

CURRENT TOPICS

Developments in integrated pest management in Italy

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Summary. In order to implement Directive 2009/128/EC and to reduce the risks arising from the use of plant protection products, a National Action Plan has been developed in Italy. The plan calls for several actions, including low pesticide-input pest management. Each producer will have to consider the many aspects that contribute to the production process, such as appropriate cultivation techniques, use of certified propagating material and balanced fertilization. Producers will also need tools to protect beneficial organisms, prevent the spread of harmful organisms, implement monitoring and alert systems, define thresholds and establish anti-resistance strategies. Advanced knowledge about plant protection products will also be required of professional users, with the introduction of specific certified training programmes; only authorized users will be allowed to purchase plant protection products classified for professional use. The spraying equipment will have to pass functional tests. Italy has articulated Integrated Pest Management (IPM) on two levels: one mandatory and one voluntary. The latter will be supported by specific funding, in line with what has already been implemented as part of the Common Agricultural Policy. With regard to the voluntary level, the enforcement of national IPM guidelines (concerning defence and weeding technical standards) that have so far characterized the application of IPM in Italy will serve as the medium-term reference tool. This paper demonstrates how IPM has evolved in Italy over the last 20 years, and why Italian producers have already been applying the requirements of Directive 2009/128/EC for some time.

Key words: IPM guidelines, Sustainable Use Directive, SUD.

Introduction

Plant protection products (PPPs) are defined (Regulation EC 1107/2009, 2009) as products, in the form in which they are supplied to users, consisting of or containing active substances, safeners or synergists, and intended for one of the following uses:

(a) protecting plants or plant products against harmful organisms or preventing the action of such organisms, unless the main purpose of these products is considered to be for reasons of hygiene rather than for the protection of plants or plant products;

(b) influencing the life processes of plants, such as substances influencing their growth, other than as nutrients;

(c) preserving plant products, insofar as such substances or products are not subject to special Community provisions relating to preservatives;

(d) destroying undesired plants or parts of plants, except algae, unless the products are applied on soil or water to protect plants;

(e) checking or preventing undesired growth of plants, except algae, unless the products are applied on soil or water to protect plants.

PPPs are indispensable tools for producing high quality commodities, along with achieving adequate levels of agricultural production.

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Recent history has shown that the application of PPPs, for their intrinsic characteristics, must be conducted with utmost care to avoid adverse effects on human health and to preserve the environment. Examples of adverse effects are the case of the rice herbicide atrazine, which created problems with drinking water, or the more recent case of neonicotinoid insecticides, suspected of being involved in the die-off of bees.

The recent European Enacted Regulation concerning “the placing of PPPs on the market” (Regulation EC 1107/2009, 2009), along with Sustainable Use Directive, (SUD) establishing “a framework for Community action to achieve sustainable use of pesticides” (Directive 2009/128/EC, 2009), give priority to the correct use of PPPs.

In order to implement the SUD, Member States must develop National Action Plans (NAPs). Every NAP will define objectives, measures, timetables and indicators to reduce the risks and impacts of PPPs on humans and the environment. Concurrently, the SUD promotes Integrated Pest Management (IPM) and alternative approaches or techniques, in order to reduce dependency on the use of PPPs.

In Italy, a Technical Scientific Committee (TSC) was established to draw up the draft of the NAP. The Committee has 23 members, of whom 13 represent the Ministries of Agriculture, Environment, Health, Economic Development and Education, and nine representatives of Regions and Autonomous Provinces. The TSC has taken steps to address the roughly 2000 comments made by stakeholders following the publication of the NAP draft, defining in December 2013 the final text submitted to the European Commission. The TSC will also have the task of producing the National Guidelines for the implementation of certain measures of the NAP (for example Natura 2000 sites) as well as implementing some aspects of the NAP itself (for example indicators).

In detail, the Italian NAP examines the following actions with the aim of reducing the risks arising from the use of PPPs:

- training and requirements for users, distributors and advisors;
- information and awareness;
- checks of equipment for the use of PPPs;
- aerial spraying;
- specific measures to protect aquatic environments and drinking water and to reduce the use of PPPs in specific areas (rail and road networks,

areas frequented by the population, protected natural areas);

- handling and storage of PPPs and treatment of their packaging and any eventual remaining amounts;
- plant health management with low use of PPPs.

In order to implement the low pesticide-input pest management provided for Article 14 of the SUD, each producer will have to consider the many aspects that contribute to the production process, such as appropriate cultivation techniques, use of certified propagating material and balanced fertilization. Producers will also need tools to protect beneficial organisms, prevent the spread of harmful organisms, implement monitoring and alert systems, define thresholds and establish anti-resistance strategies.

