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The set of indicators for assessing progress achieved under the National Action Plan for the sustainable use of plant protection products, in Italy

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ABSTRACT

The Directive 2009/128/EC establishes a framework for Community action to achieve the sustainable use of pesticides. It also establishes that Member States shall adopt National Action Plans for the sustainable use of plant protection products (NAP), which shall also include indicators to monitor the use of plant protection products (PPP) containing active substances (AS) of particular concern. In Italy, within the framework of the NAP, adopted by Interministerial decree of 22 January 2014, a set of 15 indicators has been selected and formally assumed by the Interministerial decree of 15 July 2015. Indicators aim should be assessing progress in reducing the risks and impacts of PPP use on human health, on the environment and on biodiversity. In this paper an overview of the indicators will be presented, underlining those based on data collected in accordance with Regulation (EC) No. 1185/2009 concerning statistics on pesticides.

Keywords: pesticides statistics, Directive 2009/128/EC

PAPER

1. Introduction

The paper presents a set of innovative indicators, selected for measuring and evaluate the results of the National Action Plan for the sustainable use of plant protection products (NAP) adopted in Italy. Section 2 describes the NAP and the corresponding actions, while section 3 presents the methods and criteria used to select the set of indicators. An overview of the indicators will be presented, underlining those based on data collected in accordance with Regulation (EC) No. 1185/2009. In section 4 a brief discussion follows.

2. The National Action Plan and the measures for assessing progress achieved under its implementation

The Directive 2009/128/EC (enacted into national law with Legislative Decree of 14 August 2012, n. 150) stated that a specific action plan needed to be adopted in order to reduce the risks to human health, environment and biodiversity, associated with the use of pesticides. The NAP has been adopted in Italy by Interministerial Decree of 22 January 2014. Main actions proposed by NAP in Italy concern:

1. *Training and requirements for users, sellers and advisors*, regarding specifically the risks associated with the use of plant protection products (PPP);

2. *Information and awareness*, specifically addressed to the public, on potential risks associated with the use of PPP;

3. *Control of equipment for the application of PPP*, and in particular monitoring, regulation and maintenance;

4. *Aerial spraying*, in respect of its ban except for derogations in specific cases;

5. *Specific measures to protect the aquatic environment and drinking water and to reduce the use of PPP in specific areas* (rail and road, areas frequented by the population, protected areas – Natura 2000 sites, parks, etc);

6. *Handling and storage of PPP and treatment of their packaging and remnants*;

7. *Integrated pest management (IPM) and organic farming*, with the goal to increase agricultural area carried out with voluntary and mandatory IPM and organic farming.

Furthermore one specific task regards the identification of a set of indicators, whose aim, in addition to encourage dissemination, is to verify the achievement of the objectives of the NAP and to measure and

monitor the results and the effectiveness of actions takeni. A working group (WG) coordinated by the Institute for Environmental Protection and Research (ISPRA) has defined the proposed set of indicators. Article 22 of the Legislative decree no. 150 of 14 August 2012 specifies that the set of indicators should be aimed at "assessing progress in reducing the risks and impacts of PPP use on human health, on the environment and on biodiversity" (ISPRA, 2014).

Most indicators regard, directly or indirectly, farming practices. The application of the NAP hopefully should determine significant improvements in sustainability of farming practices. The overall objective is to reduce the PPP use and especially the risks and impacts in the plant protection treatments. This will require a greater spread of voluntary integrated pest management and organic farming, the decreasing use of traditional aerial spraying, an even better performance of the equipments and treatment methods, an improved skill of operators in carrying out treatments, a greater diversification of the cropping system (higher number of crops grown, more efficient crop rotation criteria, presence and duration of cover crops, use of non-chemical alternatives), etc..

3. The set of indicators: work method and criteria for the selection

The NAP assessment relies on information built on good quality data and indicators. Indicators are selected and/or aggregated variables derived from datasets linked to assessment issues and related to policy objectives or targets.

The WG considered as "indicator" „a measure, generally quantitative, that can be used to illustrate and communicate complex phenomena simply, including trends and progress over time – and thus helps provide insight into the NAP".

The WG selected the indicators according to OECD criteria (OECD, 1993), that are:

a) relevance of information;

b) measurability in terms of immediate data availability and upgradeability;

c) scientific soundness.

Other important criteria for the selection of indicators were existing links to the official statistics. Adherence to principles of official statistics can ensure that the indicator provides objective information, has a scientifically defensible foundation, is consistent over time and from country to country and meets pre-defined quality standards (EEA, 2014).

The indicators were analyzed according to two procedures:

1) compilation of indicators fact sheets (ISPRA, 2010);

2) implementation of a web application to process and fill in the compilation of the indicators fact sheets.

