

# SCAR Collaborative Working Group on Integrated pest management for the reduction of pesticide risks and use

## Executive Summary 2011-2013 activities

### I - Context and rationale

These are times of change for crop protection in Europe. The European Union is now placing greater emphasis than ever before on crop health and plant protection policies in order to ensure the protection of human health and the environment without compromising food production and competitiveness of the agricultural sector. In 2009, the passing of Regulation 1107/2009 concerning the *placing of plant protection products on the market* and Directive 2009/128/EC which established a new framework to "*achieve a sustainable use of pesticides*" by introducing a number of measures aiming at risk reduction and "*promoting the use of integrated pest management and of alternative approaches or techniques such as non-chemical alternatives*" mark a turning point. The new legislative landscape means that farmers in the future will no longer have access to the entire range of pesticides they use today and that they will have to adopt Integrated Pest Management (IPM), incorporating alternative approaches or techniques to reduce the risks associated with the use of pesticides. In December 2012, EU Member States have initiated the implementation of the National Action Plans that will make it possible to reach the new objectives. By January 2014, Member States are required to describe how they ensure that the principles of IPM are implemented.

There is therefore a significant long-term need for support in developing policy, new knowledge and effective dissemination and implementation processes in the area of plant protection for the reduction of pesticide risks and use. Hence, the SCAR CWG focussed in their work on validating the role national plant protection and research policies have to strengthen IPM implementation and to identify existing gaps. The CWG conducted survey efforts in 2011-2012 focusing on the implementation of IPM and IPM supporting policies.

#### 1. Policy

The experience concerning the development and the ambitions on specific focus areas of the action plans vary greatly across the EU. France (Ecophyto) and Germany (the National Action Plan<sup>1</sup> from 2008) consider that those plans regarding pesticide use did require only minor adjustments and are focusing on their efforts on research and extension. Others, such as Hungary and Italy consider that they are in the early stages of policy development. There is also significant diversity in the policy levers emphasised, ranging from the revision of pesticide taxes in Denmark to handing over major implementation responsibilities to farmer organisations and the pesticide industry in the United Kingdom. Extracting lessons learned and benefiting from the varied experience across the EU will be useful in helping Member States face the new challenge.

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<sup>1</sup> The National Action Plan on Sustainable Use of Plant Protection Products (April 2008)

## 2. Research programmes

Member States are currently in the process of developing research programmes designed to support their NAP. Some are developing new programmes dedicated to the goals of the NAP while others are building on existing research efforts. In addition, a core element is to reduce the pesticide risk and use without compromising food production and competitiveness of the agricultural sector and can only be achieved by redesigning agricultural cropping systems which, in turn, request a new set of innovations. In all cases, the challenge of the new demands coupled with the current increasing scarcity of funding make it difficult for Member States to develop effective research programmes alone. Also, the nature of plant protection research in the context of health and environmental goals is clearly multi-disciplinary. Work at the European level can help to achieve a critical mass, create synergies, and enjoy access to the diverse competencies required by IPM. In some cases, research programmes could be coordinated to create synergies. Some research resources and results can be pooled to make them available to the wider research community.

National research programmes for the development of practices less dependent on pesticides can benefit from each other and create synergies and economies of scale by sharing lessons learned from past research experience, comparing national specificities and by coordinating their agendas.

## 3. Extension

All Member States must also place great emphasis on implementation. There is a demand for effective dissemination activities and implementation processes to reach the goals of their NAPs. Modifying crop protection practices away from pesticide-based methods means adopting approaches that are new, more site-specific and build on multi-stakeholder processes. It is of great value for advisory services to be informed and learn from the experience in other countries both in terms of content (innovative scientific and agronomic approaches) and learning approaches (participatory training methods, multi-actor co-innovation).

## II - Objectives of the SCAR CWG on IPM

There are existing initiatives of relevance to the new challenges in crop protection that offer a starting point. But their thematic and geographical scopes as well as the degree of information sharing and coordination need to be increased. They have been mostly focusing on the farm level, if not only the field while a great potential for improving crop protection can be obtained by the wider application of technologies and also by considering the potential of landscape ecology to reduce pest pressure and develop biological regulation processes. In addition, national research policies should be known in order to achieve a coordination of research policies needs. Also, transition to alternative cropping systems needs to consider the economic viability of innovative systems, not only for farmers but also at the supply chain level. Finally, the potential for EU sharing infrastructures, such as field experiments, co-innovation networks and monitoring systems should be evaluated. The opportunity to achieve a coordination of research policies also needs to be investigated for example by learning more about national research policies across Europe.