Advanced knowledge about PPPs will also be required of professional users, with the introduction of specific certified training programmes; only authorized users will be allowed to purchase PPPs classified for professional use.

The equipment used to distribute PPPs will have to pass functional tests.

Italy has articulated IPM on two levels: one mandatory and one voluntary. The latter will be supported by specific funding, in line with what has already been implemented as part of the Common Agricultural Policy (CAP).

With regard to the voluntary level, the enforcement of national IPM guidelines (concerning defence and weeding technical standards) that have so far characterized the application of IPM in Italy will serve as the medium-term reference tool.

This paper demonstrates how IPM has evolved in Italy over the last 20 years, and why Italian producers have already been applying the requirements of the SUD for some time.

Development of IPM in Italy

The academic and scientific community in Italy has been interested in IPM since the mid-70's. However, active and officially encouraged IPM only began to take off in 1987, with the National “Integrated Pest and Disease Control Strategies Plan”. This plan allocated funds to initiate regional activities on this subject.

Regional plant protection services have used these funds for several initiatives. These include establishing the first network of agro-meteorological

stations, promotion of monitoring programmes of the major pests through the use of pheromone and chromotropic traps, and programmes of field trials of new control strategies with the goal of rationalising the use of PPPs. The application of Regulation 270/79 (Council Regulation (EEC) No 270/79, 1979) was particularly important at this stage, as this enabled the formation and training of agricultural advisers, who have in turn made important contributions to the dissemination of IPM principles.

IPM received a decisive boost from the application of Council Regulation 2078/92 on agricultural production methods compatible with the requirements of the protection of the environment and the maintenance of the countryside (Council Regulation (EEC) No 2078/92, 1992). This regulation was one of the measures stipulated by CAP, and funded programmes of integrated pest and weed control.

To implement this Regulation, which was aimed at protecting the environment and maintaining the countryside, Italy initially developed 21 standards for IPM, one for each region. These were very different in criteria and principles, instead of a single national document. For example, neighbouring regions with adjacent fields had proposed, for the same crop, very different pest management in terms of kind and number of treatments. The European Commission did not approve of this approach by Italy.

After consultation, and in order to standardise practices, the European Commission, in agreement with the Italian Ministry of Agriculture and the Regions, proposed adoption of the "Principles & criteria of IPM and integrated weed control", established by EEC Decision n. 3864/96 (EU Decision N. C(96) 3864. 1996) and to appoint a National Committee comprising representatives from the regions. This would ensure that all regional standards comply with the principles and criteria set out in Decision n. 3864/96, and that the amount of aid conceded to farms that undertook to implement environmental measures would be fully justified. In 1997 the National Committee was established in Rome by the Ministry of Agriculture. This committee was composed of representatives from the Regions, chosen from amongst technical personnel with of PPS expertise and Ministry of Agriculture researchers.

The purpose and criteria set out in Decision n. 3864/96 are the basis for official regional standards, and these have been fundamental to the Italian experience since 1997.

Content of Decision n. 3864/96

The purpose of this Decision is as follows: "In order to ensure both plant protection and cost-effective production, PPPs with a reduced impact on the environment and human health should be used, and in the lowest possible quantities." It's important to note that an economic assessment is required to prevent economic damage in excess of the loan received.

When different strategies can be adopted, agronomic and/or biological approaches are preferred, as they ensure reduced environmental impacts within a sustainable agriculture frameworks. The use of PPPs should be limited to those cases in which biological or agronomic alternatives are not possible.

Regional standards should be similar, and should only differ when addressing area-specific plant protection issues. For example, grapevine diseases in northern Italy are different from those of the central regions or the south. Diseases such as downy mildew, caused by *Plasmopara viticola*, or infections by *Flavescence dorée* phytoplasma require specific treatments in the northern regions, but not in other areas of Italy.

The standards should be drawn up to enable correct treatments based on two important questions:

A) is treatment absolutely necessary, and if so, when is the best time to intervene?

B) what is the most suitable plant protection method?

Treatments should be justified in relation to the risk assessment. The risk assessment should be calculated through appropriate monitoring systems based on bio-epidemiological parameters and the degree of damage, and should be conducted at the level of single farms, or for areas with similar characteristics. Technical advisers and agricultural technical engineers play lead roles at this stage because they have to assess weeds to remove, the climatic conditions favouring the development of diseases, the presence of insects key to a specific crop and the suitability of one type of product rather than another. The timing of treatment and the strategies to be adopted depend on the nature of the harmful organism.

Decision 3864/96 takes into account three categories: pests, diseases and weeds.