This application program is open to consultation by potential users on/at the ISPRA site: http://indicatori-pan-fitosanitari.isprambiente.it.

The set of 15 indicators has been selected and formally adopted by the Interministerial decree of July 15, 2015. These indicators cover as much as possible the NAP objectives and actions and reflect policy priorities (Table 1). More specifically, the set of indicators is structured into seven main actions which match up the objectives of the NAP (Pallotti A. et al., 2013). However, currently, only five actions are represented by the **specific indicators** processed. The specific indicators are also integrated by **key indicators** and **cross indicators** (Graphic 1).

The selected indicators take into account and exploit existing monitoring programs and databases. Several institutions provide the data and the information and share the responsability for the processing of the indicators (Table 1). In accordance with the Interministerial decree of 15 July 2015, ISPRA, in cooperation with the Italian National Institute of Statistics (ISTAT), the Council for Agricultural Research and Economics (CREA) and the Italian National Institute of Health (ISS), is incharged to coordinate a new WG and to manage the above mentioned web page. According to the NAP updates, single indicators can be improved and the set of indicators can be integrated with new ones, above all with harmonized risk indicators that will be defined at Community level under Directive 128/2009/EC.

The availability of the data and information for the processing of the indicators is not homogeneous. Three main situations are described:

a) the data are available and directly accessible;

b) the data are potentially available, but they need more time and resources to be collected, harmonized and processed;

c) the availability of data depends upon the start and/or the continuation of specific monitoring and survey activities, which require specific programs implementation and adequate financial support.

Some indicators are immediately processable and therefore considered "active", being database already available; others, considered particularly relevant and with appropriate scientific soundness, there will be in the medium and long term whether feedbacks from the NAP actions implementation will be available and/or specific actions will be undertaken.

Futher information on scope and limits of single indicators can be found in Table 1 while detailed general information is available on-line and in the web page dedicated to the information system.

Table 1: *The set of indicators for assessing progress achieved under the NAP, in Italy*

