Area-Wide Integrated Pest Management Programmes and Agricultural Trade: Challenges and Opportunities for Regulatory Plant Protection

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ABSTRACT The Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement) entered into force for all member countries in 2000. It states that measures to protect human, animal and plant health or life shall be based on international standards where possible. These measures shall be based on a scientific risk assessment and should be implemented only to the extent necessary to achieve an appropriate level of protection. The International Plant Protection Convention (IPPC) is the international standard setting body for protecting plant health identified in the SPS Agreement. Both international treaties make provision for control of pests at regional levels (regionalization) and for identification of pest free areas. The IPPC provides guidance to countries, in the form of international standards, on the implementation of pest free areas and pest risk analysis (including systems approaches and other risk management measures). These standards can contribute to area-wide integrated pest management (AW-IPM) programmes for two main reasons. First, when AW-IPM programmes are implemented according to IPPC standards, trading partners should be prepared to recognize the results of a successful AW-IPM programme as meeting requirements, for example, of a pest free area or an area of low pest prevalence. Second, these standards provide scientific and technical guidance for the design and operation of key components of AW-IPM programmes. Therefore, countries that implement AW-IPM programmes that are in accordance with IPPC standards are better positioned to take advantage of liberalized trade while maintaining their phytosanitary security.

KEY WORDS agricultural trade, sanitary and phytosanitary measures, area-wide integrated pest management, International Plant Protection Convention

1. Introduction

The purpose of this paper is to address the relationship between area-wide integrated pest management (AW-IPM) programmes, agricultural trade and the application of phytosanitary measures by importing and exporting countries. AW-IPM programmes may be differentiated from more conventional pest control programmes (e.g. localized integrated pest management programmes) in that they incorporate systematically applied pest management strategies to reduce pest populations. In the context of this paper, the term "pest" refers to:

> *Any species, strain or biotype of plant, animal or pathogenic agent injurious to plants or plant products (FAO 1997a).*

Such programmes often are applied over large geographic areas often for extended periods of time, but may also be applied on smaller scales (e.g. greenhouses, production units, etc.). The goal of such programmes may be suppression, prevention, containment or eradication of a particular pest (Hendrichs et al. 2005). While many other considerations

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(economic, biological, environmental, social, political, etc.) will affect the decision to use, and the ultimate success of AW-IPM programmes, the focus of this paper is to discuss their role in relation to agricultural trade.

2. Area-Wide Pest Management

The decision to undertake an AW-IPM programme may be influenced by many factors, including feasibility, economics, biology of the organism, the area over which management may occur and the demand for and relative benefits of undertaking such a programme. Benefits of area-wide pest management are linked to efficiency and effectiveness gains that are possible when applying similar phytosanitary measures over large, usually environmentally similar areas. The nature of the benefits is in turn linked to epidemiological and/or economic factors. Such benefits may include reduction in pesticide use, reduced impacts on the environment, increased production and quality, increased food security, increased income for producers and reduced costs over time for managing serious pests. An additional benefit of area-wide pest management may be increased opportunities for trade from areas where pest populations are drastically reduced, contained or eradicated leading to areas of low pest prevalence or pest free areas. The role of area-wide pest management in agricultural trade is poised to grow as the volume of agricultural trade and the awareness of the risks of accompanying pests moving to new areas continue to increase (Griffin 2000).

3. Agricultural Trade

Agricultural trade has increased steadily since the World Trade Organization (WTO) provided for a global, liberalized trade framework in the 1990s. As of 2000, the global value of agricultural trade exports was approximately USD 275 000 million (USDA 2002). Developed countries such as Australia, Canada, countries of the European Community, Japan and the USA account for the majority of trade, while developing countries have had mixed results taking advantage of the liberalized trade environment. One potential barrier to agricultural trade for many countries are measures imposed by importing countries to protect human, animal or plant life and health – or sanitary and phytosanitary measures (Henson and Loader 2001, Huang 2004).

3.1. The Agreement on the Application of Sanitary and Phytosanitary Measures

The Agreement on the Application of Sanitary and Phytosanitary Measures, or SPS Agreement, is a subsidiary agreement of the WTO. It sets out rights and obligations for members of the WTO with respect to sanitary and phytosanitary measures that may be implemented for protecting human, animal or plant life and health. The SPS Agreement provides a framework to ensure that measures are applied only to the extent necessary to protect health and that the measures are technically justified. In the same vein, the agreement maintains that such measures should not be implemented arbitrarily or as disguised barriers to trade. Annex A of the SPS Agreement defines the scope of SPS measures (Fig. 1) (WTO 1994).