## 1. Objective

The objective of this proposed Collaborative Working Group was to initiate a European-level process in support of national policy, research and extension strategies enabling the development of low pesticide-input pest management in accordance with Directive 2009/128/EC, in particular with respect to article 14 and taking into consideration the potential of new areas of research and innovation.

The specific goals were to:

- Provide a European forum for exchange and needs on research priorities to design cropping systems reducing pesticide risk and use and to facilitate transition to such innovative systems;
- Contribute to the development of NAPs by facilitating sharing of national experiences on pesticide-related policies;
- Support the definition and implementation of national research programmes dedicated to the development of Integrated Pest Management strategies and coordinate national actions where feasible;

## 2. About the Collaborative Working Group on IPM

The Collaborative Working Group is relevant to EU-27 national authorities responsible for the development of their NAP and strengthening their research and extension programmes pertinent to plant protection. It is also relevant to non-EU European States sharing the goal of developing plant protection management strategies that satisfy the new health and environmental goals.

In the core CWG participated regularly: Austria, Belgium, Switzerland, Czech Republic, Germany, Denmark, Spain, France, Ireland, Italy, The Netherlands, Poland, Sweden, The United Kingdom and Turkey; Hungary participated to one meeting. The Collaborative Working Group on IPM was active from May 2011 until June 2013 and met five times.

The CWG identified the following five tasks for the CWG:

Task 1: Scientific Support to NAP development regarding IPM

Task 2: Compare research programmes and facilitate their coordination

Task 3: Identify long-term research needs

Task 4: Strengthen pest monitoring systems

Task 5: Reflection on new extension needs and identify research needs

The best suited method to gather the relevant information was to conduct two surveys. The CWG conducted a Europe-wide [survey of plant protection policies and associated research and extension relevant to Integrated Pest Management](#). The results of this general and transversal mapping survey were completed with phone interviews, internal debates of the CWG and with Member States presentation of NAP. The second survey focused on IPM pest monitoring systems across Europe and the potential to initiate the cross-border use of pest monitoring system.

The full survey information and survey report are annexed.

### III - Main results

#### 1. Policy

##### Task 1: Scientific Support to NAP development regarding IPM

The survey results were compiled to map the current status (by end of 2011) of the National Action Plans. Table 1 gives an overview of the situation in MS (Based on available information in October 2012). It expresses a great diversity in the dynamics of the implementation of NAPs.

The Directive 2009/128/EC sets out the requirements which MS have to implement in NAPs, including IPM. For example, many MS defined specific water protection goals, lay out particular provisions for handling, storage and sales of pesticides and training of pesticide users, advisors and distributors. IPM is addressed by enhancing the education and training of farmers and advisors concerning alternative plant protection strategies, the use of biological control and the development and implementation of crop specific IPM guidelines. In particular, the training of advisors and the increase of advising activities in IPM are emphasised.

Table 1: National Action Plan at-a-glance<sup>2</sup>

Country	Start and end date of Ntl Programme	Do you have a national crop protection policies dedicated to pesticide use or risk reduction in force?	Do you have a national policy programme specifically dedicated to IPM?	IPM focus
AT <sup>2</sup>		In progress		
BE	2005-2012	Yes	No	at regional level
BG		In progress	Yes	Encourage IPM
CH	started 2008	Yes	Yes	IPM became standard
CZ <sup>3</sup>	2012-2020	In progress (2017-2020)	In progress	
DE	2008-2020	Yes	Yes	Within agri-environmental programmes
DK	2009-2013	Yes	Yes	Have a dedicated IPM advisory programme
EE	none at this time	No	No	Estonian Plant protection Act with IPM principles
ES	2007-2012 In progress the new National programme: 2013-2016	Yes	No	No specific IPM focus
FI	started 2011	Yes	Partially dedicated	Have 9 demo farms on IPM and IPM dissemination efforts
FR	2008-2018	Yes	Yes	Most of the Ecophyto 2018 plan targets IPM
LT <sup>2</sup>	Plant Protection Plan (Approved Minister for Agriculture of the Republic of Lithuania of 29 June 2012)	In progress		Under discussion
LV <sup>2</sup>		In progress		National strategy for good agriculture practice and IPM system
IE		In progress	No	No specific IPM focus
IT		In progress	Partially dedicated	1 of 4 working groups in the national policy is dedicated to IPM
IT (Emilia Romagna)	L.R. 28/98; PSR – Rural Development Plan 2007-2013			
NL	ended 2010 - new one starts 2013	Yes	No	under discussion
NO	2010-2014	Yes	Yes	IPM focus until 2014, not clear after

<sup>2</sup> Based on available information in October 2012 – see the following website for up-to-date information [http://ec.europa.eu/food/plant/pesticides/sustainable\\_use\\_pesticides/national\\_action\\_plans\\_en.htm](http://ec.europa.eu/food/plant/pesticides/sustainable_use_pesticides/national_action_plans_en.htm)

<sup>3</sup> Information from the workshop report of the EU Expert Meeting on National Action Plans on Sustainable Use of Plant Protection Products (June 5,6, 2012).