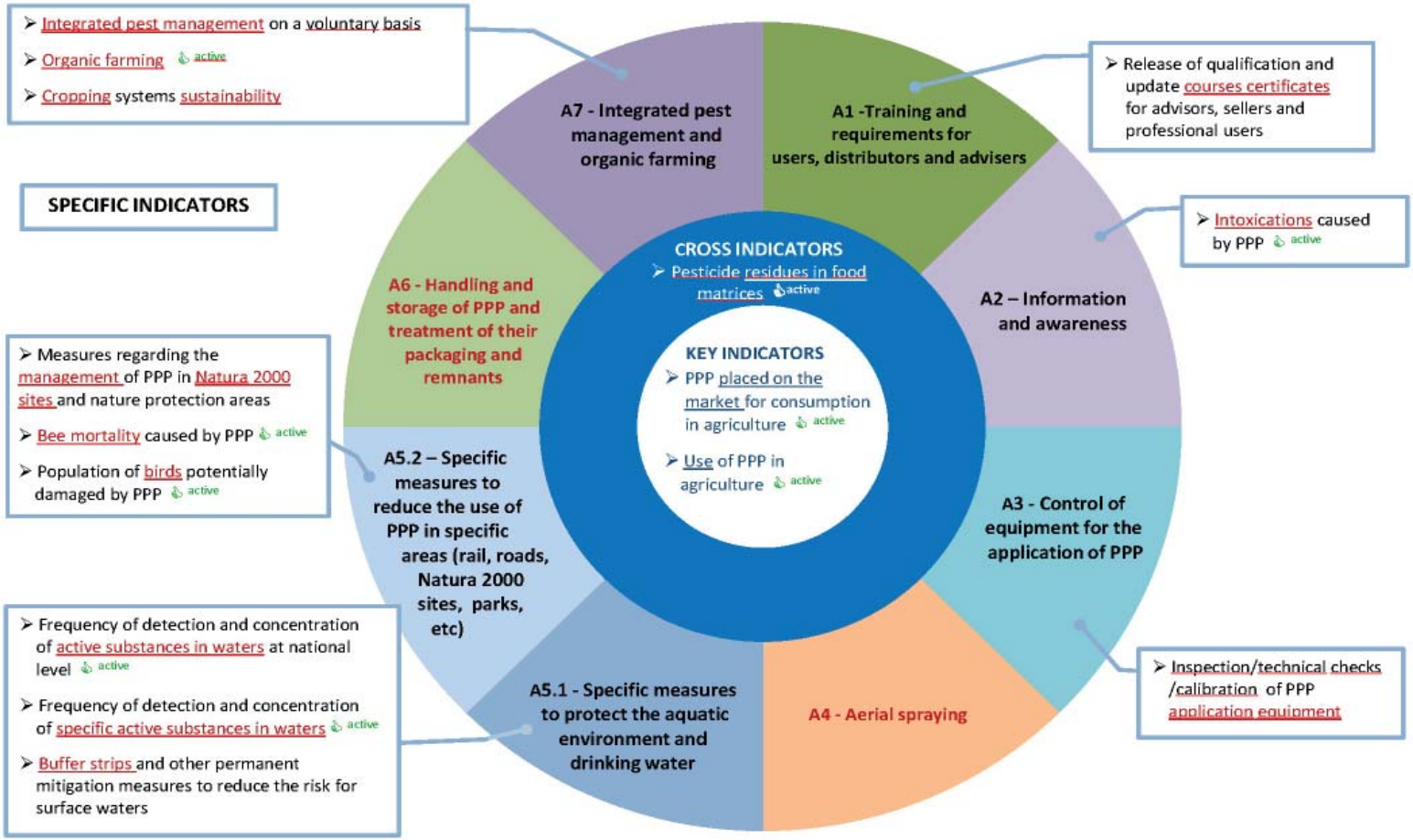
Indicator	Indicator brief description	Institution calculation	Institution data	Indicator status
PPP placed on the market for consumption in agriculture	It allows to assess the amounts of PPP and AS yearly placed on the market for consumption in agriculture, as well as to compare the trends over time and on territorial (regional) basis. Data on placing on the market are considered to be a proxy of PPP sold and used in the field. They do not allow to (a) quantify their use in the various agricultural crops, (b) consider the environmental factors that affect their use in agriculture and (c) analyze their impact on the environment and human health.	ISTAT	ISTAT	*Active*
Use of PPP in agriculture	It provides information on the intensity of use of PPP and AS in individual crops in terms of quantity/ha and potential environmental impact.	ISTAT	ISTAT	*Active*
Release of qualification and update courses certificates for advisors, sellers and professional users	It expresses, in absolute value, the number of brand new certificates and those resulting from updating courses released to advisors, sellers and users of PPP. It allows to assess training achievements trends but does not reflect the effects on human health and the environment, i.e. the effectiveness of training.	MiPAAF	MiPAAF, Regions	*To be activated*
Intoxications caused by PPP	It is based on the number of surveyed/observed incidents and on related poisoning episodes of agricultural workers and general population.	ISS	ISS	*Active*
Inspection / technical checks / calibration of PPP application equipment	It expresses the number of technical checks and calibrations performed in the year. It measures the efficiency of PPP application equipment.	MiPAAF	MiPAAF, Regions, ENAMA	*To be activated*
Frequency of detection and concentration of AS in waters at national level	It provides detection frequency and concentrations of PPP residues in surface and ground waters as well as a national overview of contamination status. It allows to follow the evolution of the contamination due to the use of pesticides and, ultimately, to monitor the effectiveness of specific actions taken for mitigating risk.	ISPRA	ISPRA, Regions / ARPA-APPA	*Active*
Frequency of detection and concentration of specific AS in waters	It measures the contamination of surface and groundwater by residues of "specific/selected" AS.	ISPRA	ISPRA, Regions / ARPA-APPA	*Active*
Buffer strips and other permanent mitigation measures to reduce the risk for surface waters	It estimates the surface area change over time (percent) of the buffer strips (not cultivated vegetated strips and other ecological infrastructure) located along water bodies in order to limit pollution due to runoff, percolation and drift.	MiPAAF	MiPAAF	*To be activated*
Population of birds potentially damaged by PPP	Intended to detect the effects of agricultural practices on biodiversity, it estimates the trend of population of nesting species in agricultural habitats. It is calculated considering the specific ornithological area of the plains, where it is assumed that the use of PPP is more intensive.	CREA/LIPU	MITO 2000	*Active*
Integrated pest management (IPM) on a voluntary basis	It describes the utilized agricultural area (UAA) and the tons of crops produced according to integrated pest management (IPM) on a voluntary basis.	MiPAAF		*To be activated*
Organic farming	It describes the utilized agricultural area (UAA) cultivated according organic farming techniques. It is calculated as the ratio of the organic farming area and the total UAA.	MiPAAF	SINAB	*Active*

