference farms, etc. In each case, a table can be used for comments, and the degree of implementation is assessed using a scale of 0 to 3, 4 or 6 scores, depending on the importance of the requirement within the IPM concept.

The assessment was done by experts from the state plant protection services in collaboration with the consultants of the states mentioned above. If they determined that implementation did not meet the requirements of the IPM guidelines, the farm received a score of 0 or, at most, 1 or 0 to 2. If implementation performance exhibited room for improvement, the score could be 2, 2 to 3 or 3 to 4, and if performance fully meets the special requirement of the IPM guideline, the maximum score (3, 4 or 5 to 6) was possible. Thus, a total of 80 points could be achieved.

This approach allowed identification of shortcomings in IPM implantation in arable cropping, e. g., insufficient use of fungus-resistant cereal varieties or of non-chemical crop protection measures.

In 2011 (before the project started) the demonstration farms for IPS reached 62 to 83% of the maximum achievable scores. The evaluation of the first project year showed an increase of 2–8% to 70 to 85% of the maximum possible scores. In the second year of the project (2013), a further increase could be achieved and thus amounted to 70 to 90%.

The current discussion relates to what percentage of the maximum achievable scores must be obtained to fulfil an adequate level of IPM. Further development of the IPM scoring system considering bonus points for certain cultural and non-chemical control measures within the context of special environmental protection programs is discussed.

MULTI-ANNUAL RESULTS OF DATA OF THE DEMONSTRATIONS FARMS FOR INTEGRATED PEST MANAGEMENT IN ARABLE CROPS IN MECKLENBURG – WESTERN POMERANIA IN COMPARISON WITH FARMS OF REFERENCE FARMS NETWORK FOR PLANT PROTECTION 39

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The project "Demonstration farms for integrated pest management (DIPM)" was established in Mecklenburg-Western Pomerania with five farms in arable crops in 2011. These typical farms for this region demonstrate the IPM with an intensive support by state advisory service and a special consultant.

In 3 winter wheat (WW), winter barley (WB) and winter oilseed rape (WOR) fields per farm the pesticide use and monitoring expenses by the consultant were collected in the years 2010 and 2011 (before the project started) and in the first years of the project (2012 and 2013). These multi-year data at field level (n=15 fields per year) were compared with the data of the farms of the reference farms network for plant protection (RF). Finally, the environmental risk by the pesticide use has been analyzed for aquatic and terrestrial organisms by the model SYNOPS-GIS. The results showed that the treatment frequency index (TFI) in winter wheat, winter barley and winter oilseed rape during were 13%, 25% or 18% significantly lower in depending on the year in the DIPM the project period (2012–2013) in comparison to the RF (Tab.). The reduction of the TFI was mainly achieved in fungicide (WW, WB) and insecticide use (WW, WB, WOR). This was achieved by the intensive monitoring by the special consultant.

Tab. Pesticide use intensity (TFI) in winter wheat, winter barley and winter oilseed rape in DIPM and RF in Mecklenburg-Western Pomerania in 2010 to 2013

		Before project started				Project period			
		2010		2011		2012		2013	
		DIPM	RF	DIPM	RF	DIPM	RF	DIPM	RF
WW	$\bar{x}$	6,4	6,7	6	6,7	4,7	5,4	5,4	6,9
	s	1,9	1,3	1,2	1,4	1,1	1,7	1,4	1,8
WB	$\bar{x}$	3,8	4,1	3,9	3,8	3,7	4,7	3,5	4,9
	s	1,2	0,6	1,1	0,9	1	1,3	0,8	1,1
WOR	$\bar{x}$	6,1	6,6	6,8	8,1	5,3	6,7	6,1	7,2
	s	1,4	1,9	1,3	0,9	1,5	0,8	1	1,2

The reduction of pesticide use was mainly based on intensive field monitoring by the consultant and the state advisors supporting of the managers of the DIPM. The first results from MV show that monitoring activities for the implementation of integrated pest management in arable crops in the amount of 2.8 h in winter wheat, 1.8 h in winter barley and 3.1 h in winter oilseed rape were needed. In 2012, the chronic aquatic risk was medium in the two networks but twice as high in the DIPM as the RF. In 2013, the chronic aquatic risk was approximately at the same level in both networks and lower than 2012. The analysis of chronic terrestrial risk (earthworm) exhibited and networks at a low risk in both years. It should be noted that the chronic aquatic and terrestrial (earthworm) risk was strongly determined by the TFI and the choice of pesticides. The work is financially supported by the German Federal Ministry of Food and Agriculture (BMEL) through the Federal Agency for Agriculture and Food (BLE), grant number 2810MD001.

THE DEVELOPMENT OF INTEGRATED PLANT PROTECTION IN POLAND 40

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In 1964 for the first time in Polish bibliography the conception of integrated pest control was presented and a year later the results of introductory research of integrated control of sugar beet pests was published. At the same time several research programmes were undertaken in order to determine the role of natural factors in the reduction of pest numerousness as well as to increase the participation of biological and other non-chemical methods in crop protection. On the May 18th 1970 Polish government established the Act of the Council of the Prime Minister No 64/70 regarding organising research on toxicology and safe application of pesticides and control of residues in food and environment of human existence.