Table 1 (continue): National Action Plan at-a-glance<sup>4</sup>

Country	Start and end date of Ntl Programme	Do you have a national crop protection policies dedicated to pesticide use or risk reduction in force?	Do you have a national policy programme specifically dedicated to IPM?	IPM focus
PL		In progress	Yes	IPM principles within the Integrated Production system
SE	2010-2013	Yes	No	No specific IPM focus
TR	Veterinary services, plant health, food and feed law initiated in 2010	Yes	Yes	Emphasis on biological control in IPM
UK	Pesticides Strategy updated annually	Yes	Yes	Under generic arable and horticultural policy

## 2. Research

### Task 2: Compare research programmes and facilitate their coordination

A purpose of the survey was also to share information on past and current research programmes aiming at reducing pesticide risks and use and to assess to what extent a better coordination would be possible and provide added value.

From Table 2, we can highlight that several Member States already have or are planning national research programmes as part of their NAP. Most will include IPM research topics, but only a few are explicitly dedicated to IPM. This context makes it difficult to identify specific IPM research programme or budget because it is often part of a larger programme. A more in-depth analysis of these National programmes is needed.

<sup>4</sup> Based on available information in October 2012 – see the following website for up-to-date information [http://ec.europa.eu/food/plant/pesticides/sustainable\\_use\\_pesticides/national\\_action\\_plans\\_en.htm](http://ec.europa.eu/food/plant/pesticides/sustainable_use_pesticides/national_action_plans_en.htm)

Table 2: IPM related programme and budget

Country / Region	Partner	National IPM-related programme (short description and references)	Average annual budget for research
AT	BMLFUW	Including PFEIL-15 Applied research for agriculture, forest and water	0.8 M euros in 2010/2011 on IPM-related topics
BE	IWT	Agricultural research and innovation activities (LA-trajecten)	10 M euros
CH	Federal Research Station Agroscope	No specific research program for IPM, but the current research program of Agroscope is related to IPM, since three research departments (Crops in Alpine Areas, Arable Crops and Vines, Fruit and Vegetable) covers plant protection research and therefore specific aspects of IPM	
CZ	Ministry of Agriculture (MoA) and the National Agency for Agriculture Research (NAAR)	IPM and pesticide-related risk reduction 2013-2018: Comprehensive sustainable systems in agriculture “CSS”.	2.6 M euros (covered 2 programmes on different periods of time)  Ministry of Agriculture provided € 0.9 million from its budget, programme has been opened since March 2012
		Programme of applied research: Complex sustainable systems in Agriculture 2012-2018	Total budget 104 M euros over 7 years
		Plant health research projects in 2012: IPM systems of plant protection	30 projects for 2 900 000 euros
DE	BMELV	National Innovation Programme	37 Mio. €
		Federal Organic Farming Scheme and other forms of sustainable agriculture (BÖLN)	17 Mio €
		International cooperation and Food security	2.5 Mio. €
		Demonstration Farms on Integrated Plant Protection	1,4 Mio. €
	JKI	Scientific support programme for NAP implementation	1 full time scientist
		Development of approaches for IPM; Development of alternative approaches; Evaluation of pesticide use and potential for pesticides use reduction in long-term experiments; Economic assessment of IPM approaches	Several full time scientists per topic
		Development of models and IT-supported technologies for DSS in arable crops and spatial applications GIS	1-2 full time scientists per topic
		Applied research and EU collaboration on minor use issues (collaboration in international MU groups)	2 full time scientists