Indicator	Indicator brief description	Institution calculation	Institution data	Indicator status
Measures regarding the management of PPP in Natura 2000 sites and nature protection areas	It provides information on the number and type of measures (regulatory, administrative or contractual) on the use of PPP included in Natura 2000 sites Management Plans and in the protected areas (parks, etc.) Plans. It allows to assess over time the implementation of the measures in sites and areas characterized by a percentage of UAA ≥ 20%. It does not detect the environmental effectiveness of the measures taken.	ISPRA	MATTM	*To be activated*
Bee mortality caused by PPP	It shows the number of bee mortality cases attributable to PPP throughout the country. It tries to detect agricultural practices and specific PPP responsible of bee mortality. The mortality data/reports come from SPY-BEENET project (MiPAAF) and the National Health Service (MINSAL).	IZS LT	MiPAAF, MINSAL	*Active*
Pesticide residues in food matrices	It allows to assess the proper use of PPP and to monitor the risks to consumer health associated with food intake. It detects the residue levels of pesticides in or on food of plant and animal origin. Every year 10 vegetables, both from organic farming and conventional agriculture, 2 foods of animal origin and one baby food are sampled.	MINSAL	MINSAL	*Active*
Cropping systems sustainability	It aims to highlight the adoption of preventive measures and non-chemical means. It assumes that the greater is the diversity of cropping system the lower is the presence of organisms harmful to crops. The evaluation of this diversity is based on: number of crops grown, rotation type and presence and duration of cover crops. A further aspect is the use of non-chemical means. Data source is mainly Farm Accountancy Data Network (RICA).	MiPAAF, S.S. S. Anna	CREA	*To be activated*

ARPA - *Regional Agency for Environmental Protection*
APPA - *Provincial Agency for Environmental Protection*
ENAMA – *Italian Agricultural Mechanization Body*
CREA - *Council for Agricultural Research and Economics*
ISPRA - *Institute for Environmental Protection and Research*
ISS – *Italian National Institute of Health*
ISTAT – *Italian National Institute of Statistics*

IZS LT - *Institute of Animal Health and Food Safety for Latium and Tuscany Regions*
MATTM - *Ministry of the Environment and Protection of Land and Sea*
MINSAL –*Ministry of Health*
MiPAAF - *Ministry of Agriculture Food and Forestry Policy*
MITO 2000: *ITalian Ornithological Monitoring*
S.S. S. Anna – Sant'Anna School of Advanced Studies

Graphic 1: *The set of indicators structured into the seven main actions of the NAP*



Special attention deserve the first two indicators in Table 1, as they concern statistics on pesticide.

The Regulation (EC) No. 1185/2009, concerning statistics on pesticides, establishes a common framework for the systematic production of Community statistics on the placing on the market and use of pesticides on specific relevant crops.

The Regulation points out that the statistics shall serve the purposes of Directive 2009/128/EC, in particular, to monitor actions implemented through the application of the NAP.

Harmonised and comparable Community statistics on pesticide are essential for the development and monitoring of Community legislation and policies in the context of the Thematic Strategy on the Sustainable Use of Pesticides.

At EU level, the need for harmonised data, specifically on pesticide use, has been clearly recognised (EUROSTAT, 2008). Once the regular collection of usage statistics on PPP use has been established, it is possible to monitor changes over time in the use on particular crops or in the use of specific pesticides.

As stated by Legislative decree no. 150 of 14 August 2012, these data will be also used for the compilation of the indicators and will make an essential contribution in detecting "trends in the use of certain AS with particular reference to the type of crop, treated areas and pest management practices."

The statistics produced in Italy by ISTAT are essential for assessing policies of the EU on sustainable development and for calculating relevant indicators on the risks related to pesticide use (Table 2). ISTAT produces two types of statistics on pesticides:

- Statistics on the annual amounts of pesticides placed on the market.
- Statistics on the annual amounts of pesticides used on specific relevant crops.

Table 2 - The first Indicator - PPP placed on the market for consumption in agriculture: products and traps, and active substances, distributed for agricultural use, for category (in Kg) - Year 2014

Geografical areas	Fungicides	Insetticides and acaricides	Herbicides	Various	Biologicals	Total	Traps (number)
Plant protection products and traps							
North	32.311.368	13.113.263	14.877.177	5.975.714	-	66.277.522	192.974
Center	8.719.766	1.890.090	2.856.572	2.928.784	-	16.395.212	109.236
South	24.283.832	7.280.423	6.474.763	9.265.091	-	47.304.109	172.250
ITALY	**65.314.966**	**22.283.776**	**24.208.512**	**18.169.589**	-	**129.976.843**	**474.460**
Active substances in plant protection products							
North	17.553.146	2.962.111	4.846.597	2.971.451	168.019	28.501.324	-
Center	4.513.302	338.963	902.276	1.390.162	43.963	7.188.666	-
South	14.857.090	2.290.614	2.049.887	4.433.030	101.440	23.732.061	-
ITALY	**36.923.538**	**5.591.688**	**7.798.760**	**8.794.643**	**313.422**	**59.422.051**	-