A.1) Criteria for pest control

For each type of crop, the major pests must be identified, along with the minor pests that only ap-

pear occasionally or that are common to the specific area. The density of the harmful stages must be controlled through specific sampling techniques. This criterion defines the “economic threshold”, that is the pest’s population level or degree of crop damage at which the value of the crop destroyed exceeds the cost of controlling the pest. Economic thresholds can be expressed in a variety of ways including the number of insects per plant or per square meter, or the amount of leaf surface damaged. The economic threshold refers to crops under “normal” growth conditions, in terms of production, water balance, and parasite damage in previous years.

The presence of natural enemies and their relationships with the pests should be verified. It is important to use PPPs that are not harmful to useful natural enemies, for example to choose an insecticide that does not kill *Anthocoridae* in pear orchards because this beneficial insect is of great benefit for controlling pear psylla. The timing of the intervention should be based on the following criteria: how widespread the infestation is, the developmental stage and degree of threat from harmful species, the presence of different pests at the same time, active ingredient properties, efficacy and mode of action and weather conditions and forecast.

A.2) Criteria for disease control

The serious threats posed by the most plant diseases makes it imperative to take proactive measures. Only for pathogens with low epidemic risks is it possible to wait for symptoms to appear before applying treatments. Therefore, different approaches can be used and the relative protection methods may be planned. Empirical forecasting assessments and forecasting models can be applied, for example the three/ten rule and EPI (Etat Potentiel d’Infection) for grapevine (Baldacci, 1947; Vercesi *et al*, 2008; Parisi *et al*, 2012). Accurate symptom assessment of the diseases must be assured, and use, where appropriate, of resistant/tolerant cultivars and standard/certified seed and planting material is advocated.

A.3) Criteria for weed control

For effective weed control, the target species should be accurately identified. One of two assessment criteria should be used: a forecast of weed species or an assessment of the weeds present. Mechan-

ical and physical interventions are to be preferred to chemical treatments (for example using appropriate cultivation in row crops).

B) Criteria for the choice of the most appropriate plant protection method

In choosing an appropriate plant protection method, it is necessary to consider all of the following opportunities or solutions: agronomic practices that can create unfavourable conditions for pests (for example crop rotation, balanced fertilization, localized irrigation), physical methods (for example soil solarisation), biotechnical methods (for example antagonist species, attractant baits) and natural products. The use of PPPs should only be considered if the other means cannot accomplish the desired levels of control.

The selected PPP should be effective, but also selective, in order to avoid harming beneficial organisms, and pose no threat to health and the environment. This should include toxicity for humans, impact on agro-ecosystems, residues in food chains and environmental effects. It’s important to avoid creating resistant pest, pathogen or weed strains. The choice of the product must therefore take account of the entire defence strategy, including any other PPPs that will be used during the season to control the same target.

Finally, in order to minimise the amount of PPPs used, the distribution parameters must be optimized. The use of sprayers and application equipment should be regularly calibrated to reduce non-target spray drift. The objective of this approach is to reduce the amounts of active ingredient used per unit area by minimising the number of interventions or by localised distribution.

The current situation

The principles and criteria set out by Decision n. 3864/96 and described above have been and are still in force, not only in compliance with Reg. 2078/92 (applied in Italy starting in 1997), but also in observance of the subsequent European Environmental Policy. Consequently the IPM National Committee has also been active for a corresponding period.

In order to support the regional standards, the IPM National Committee has been publishing the “National guidelines for Integrated Pest Manage-

ment" on an annual basis. These guidelines cover more than 100 of the most important crops grown in Italy, and contain control strategies for each crop to guard against major diseases, pests and weeds. The guidelines are not simply positive or negative lists.

For every pest, disease and family of weeds, the guidelines provide the opportunity to develop a control strategy, choosing from a short list of the active ingredients to be used, in accordance with certain constraints. These may relate to the number of treatments with the same product, the total number of interventions with products having the same action mode, the timing of use, the observance of a threshold or the occurrence of certain environmental conditions.

With regards to weed control, the guidelines indicate the maximum doses to be distributed. The selection of active ingredients is made on the basis of their intrinsic characteristics, while always preserving the possibility to plan effective control strategies, minimizing the risks of occurrence of resistance and taking into account issues related to residues or particular market needs.

Over the years, the implementation of IPM in Italy has expanded to cover an area that is currently estimated to be at least 1.5 million ha. The crops involved have mostly been fruit, grapes and vegetables, which require the greatest usages of PPPs. Almost all the apple orchards in the Trento and Bolzano provinces, the processing tomato crops in the North of Italy, and the fresh-cut crops and most of the fruit crops in the Emilia-Romagna region are regulated by IPM. These are the most suitable areas in Italy for growth of these crops, where the most significant production volumes are concentrated.