Table 2 (continue): IPM related programme and budget

Country / Region	Partner	National IPM-related programme (short description and references)	Average annual budget for research
DK	Ministry of Agriculture (DAFA)	<u>Green Development and Demonstration Programme (GUDP)</u> , some IPM related research are included	GUDP has a budget of ca. 30 m. EUR per year.
	Ministry of Environment (Danish Environmental Protection Agency)	<u>Pesticide research programme</u> . Currently it supports a project on integrated weed management in arable crops and biological control of pests in strawberry.	Budget of ca. 2.5 M euros per year
	DAFA and Ministry of Environment	Green Growth : a budget was allocated to support the implementation of IPM in Denmark	Approximately 2 M euros was allocated to a research programme focussing on the development of forecasting, monitoring and decision support systems.
	Ministry of Science, Innovation and Higher Education		Currently the committee on food is financing projects on pesticide resistance (ca. 2.5 M euros), cereal rust diseases (ca. 2.5 M euros), disease resistance in GMOs (2 M euros) and disease resistance without yield loss (ca. 2 M euros).
EE		Individual IPM projects	20,000 euros
ES	Ministry of Economy and Competitiveness 2013-2016	<ul style="list-style-type: none"> <li>- National Programme of R+D+I oriented to challenges to society (www.inia.es):</li> <li>- Specific programme of Agriculture and technology research (RTA): - Specific programme of Genetic Resources (RG: RF, RZ, RM)</li> <li>- National Programme of R+D+I of excellence to generate knowledge. AGL. (www.mineco.es)</li> </ul>	The RTA budget (2013 – 2016), has been officially approved but not yet published
FI	MTT	IPM implementation and pesticide-related risk reduction (ongoing projects 2013-16 directly related to IPM-implementation).	2014: 300 000 € 2015-16: 40 000 € /year Applied research on plant protection with relevance to IPM implementation is carried out at MTT with a yearly budget of about 2,3 million euros.



Table 2 (continue): IPM related programme and budget

Country / Region	Partner	National IPM-related programme (short description and references)	Average annual budget for research	
FR	Ministry of agriculture (PF)	Ecophyto Research programme: ( <a href="http://agriculture.gouv.fr/Ecophyto-in-English-1571">http://agriculture.gouv.fr/Ecophyto-in-English-1571</a> )	>2 M euros per year Specific Ecophyto funding:	
			Ecophyto (2009)	1 257 907
			Ecophyto (2010)	1 413 886
			Ecophyto (2011)	1 958 681
			Ecophyto (2012)	2 434 230
			Ecophyto (2013)	1 367 466
	INRA (PO)	Sustainable Management of Crop Health meta-programme (SMaCH)	1M€/year	
HU	SZIE (PO)	IPM development in selected field crops and orchards, Complex National R&D programs for healthy food and environment	50,000 euros/year	
	Ministry of Rural Development	IPM related programme;; Hungarian Plant Protection Chamber (operating and developing pest forecast system), National Food Chain Safety Office (R&D for minor use)	Both together 40,000 euros/year	
IE	Teagasc	IPM related research programmes: - Fungal population sensitivity to fungicides; - Agronomic approaches to disease control; - Host resistance and tolerance to fungal disease; - Breeding for blight resistance (potatoes).	0.4 M euros on these topics	
IT	Emilia Romagna Region	- Coordination and support of IPM technical assistance; - Pest and disease field monitoring - Monitoring programme for pesticide resistance	1 M euros	
LT	Ministry of Agriculture (ŽŪM)	2013-2015: Investigation of Integrated Pest Control measures in the most important agricultural crops	48,000 euros/year	
	Lithuanian Research Centre for Agriculture and Forestry (LRCAF)	2012-2016: Pests in agro and forestry ecosystems	184,000 euros/year	

Table 2 (continue): IPM related programme and budget

Country / Region	Partner	National IPM-related programme (short description and references)	Average annual budget for research
NL	Ministry of Economic Affairs	In recent years NL has invested heavily in the development and dissemination of knowledge on IPM. In the years to come, the emphasis will be on an even broader dissemination of knowledge and methods, as well as continuing the development of new integrated methods. This is done in a public-private cooperation research programme.	2.5 M euro's/year (public investment)
NO		IPM research is within a research programme called "The Food Programme" or "research programme on Sustainable Innovation in Food and Bio-based Industries" (BIONAER)	The total budget of BIONAER is 28 M€ annually, part of it is used for IPM research. Foundation for Research Levy on Agricultural Products and The Agricultural Agreement Research Fund also finances research on IPM nationally.
PL	State Budget via Ministry of Agriculture and Rural Development	Significant part of the research done in this programme (2008-2014) (and related budget) is dedicated to IPM. Another programme is planned for 2015-2020	1 M euros
	IPP-NRI (co-investigator)	Involved in PURE Long Term Programme "Protection of cultivated plants with the consideration of food safety, reduction of yield losses and threat to human farm animals and the environment"; connected with IPM and reduction of the risk in PPP.	
PT			
SE	FORMAS	Annual Open Call (applied research in Agriculture, Forestry and Water)	5M/year Over the last four years, four specific IPM projects were funded (1.5 M€)
TR	MFAL-GDAR	Plant Health research programme including IPM research	1.2 M€ in 2012 of which 470,000 euros were dedicated to IPM topics
UK	Defra-funded pesticides R&D programme	This programme, managed by CRD (Chemicals Regulation Directorate), has a longstanding significant programme of work to reduce reliance on chemical pesticides by developing novel alternative technologies.	Development of biopesticides through R&D and a special Biopesticides Scheme: since 2006 approximately £2.1 million has been spent on research (excluding R&D on semiochemicals) and £150,000/year spent on the Biopesticides Scheme and related regulatory activities.