3.1.1. Provisions of the Sanitary and Phytosanitary Agreement

The SPS Agreement contains several key provisions that define rights, obligations and responsibilities of members in designating SPS measures at the national level. Provisions that are particularly applicable to AW-IPM programmes include: (1) risk assessment, (2) harmonization, (3) equivalence, (4) least trade restrictive (minimal impact), (5) appropriate level of protection, (6) regionalization, (7) area freedom, and (8) low prevalence.

Article 2 (Basic Rights and Obligations) of the SPS Agreement states that members shall ensure that any sanitary or phytosanitary measure is applied only to the extent necessary to protect human, animal or plant life or health, is based on scientific principles and is not maintained without sufficient scientific evidence.

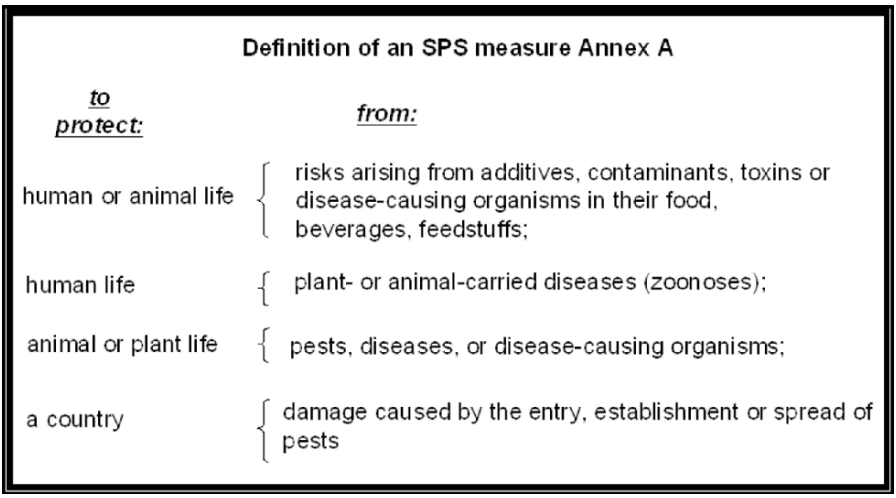

Figure 1. *Definition of a Sanitary and Phytosanitary (SPS) measure from Annex A of the Agreement on the Application of Sanitary and Phytosanitary Measures (WTO 1994).*

This means that measures should be technically justified and based on available scientific information (see also Articles 3 and 5) (WTO 1994).

Article 3 (Harmonization) of the SPS Agreement states that measures should be based on international standards or that measures that deviate from standards should be technically justified. Members can use international standards as the basis for their national regulations and know that those measures cannot be challenged under the SPS Agreement. The agreement identifies the internationally recognized standard-setting bodies as: (1) the Codex Alimentarius Commission for food safety and human health, (2) the Office Internationale des Epizooties (OIE) for animal health, and (3) the International Plant Protection Convention (IPPC) for plant health.

International standards developed by these organizations incorporate available scientific information and assess the risks associated with a given situation. As such, any measure based on a standard is by default considered to be technically justified (WTO 1994).

Article 4 (Equivalence) of the SPS Agreement states that members should accept as equivalent alternative measures that achieve the same level of protection that differ from their own measures (WTO 1994).

Article 5 (Assessment of Risk and Determination of the Appropriate Level of Sanitary or Phytosanitary Protection) addresses the application of risk assessment in determining appropriate SPS measures. Importantly, it states that risk assessments used for determining SPS measures should be based on methods developed by relevant international organizations and take into account available scientific evidence. It is also important to note that measures, which deviate from standards, as defined in Article 3, should be based on risk assessment. Furthermore, Article 5 states that members should implement measures only to achieve an appropriate level of protection, and that these measures should be the "least trade restrictive" possible. The SPS Agreement allows for measures that are more stringent than those defined by standards, but these measures should be fully justified by a risk assessment (WTO 1994).

Article 6 (Adaptation to Regional Conditions, Including Pest or Disease-Free Areas and Areas of Low Pest or Disease

Prevalence) discusses the provisions for regionalization, pest free areas and areas of low pest prevalence. These concepts are significant for AW-IPM programmes as they provide for the recognition of pest free areas and areas of low pest prevalence – the goal of AW-IPM programmes (WTO 1994).

3.2. The International Plant Protection Convention

As stated above, the SPS Agreement identifies the IPPC as the international standard setting body for plant health. The IPPC is an international treaty with its own signatories, or contracting parties. It originally entered into force in 1952; it was amended in 1979 and the 1979 text entered into force in 1991. More recently, in 1997, the text was revised again largely to meet expectations set forth in the SPS Agreement. The 1997 amendments created a secretariat, the Commission on Phytosanitary Measures and formalized standard-setting as part of the IPPC's mission. The 1997 text will enter into force after the amendments have been accepted by two-thirds of the contracting parties to the IPPC (currently 137 countries). Until this happens, the Commission on Phytosanitary Measures operates as the Interim Commission on Phytosanitary Measures (ICPM).