Positive results of this Act were following:

- withdrawing of DDT, mercury dressing and other hazardous substances,
- limitation until withdrawal of application of dust forms of plant protection products and organising research systems on residues of plant protection products.

In the same time the system of plant protection products registration was introduced in Poland and also on the territory of the whole country registration of occurrence and density of most important pests was organised. Based on above mentioned activities as well as taking into account the obtained results of experiments elaboration and implementation to the practise of integrated plant protection products took place: in glasshouses (1984), orchards and agriculture crops (winter wheat – 1992, winter rape – 1994).

Important for the development of integrated plant protection was voted by Polish Parliament in 2003 New Plant Protection Act were in the article 68 is stated: "The treatments with the use of plant protection products shall be carried out taking into account, in the first place, biological, agrotechnical and breeding methods or integrated control".

From the end of 90's of the last century the integrated production technology has been implemented to the practice and presently State Inspection of Plant Protection and Seed Production is responsible for the certification of such technology.

Summarising present situation it could be said that there are a number of positive factors which effect the development of integrated plant protection and production as following:

- Polish legislation,
- obtained research results and well-prepared scientists,
- pressure of ecological groups and consumers of agriculture products,
- world trends in plant protection,
- achievements in the production of plant protection products and sprayers.

ECOPHYTOPIC: THE FRENCH IPM WEBSITE – 2 YEARS OF EXPERIENCE 61

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Two years ago the Ecophytopic portal (ecophytopic.fr) officially entered the panorama of the IPM in France.

<u>A rich content</u>

This portal consists of seven platforms dedicated to six agricultural sectors with one more global platform with definition and on-going information. The target of this portal is the different stakeholders involved in IPM and mainly advisers, trainers and farmers. On short-term side, EcophytoPIC relies on the principles of IPM, developing preventive techniques and control methods (biocontrol, physical methods, optimization of chemical control) and addressing the whole area of monitoring, diagnosis and decision. Concerning the practical case, the Dephy network set up under the Ecophyto, provides a lot of information at the farmer and the experimental levels. This network will become an important source of information in EcophytoPIC with technical data, analyzes and briefs. In long term side, EcophytoPIC is looking for new techniques and field testing that should help to contribute to the objectives of reducing the use of pesticides.

EcophytoPIC team identified all past or current national and European programs and provides access to the understanding of projects but also all the results and deliverables of these projects it aims to. These are available in two special sections (Innovation, Research) but can also feed the sections on technical methods of control and surveillance. Again, the Dephy network, through its program of experimentation, but all CASDAR projects (founding by the French Ministry of Agriculture) are described with an explanatory note and all available deliverables.

<u>A dynamic in Ecophyto plan</u>

In December 2012, the first four platforms (all crops, field crops, vegetable crops, fruits) were open to the public. End of 2013, two new platforms (viticulture, horticulture) pursued the construction of the portal.

Finally 2014 is an important year after the opening of the last platform (tropical crops), by focusing on the development of new tools. Among them, a dedicated trainers training platform was launched in October. This platform is an introduction to IPM and allows trainers to have a more holistic vision as possible on the subject but also to get access to portal resources. Additional functionality for non-agricultural sectors was developed with links to the two portals devoted to them. Next, the team works on the development of an interactive tool to raise awareness in the design of efficient systems less dependents of plant protection products. This tool will complement guides with a more direct and playful approach but also due to links to resources in the portal. This tool will be online in the first quarter 2015. EcophytPIC is also french news in the field of IPM:

– Calendar: Dates of events and conferences and links to the papers presented at these events

– Press review: monthly inventory of articles from journals

– Focus: folders on a specific topic by connecting the resources of the portal; currently seven cases up this topic; the frequency of publication of these records is 3 to 4 per year

– Testimonies: Video making an inventory of the use of alternative methods; testimony is the opportunity to link different sections

– Europe: setting link to databases, guidelines and guides IPM products in different European countries. At this moment, thirteen countries are represented.

So EcophytoPIC is now a documentary database with more than 1,400 articles and 6,000 references, but also more than 130 news. You may participate in, by sending your document at ecophytopic@acta.asso.fr

ISIP – THE ADVISORY PORTAL FOR PLANT PRODUCTION IN GERMANY 62

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ISIP, the Information System for Integrated Plant production, is a Germany-wide online decision support system. It has been initiated in 2001 by the German federal extension services as a common advisory portal, thus achieving synergies by pooling existing information. Despite the centralised character of the system, the regional identity of the co-operating services was to be preserved by a distributed administration and data input.

Since information transfer is the primary task of extension services, the system is intended to make this work more efficient by using modern IT. By combining general with specific data, recommendations can be refined from regional to individual. The information is primarily distributed via HTML pages; the usage thus requires only a browser on a desktop computer (www.isip.de) or a mobile device (m.isip.de).