### Task 3: Identify long-term research needs

The new demand placed on crop protection challenge is to develop new approaches to innovation, integrated and multidisciplinary research, new competencies and new areas of study. The task builds on R&D priorities emerging from a collective reflection using scenario-building (based on the ENDURE foresight study “European Crop Protection in 2030”).

The survey provided little information on long-term needs. However, it was pointed out that IPM strategies should be tested for their long-term sustainability and this often requires investments which go beyond the timeframe of a typical research programme. The CWG found examples of well-established sites where systems experiments are carried out regarding crop protection research questions in Germany, France, Denmark, Italy, Poland, Sweden and the United-Kingdom. These typically test combinations of factors involve different crop sequences, varietal mixtures, weeding and soil management regimes.

Even if the Group has not specifically addressed long-term research needs, like considering climate change, land-use changes or CAP, it acknowledges the findings emerging from the Strategic Research Agenda of the Joint Programming Initiative on Agriculture, Food and Climate Change (JPI-FACCE).

### Task 4: Strengthen pest monitoring systems

With this task, the CWG wanted to obtain an overview and deeper understanding of pest monitoring systems to better anticipate pest emergence and as support for sustainable crop protection. Results expected were to share experiences and methods and to identify instances where monitoring systems can be networked at a supra-national level.

PMS integrate a wide range of domains, from forecast and monitoring of pests and diseases, warning and alert systems to scouting thresholds and advisory services on integrated pest management. It also covers a wide range of actors including farmers, advisors, scouts, people from government, industry, researcher etc. In this respect pest monitoring systems are not limited to computer-based systems but comprise initiatives, networks, activities, tools etc. that assist farmers in taking the right decision in integrated pest control.

As mentioned above, the CWG decided to answer this task with a Europe wide survey. Its goal was to map out the current situation on pest monitoring systems (PMS) for integrated pest management. The three major components of PMS and their interlinks were in the focus of this survey:

**In-field monitoring/surveillance/scouting:** Up-to-date and periodic in-field monitoring/surveillance/scouting of weeds, pests and diseases;

**Decision support systems:** Alert systems, simulation and forecasting systems which help farmers to identify monitor and control weeds, pests and diseases;

**Pest warning services by extension services/advisors:** Specific advice from independent extension services/advisors. The advice is generally based on individual professional working experience and the interpretation of up-to-date DSS outcomes and monitoring/surveillance/scouting results.

The supervision of pest monitoring systems and evaluation is mostly in responsibility of governmental institutions in cooperation and supported by national stakeholders such as boards of agriculture, national and regional advisory service and research institutions. The development of PMS requires immense resources which is one of the reasons that DSS are

only developed for the most damaging pests. Thus, benefits can be created by sharing systems based on a common ontology between countries or regions and for pests which currently occur rarely or below economic damage thresholds but are anticipated to become more damaging in the future.

It is assumed that increased efforts to network PMS on a national but also the European level would create further benefits for the assessments of the efficacy and impact of control options on a long-term basis and across regions.

Cross-border use is recognised as useful, especially for minor crops or special pests. The availability of weather data in the “right” format is considered as the crucial point in cross border approaches. Experiences exist but go back to a time, where data harmonization issues were not a topic on any official agenda. This is different today. The use of spatial data can lead to a more regionalised or spatially explicit decision support. EU initiatives such as INSPIRE and SEIS<sup>5</sup> push the harmonization of (spatial) data (including e.g. meteorological data) on EU level. This should be used for new experiences in cross-border use projects.

### 3.Extension

#### Task 5: Reflection on new extension needs and identify research needs

Even though investment in extension may not be usually recognised as research per se, dissemination, communication, co-innovation, facilitation of collective processes, training and advice, i.e. all the interactions linking farmers to researchers, are widely recognised as major bottlenecks to mainstreaming IPM. Furthermore, this sector is an essential part of the innovation process. Existing innovative extension initiatives should be taken advantage of as sources of inspiration and agricultural knowledge systems should be better understood. The efficacy of an agricultural production system has to take into account advisory services which are key players in the knowledge generation and decision-making process of farmers. Also, the way knowledge is spread is important to IPM implementation; therefore information on how knowledge is disseminated to or co-generated with farmers in the different countries should be known and shared.