Source: ISTAT, Survey on the distribution of pesticides for agricultural use

The usage statistics allow to estimate active substances (AS) contained in pesticides used on each selected crop. Moreover they allow to monitor changes over time in the use of AS on crops, since information for each individual crop are collected periodically and compared with the preceding years. In Italy crops are selected taking into account the most relevant cultures for the NAP. Crops currently surveyed are: grapevine, maize, durum wheat, tomato and potato. Usage statistics are collected through samples of farms and provide information on the pesticides used on two or three crops each year, estimating the total amount of any specific pesticide and the area of crop treated with those pesticides. The data are collected through telephone interviews directed to a representative sample of farmers and growers. The phone calls are preceded by an information letter and are performed by trained personnel. Telephone surveys are used to reduce the cost of the surveys. These surveys are in fact similar in structure to personal interviews, but they avoid travel time and costs. However, for each call it is preferable to cover a single crop per farm.

Some useful information can be obtained from the statistics on the annual amounts of pesticides placed on the market which are compiled by companies and can be used as a proxy for pesticides use data. ISTAT produces an annual census survey and data (totals) are released at NUT3 level. Sales figures may be used to adjust and improve surveys on the use of pesticides. One of the advantages is these statistics are much cheaper to collect as they are compiled directly by companies and not by farmers. The data are generally accurate, as chemical companies normally know the amount of each product placed on the market and are able to provide annual figures. However, due to commercial reasons, these statistics can give rise to confidentiality issues and restrictions on the release and use of data. In fact, when published, data are grouped, masking the specific AS.

4. Discussion and conclusions

The initial objective of the activity was to define a set of innovative indicators for measuring and evaluate the results of the NAP adopted in Italy. The work continued with the revision, consolidation and optimization of the indicators list published in the Interministerial decree of 22 January 2014, regarding the adoption

of the NAP. The ultimate achievement on the indicators was the proposed set of 15 indicators, adopted with the Interministerial decree of July 15, 2015.

At present ISPRA, in strict cooperation with ISTAT, ISS and CREA, is coordinating a new WG whose main task is to process the selected "active" indicators and manage the website *http://indicatori-pan-fitosanitari.isprambiente.it*.

The WG also aims, in accord with the NAP updates, to improve the definition and performance of the indicators and to integrate the set of proposed indicators with new ones, above all with harmonized risk indicators that will be defined at Community level by Directive 2009/128/EC. It is expected also that most of the indicators named "to be activated" (e.g. "Release of qualification and update courses certificates for advisors, sellers and professional users", "Inspection/technical checks/calibration of PPP application equipment", "Integrated pest management (IPM) on a voluntary basis", "Measures regarding the management of PPP in Natura 2000 sites and nature protection areas" and "Cropping systems sustainability"), will be processed in a reasonable time, since the data will be soon available partly as a consequence of the NAP actions implementation.

The WG expects a discussion and cooperation with other experts and scientific bodies, in particular universities and research institutes, that have specific expertise in this field and that so far the WG was not able to involve suitably in the work.

Interesting information and proposals are arising, for example, from the assessment of the effectiveness of laws, e.g. environmental monitoring of the Rural Development Plans or evaluation of the measures implemented by the regions according to Directive Habitats and Directive Birds.

At this time, experts are loading the available information on indicators in an information system, accessible via the above mentioned link. A first review of active indicators will probably be on-line early 2017. By the end of 2017, Member States shall submit to the European Commission a report on the achivement of the objectives and targets established in the NAP. The report should take in account also the information and evaluations arising from indicators processing. But, even more relevant, not further the beginning of 2019 (that is within 5 years from the NAP adoption) Member States shall revise NAP and propose a possible review and, if necessary, reformulation of the actions previously implemented.

The information system will represent the opportunity for stakeholders and policy makers of assessing results of NAP actions implementation and progress in reducing the risks and impacts of PPP use on human health, on the environment and on biodiversity.

The selected indicators represent a useful tool for researchers to evaluate the evolution of farming practices and measure the spread of good practices aimed to reduce PPP impacts and risks and to reach more efficient and sustainable crop production systems.

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[i] These actions are complemented by other activities as: promotion of monitoring programs on frequency of detection and concentration of active substances (AS) in surface waters and groundwater and on the PPP residues in food; the definition of priorities and the implementation of research and experimentation in support to the NAP and on higher education; the support of coordination measures to carry on control activities and NAP updating; compilation of technical manuals to support actions implementation; etc.