The application of IPM has yielded very positive results, such as the early exclusion of PPPs with the worst eco-toxicological properties, which were later banned by the EU. Example are removal of vinclozolin, used against *Botrytis cinerea*, and quinalfos used against *Lobesia botrana*, *Eupoecilia ambiguella* and *Cydia pomonella*. Use of IPM guidelines has resulted in 76% reduction in PPPs used on apples, 83% on grapes, 67% on pears and 78% on peaches. At the same time, this policy has also reduced the use of PPPs with risks concerning chronic effects on human health, including those with risk categories R40 - Possible risk of cancer, R60 - May impair fertility, R61 - May cause harm to the unborn children R62 - Possible risk of impaired fertility, R63 - Possible risk of harm to unborn

children and R68 - Possible risk of irreversible effects. Examples are the 81% reduction in the use (crop) of PPPs with R40 and 94% reduction of those with R63. The use of residual herbicides has been excluded in for pre-emergence treatments of wheat. Within orchards these pesticides can only be used during the first 3 years after planting. The correct timing of herbicide distribution has reduced the amount used by 6% on extensive crops and 36% on vegetables (Galassi, 2009; notices of the IPM National Committee).

Currently, IPM national guidelines are used by all farms funded by agricultural programmes aimed at protecting the environment and maintaining the countryside, along with companies participating in the common organisation of agricultural markets (Regulation (EU) No 1308/2013, 2013). Today, most producers apply the IPM guidelines, because IPM compliance has become a prerequisite for suppliers to Large Organised Distribution.

Conclusions

The principles set out in Decision 3864/96 are very similar to those indicated in the SUD. Experience accrued in Italy over the past 20 years provides a valuable background for the implementation of SUD. Other than IPM guidelines, several requirements imposed by SUD had already been implemented by Italian law for some time, such as PPP user and retailer training, the meticulous recording of all pesticide treatments by professional users and inspections of spraying equipment. Moreover, technical assistance services have promoted IPM and organic farming. SUD presents Italy with an opportunity to promote a model of advanced agriculture that is increasingly sensitive to health issues and environmental protection.

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Literature cited

- Baldacci E., 1947. Epifitie di *Plasmopara viticola* (1941–1946) nell'Oltrepo Pavese e adozione del calendario d'incubazione come strumento di lotta. *Atti Istituto Botanico, Laboratorio Crittogamico VIII*, 45–85.
- Council Regulation (EEC) No. 270/79 of 6 February 1979 on the development of agricultural advisory services in Italy. *Official Journal L 38*, 14 February 1979, 6–10.
- Council Regulation (EEC) No. 2078/92 of 30 June 1992 on agricultural production methods compatible with the requirements of the protection of the environment and the maintenance of the countryside. *Official Journal L 215*, 30 July 1992, 85–89.
- European Parliament, 2009. Directive 2009/128/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for Community action to achieve the sustainable use of pesticides. *Official Journal L 309*, 24 November 2009, 71–86.
- Galassi T., A. Guarino, G. Marano, D. D'Ascenzo and A. Saglia, 2009. IPM implementation in Italy, Giornate Fitopatologiche – Workshop Endure, Bologna, Italy, 5 November 2009. <http://www.endure-network.eu/content/download/5123/41418/file/IPM%20implementation%20in%20Italy.pdf> (accessed 15 December 2014)
- Parisi N., B. Cavagna, M. Ciampitti, A. Poggi, S. L. Toffolatti and A. Vercesi, 2012. Confronto tra strategie peronosporiche classiche e basate sul modello EPI nella difesa del vigneto in Oltrepo Pavese. *Atti Giornate Fitopatologiche 2*, 385–392.
- Regulation (EC) No. 1107/2009 of the European Parliament and of the Council of 21 October 2009 concerning the placing of plant protection products on the market and repealing Council Directives 79/117/EEC and 91/414/EEC. *Official Journal L 309*, 24 November 2009, 1–50.
- Regulation (EU) No. 1308/2013 of the European Parliament and of the Council of 17 December 2013 establishing a common organisation of the markets in agricultural products and repealing Council Regulations (EEC) No 922/72, (EEC) No 234/79, (EC) No 1037/2001 and (EC) No 1234/2007. *Official Journal L 347*, 20 December 2013, 671–854
- Vercesi A., Zerbetto F., Buccini M., Mogicato M., Rho G., Fremiot P., Sancassani G. P., Checchetto F., Cacciatori G., Delillo I. and Tridello G. Strizyk S., 2005. Monitoraggio e simulazione dell'andamento epidemico di *Plasmopara viticola*. *L'informatore agrario 15*, 73–79.

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