Knowledge-sharing, a collective reflection on the new challenges in crop protection within the agricultural extension community across Europe and the development of new extension instruments to follow transition towards IPM need to be facilitated via co-innovation networks, new advisory frameworks and tools such as ICT-based advisory systems such as online diagnostic tools. Future initiatives could benefit from links to the Collaborative Working Group AKIS and DG AGRI's FAS programme.

Research needs to develop knowledge transfer and implementation specific to the development of low pesticide input pest management need to be identified.

Three existing European fora can be included in a collective reflection on new extension needs:

#### EUFRAS - European Association of Farm and Rural Advisory Services<sup>6</sup>

EUFRAS is a European association of public and private rural and agricultural extension services modelled after the Global Forum for Rural Advisory Services. It assists farmers and rural dwellers by promoting networking and opportunities for collaboration, by fostering

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<sup>5</sup> <http://ec.europa.eu/environment/seis/>

<sup>6</sup> <http://www.eufras.eu/>

better interactions with research organisations, by contributing to shared policy issues and by supporting the development of better advisory services in Europe in general.

#### European Innovation Partnership 'Agricultural Productivity and Sustainability' - EIP<sup>7</sup>

The EIP "Agricultural Productivity and Sustainability" provides a working interface between agriculture, bio-economy, science and others at EU, national and regional level. It serves as a catalyst to enhance the effectiveness of innovation-related actions supported by Rural Development Policy as well as the Union Research and Innovation.

#### ENDURE Co-innovation initiative<sup>8</sup>

A group of ENDURE partners from INRA and ACTA (FR), WUR (NL), and VFL (DK), in collaboration with MTT (FI) is developing a European initiative on co-innovation using crop protection within sustainable agriculture as a domain of application. It is developing the theory and practice of co-innovation via the creation of a community of practice and a resource centre on collaborative approaches to innovation in the context of mainstreaming Integrated Pest Management practices.

## IV - Recommendations

Through the survey analysis and the ensuing discussions in the SCAR CWG, several priority topics regarding potential multi-Member State joint actions emerged.

### 1. Develop relevant and science-based indicators

The development of indicators used in assessing the progress of large research and/or policy programmes is of concern to all involved in the implementation of National Action Plans. An initial area for future joint action is to enable countries to compare and share information as well as to harmonise the selected indicators of interest at national level. Harmonised indicators in terms of the Directive shall help to identify priority concerns for pesticide use in different crops and areas. In terms of IPM implementation indicators help assess to what extent differences between countries are due to environmental conditions or to crop protection strategies.

Obviously, indicators of use, risk or impact are useful at local scales, including the individual farmer level. There is one specific area where indicators might be very helpful in guiding farmer practices. It concerns the relationship between pesticide burden, any agricultural practices that affect crop protection, and environmental impact. This relationship is not always clear. Indeed, to-date there is a lack of understanding on how farming practices and pesticide use which occur in a particular space and time, relate to health and environmental impacts which often emerge at a different time and space. As a result, there are no guiding principles for farmers to adjust their practices with a certain degree of assurance that such adjustments will translate to reduced impact. To identify which management practices should be implemented, how they should be adjusted, and how to facilitate their adoption by operators, this major bottleneck needs to be addressed.

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<sup>7</sup> <http://ec.europa.eu/agriculture/eip/>

<sup>8</sup> [http://www.endure-network.eu/about\\_endure/all\\_the\\_news/endure\\_launches\\_co\\_innovation\\_initiative](http://www.endure-network.eu/about_endure/all_the_news/endure_launches_co_innovation_initiative)

*Priority research 1. Conduct joint research on the relationship between practices and their contribution to environmental impacts and benefits.*

The SCAR CWG on IPM recommends further development of indicators of use, risk and impact with an emphasis specific to joint research on the relationship between practices and their contribution to environmental impacts and benefits.

## 2. Optimise pest monitoring systems and decision support

Regarding pest monitoring systems and decision making, several potential joint actions have been identified to optimise current monitoring systems:

- Help share monitoring information among farmers and among for-profit and public sectors with respect to both technical and proprietary aspects;
- Harmonise monitoring protocols to compare data and create new models, especially for cross-border application;
- Increase the biogeographical area where existing Decision-Support Systems (DSS) are applicable by sharing and adapting them across regions.

As for research, the potential of DNA-based technologies to improve the detection of invasive and quickly evolving pests has been demonstrated but needs joint effort to make reliable information applicable to a full range of European pests, easily available in databanks and reliable. This could complement the development of ICT-based diagnostic tools for farmers and advisors.