Three types of information can be distinguished in ISIP, differing in scale. The most general information is given in an encyclopaedia, where background information and standard recommendation for more than 20 crops and 200 pest and diseases are available. More specific information is provided in regional news. The members of the ISIP association can maintain own pages in the system, where they can distribute topics ranging from contact data to legislative news. Decision support modules (DSM) deliver the most specific results. They comprise results from a simulation model (mainly delivered by ZEPP – see separate presentation) and/or monitored field observations as well as a comment of the regional extension officer. This concept of the 'threefold decision support' gives a comprehensive overview for a defined pest or disease.

Decision support modules provide a very efficient way of knowledge transfer. Scientific results can be used in practice when presented in a straightforward manner. DSM are shown in ISIP as maps, tables and graphs. Maps present data in a geographical information system (GIS) for a regional overview. Tables and graphs give a more detailed view in a specific area. A limited set of colours and icons provide for a consistent interface for the user. To release the user from having to check his individual results consistently, an automatic warning service can be set up. When a module-specific threshold is exceeded, an SMS or e-mail is generated by the system and sent to the user.

The advantages of the ISIP system differ between the two target groups. On the one hand, the farmer gains most from the on-line calculation of prognosis models which deliver site-specific recommendations. Furthermore, the automatic warning service reduces online as well as response times especially for time-critical decisions. On the other hand, extension officers benefit from the mobile input of monitored field data and advisory comments. This eliminates further processing and ensures a fast and efficient information transfer.

IPM IN US SCHOOLS: REDUCING RISKS FROM PESTS AND PESTICIDES AND INCREASING AWARENESS AND APPRECIATION FOR IPM AMONG CONSUMERS AND TAXPAYERS

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More than 40 reports over the past twenty years have documented unmanaged pest problems and high risk pesticide use practices in US schools. In 2006, a broad-based coordinated national effort was initiated with ongoing support from US EPA USDA to achieve verifiable IPM at an advanced level along the IPM continuum in all US schools by 2015. The work has included traditional models including demonstrations and publications; novel peer-to-peer regional learning communities composed of school district representatives, agency representatives, contracted service providers and others; making the connection between environmental justice, cockroaches, and childhood asthma and obesity; addressing new pest challenges including bed bugs; and social networking to a new contact database of facility managers at school districts nationwide. Our 2012 survey indicates we now have IPM in school districts in more states than ever before, with about 20% of school districts nationally implementing key elements of IPM. Momentum continues to build, including a recent commitment of an additional $1.5 million USD annually from US EPA and designated school IPM lead staff in each EPA region. Performance metrics include reductions in both pest complaints and pesticide applications, numbers of school districts and children impacted, leveraged funding, and school districts with IPM policies, plans, coordinators and other programmatic elements. Achieving IPM in US schools has implications for agriculture including increasing policy maker, consumer and taxpayer awareness and support for IPM and providing a model for coordinated efforts to achieve IPM objectives in other arenas.

IMPLEMENTING IPM IN STRAWBERRY PRODUCTION IN FINLAND BY UTILIZING DEMONSTRATION FARMS AND EXPANSIVE LEARNING

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The IPM implementation in strawberry crops was supported in demonstration farms to encourage the use of selective pesticides, biocontrol and decision making based on pest monitoring. Another objective was to study the learning process of growers who implemented new IPM elements to better understand the between-farms variability in implementation success. The IPM concept among ~ 200 berry producers was first defined from the discourse data of group interviews. The majority of growers conceived IPM as increased efficiency of pesticide use, i.e. as first stage IPM. In the group interviews, strawberry producers named documentation and learning from it, and the use of action thresholds for pest control, as the most challenging IPM elements although many were already using them. Therefore, the project was later focused on these elements. In four demonstration farms, growers were guided to the use of monitoring methods and to documenting monitoring results in a web-based prototype of IPM portal. Each farm had a conventionally managed plot and an IPM-plot where management actions were guided by pest monitoring results. The success of pest management in both plots was verified by flower stalk analysis to measure the quality and quantity of the strawberry yield. After the first summer, the farmers reflected on their pest management experiences through semi-structured thematic interviews. The discourse data was analyzed for expansive learning actions using activity theory as the theoretical framework, and root conflict analysis was applied to the most interesting case for determining all pest management challenges and related issues in the farm. While reflecting, the growers modeled their own behavior, first at conceptual level then by adjusting their concrete pest management actions for the next summer. There were differences in how quickly the farmers adopted offered IPM elements, whether their learning was restricted to the offered elements or expanded also to other IPM elements and crops, and in the degree of adopting the use of the portal as a means of documentation. In all farms, pest management became more proactive. The level of pest damages was similar in both types of plots, as was the number of chemical treatments, but in IPM plots only selective pesticides with lesser ecological effects were used. In the second summer, the decision making concerning the need and timing of pesticide treatments in the IPM plots “spread” also to the conventional plots. Only one farm of the four adopted the use of the portal as a means of documentation. The results on expansive learning can be utilized for developing tools for purposes of consulting farms on their development issues, and for designing specific means of supporting IPM implementation according to the farms’ specific challenges. The reflection data was found useful also for purposes of user

studies when testing prototypes of IT-based tools for documentation and pest management decision-making.