In addition to these information systems, a new generation of Decision-Support Systems is needed. Indeed, whereas pesticide use is usually based on real-time tactical decision-making (one crop/one pest/one technique), IPM requires a more strategic and dynamic approach based on a combination of diverse techniques. To caricature, the new systems would provide for example insights on desired varieties, cropping sequences, combination of direct control methods, relevant agronomic practices (irrigation, fertilisation, soil management, etc.), and expected damage and economic consequences, instead of "spray/don't spray" guidance.

Epidemiological models should be used in the context of the cropping systems and consider crop damages.

Considering that there is a high demand to improve monitoring and decision-making coupled with the realisation that many emerging systems are already in place across Europe points to cross-national opportunities. This is probably one of the areas most ready for joint actions where the biogeographical area of applicability of DSSs can be extended by sharing and adapting them across regions.

*Priority research 2. Characterisation, detection and identification of harmful and beneficial organisms for crop health.*

The SCAR CWG on IPM believes that pest monitoring and decision support systems would benefit from research and development effort on the characterisation, detection and identification of harmful and beneficial organisms for crop health with new, fast and reliable tools, models, information systems, and databanks.

*Priority research 3. Pest monitoring systems and predictive models to inform both strategic and tactical decisions.*

The SCAR CWG on IPM supports further research on pest monitoring systems and predictive models to inform strategic and tactical decisions in order to map the effect and interactions of cropping systems, pest pressure, climate and environments on crop damages at various temporal and spatial scales.

The exchange and adaptation of models is recognised as an opportunity for the efficient use of resources with shrinking national public budgets and human resources. Cooperation can be facilitated by enabling links between DSS by using a standard ontology and collating the data in harmonized formats that their exploitation and exchange with other environmental networks or purposes would be possible.

### 3. Design cropping system that prevent or minimise pest pressure

Achieving lasting control requires work at the cropping system level and on the combination of multiple control strategies. Agronomic practices such as crop sequence, sowing date and density, and/or introduction of non-conventional crops, need to be taken into account when adding robustness to cropping systems. Although this area may not yield results quickly, the types of results expected are key to devising more robust solutions. Initially, joint actions could involve sharing on, or coordination of existing cropping-system experiments.

One general recommendation is to share information and results on cropping systems research and set up a EU-level network of IPM experiments. Managing weeds while adopting a low-pesticide input approach is emerging as a major challenge for arable crops across Europe. One specific recommendation here is to integrate sets of alternative weed control methods and address weed management at the cropping system level.

*Priority research 4. Sustainable cropping systems at the landscape level that prevent or minimise pest pressure.*

The SCAR CWG on IPM identifies research on designing cropping systems that prevent or minimise pest pressure via sustainable management of disease resistance, habitat manipulation, temporal, spatial and intra and inter-specific diversification as a priority area promising longer term benefits. In particular, taking into account landscape-level effects in the design of cropping systems is a new and promising avenue for research.

*Priority research 5. Integrated Weed Management in arable cropping systems.*

Regarding the special challenge posed to IPM by weeds, particularly in a context of global change, the SCAR CWG on IPM identifies as a priority Integrated Weed Management in arable cropping systems with model-based design of innovative strategies and evaluation of their sustainability under a variety scenarios.

#### *Priority research 6. EU-level network of IPM experiments.*

Considering the pre-existence of a number of relevant cropping system-level experiments across Europe, the SCAR CWG on IPM emphasises the opportunity of setting up an EU-level network of IPM experiments. Such a network benefits from, the exchange of long-term data of existing experimental sites in different regions and several cropping systems and the efficient use of a resources.

#### **4. Diversify direct control methods**

Approaches involving chemical control, bio-pesticides and biological control, plant genetic resistance, mechanical control alternatives and particularly their combination developed with a pesticide reduction objective concern a large number of actors, a broad diversity of disciplines and usually imply a key role for the for-profit sector. Therefore, joint actions in this area need to be particularly multi-disciplinary, to be structured via public-private partnerships, and address multiple sectors of intervention including policy (e.g., rules on registration of biological agents or products and on the development of new cultivars).

A promising area for joint research regards the exploitation of landscape management and habitat manipulation for the conservation of beneficials (see section "Cropping system" in the full SCAR CWG report "Analysis of research and extension needs for the development of IPM").

Regarding the particular challenge of minor use crops, the general recommendation here is to develop sustainable methods and to diversify control methods.

The potential of biological control methods needs to be further developed in terms of the diversity of products, their availability, reliability and use.

#### *Priority research 7. Develop efficient and reliable bio-control methods and enhance their integration into IPM strategies.*

The SCAR CWG on IPM believes that research and development on efficient and reliable bio-control methods and their integration into crop protection strategies is key to the goal of reducing reliance on pesticides.

#### **5. Manage pest evolution**

The management of new or quickly evolving pests with respect to pesticide resistance or sustainable plant genetic resistance is a relatively new area widely recognised as deserving attention. However, there are few existing research initiatives and the required monitoring systems are not in place. New collaborations would therefore need to build on scant pre-existing resources.

The reduction of the emergence of Invasive Alien Species and quickly-evolving pests as well as the mitigation of their impact will be best achieved by developing robust or resilient systems.



*Priority research 8. Develop robust and sustainable IPM systems against new and quickly evolving pests.*

The SCAR CWG on IPM recommends research efforts on the development of robust and sustainable IPM systems to reduce emergence and mitigate the impact of Invasive Alien Species and quickly evolving pests.

*Priority research 9. Integrated and sustainable deployment of crop health strategies based on plant genetic resistance and prevention of resistance to pesticides.*

The SCAR CWG on IPM highlights the importance of integrated and sustainable deployment of crop health strategies based on plant genetic resistance and sustainable use of pesticides preventing resistance to pesticides.

## 6. Social aspects, economics and assessment

Interdisciplinary research where agronomy, biology and ecology join human and social sciences is needed to enable work at the level of the entire food chain because many bottlenecks involve stakeholders downstream and upstream of the farm gate.

There are a number of research possibilities regarding social and economic aspects. Research on the relationship between IPM and its impact on yield and on farm economics appears as a priority area. Assessing the value of IPM labels, certification schemes and standards as well as gaining a better understanding of the role of supermarket procurement policies is also very valuable.

*Priority research 10. Assess the value of IPM labels, standards and guidelines, and the role of retail chains and supermarket procurement policies;*

Considering the high level of investment made on the recognition of IPM, the SCAR CWG on IPM recommends research to assess the approaches concerning the impact of production standards and guidelines as well as existing or potential supermarket procurement policies on IPM uptake and the benefits and recognition of labels by consumers.

*Priority research 11. Economic and social barriers to and opportunities for IPM implementation at farm and supply chain levels.*

## 7. Facilitate extension for IPM

Even though investment in extension may not be usually recognised as research per se, dissemination, communication, co-innovation, facilitation of collective processes, training and advice, i.e., all the interactions linking farmers to researchers, are widely recognised as major bottlenecks to mainstreaming IPM. Furthermore, this sector is an essential part of the innovation process. Existing innovative extension initiatives should be taken advantage of as sources of inspiration and agricultural knowledge systems should be better understood.

There are a number of innovative extension initiatives scattered across Europe. One joint action achievable in the short term is to share information on how knowledge is disseminated to or co-generated with farmers. One recommendation is to explore agricultural knowledge systems including advising approaches, the relationship between researchers, advisors and

farmers, co-innovation, and the use of IPM guidelines and training resources. Another valuable joint action which would be relatively easy to achieve in the short-term is to share approaches, results and develop connections among demonstration farms across Europe.

*Priority research 12. - Explore agricultural knowledge systems and new collaborative approaches.*

Considering that IPM development is a process of innovation, the SCAR CWG on IPM places priority on research on formal and informal agricultural knowledge systems including advisory approaches, training, the relationship between researchers, advisors and farmers, farmer networks, and new collaborative approaches for technological and organisational innovation which draw from different economic sectors, areas of expertise and the world of practice.

*Priority research 13. Demonstration farm networks across Europe.*

Considering the widespread pre-existence of IPM or IPM-related demonstration farms and their recognised value for testing and proving IPM strategies at farm level, the SCAR CWG on IPM identifies the opportunity to create a network of such demonstration farms across Europe and to share approaches and results.

## V - Conclusion

Farmers face the challenge of reconciling production with health and environmental goals. New European legislation now places additional pressure to mainstream IPM and speed up the transition to systems less dependent on pesticides. But IPM is a dynamic and complex approach affected by external drivers such as land use, climate change, cropping systems types, markets, etc. This means that IPM is site specific and knowledge intensive. To cope with such a challenge, it is paramount that MS share their results, experiences and infrastructures. The CWG on IPM has identified a number of priority areas where jointly conducted actions and enhanced research activities at a European scale would make it possible boost implementation of IPM among European farmers in a diversity of situations.

The upcoming ERA-NET on IPM is one important vehicle through which such joint actions could be promoted.

## VI - Associated documents

- Analysis of research and extension needs for the development of IPM from the SCAR CWG on IPM.
- Pest monitoring systems across Europe within the realm of integrated pest management from the SCAR CWG on IPM.