The purpose of the IPPC is to secure common and effective action to prevent the spread of plant pests and to promote measures for their control. Although the IPPC has a clear relationship to the SPS Agreement and to agricultural trade, its scope is not limited to trade. The scope of the IPPC applies to protecting all plants including wild flora from plant pests. Plant pests include any organism that may affect plant health, including diseases and weeds (FAO 1997a). To achieve this goal of protecting plant health, the text of the IPPC sets forth rights, obligations and responsibilities of contracting parties, including pest risk analysis, harmonization, equivalence, minimal impact, regionalization, pest free areas and areas of low pest prevalence. According to the IPPC, contracting parties should make provision for a national plant protection service that is responsible for performing certain key functions including: (1) phytosanitary certification, (2) establishment of an official contact point, (3) surveillance, (4) implementation of appropriate phytosanitary measures, (5) conducting treatments and certifying exports, (6) exchanging scientific and technical information, (7) developing and observing standards, (8) recognition of equivalence, (9) conducting eradication programmes, and (10) recognition of pest free areas and areas of low pest prevalence (FAO 1997a).

3.2.1. International Standards for Phytosanitary Measures

Contracting parties receive guidance on meeting these provisions through the use of international standards developed under the auspices of the IPPC. International Standards for Phytosanitary Measures (ISPMs) are developed under the guidance of the ICPM. The ICPM (comprised of contracting parties to the IPPC and members of the Food and Agriculture Organization of the United Nations (FAO)) decides which ISPMs should be developed as part of the work programme. An expert panel is formed to draft the standard, ensuring that the best scientific expertise is incorporated into the standard. The Standards Committee reviews and revises the draft standard, which is then sent to all members of the ICPM for comment. After another review by the Standards Committee, the draft standard can be submitted to the ICPM for adoption. To date there have been over 20 standards adopted. It should be noted that although priorities for new standards are determined by the ICPM by consensus, topics may be suggested by individual members (countries), regional plant protection organizations, international organizations (e.g. International Atomic Energy Agency (IAEA), WTO) or other organizations such as international non-governmental organizations.

There are three general types of standards: reference, concept and specific. Reference standards include the ISPM No. 5 (Glossary of Phytosanitary Terms) (FAO 2001) and

ISPM No. 1 (Principles of Plant Quarantine as Related to International Trade) (FAO 1995). Concept standards include ISPMs such as ISPM No. 4 (Requirements for the Establishment of Pest Free Areas) and ISPM No. 6 (Guidelines for Surveillance). The pest risk analysis standards (ISPMs No. 2 Guidelines for Pest Risk Analysis, No. 11 Guidelines for Pest Risk Analysis for Quarantine Pests Including Analysis of Environmental Risks and Living Modified Organisms) are also concept standards. Specific standards address specific pests or commodities. Currently, ISPM No. 15 (Guidelines for Regulating Wood Packaging Material in International Trade) (FAO 2002b) is the only specific standard; however, several commodity and pest specific standards are in various stages of development.

3.2.2. Standards and Area-Wide Pest Management

Of the standards that have been developed to date, several have direct implications for area-wide pest management programmes. These include: (1) ISPM No. 3 Guidelines for the Export, Shipment, Import and Release of Biological Control Agents and other Beneficial Organisms (Revised) (FAO 2005a), (2) ISPM No. 6 Guidelines for Surveillance, (3) ISPM No. 4 Requirements for the Establishment of Pest Free Areas, (4) ISPM No. 22 Guidelines for Areas of Low Pest Prevalence, (5) ISPM No. 9 Guidelines for Pest Eradication Programmes, (6) ISPM No. 10 Guidelines for Pest Free Places of Production and Pest Free Production Sites, (7) ISPM No. 2 Guidelines for Pest Risk Analysis, (8) ISPM No. 11 Guidelines for Pest Risk Analysis for Quarantine Pests Including Analysis of Environmental Risks and Living Modified Organisms, and (9) ISPM No. 14 The Use of Integrated Measures in a Systems Approach for Pest Risk Management.

These standards can contribute to AW-IPM programmes for two main reasons. First, when AW-IPM programmes are implemented according to these standards, trading partners should be prepared to recognize the results of a successful AW-IPM programme as meeting requirements, for example, of a pest free area or an area of low pest prevalence. This means that such programmes will meet criteria for pest risk management as defined in the pest risk analysis standards (ISPM Nos. 2, 11 and 14) so that exporting countries can more fully benefit from their AW-IPM programmes through enhanced trade opportunities. At the same time, importing countries should be prepared to consider and recognize such programmes as pest risk management options, according to the principles of harmonization and equivalence (WTO 1994, FAO 1997a).

Second, these standards provide scientific and technical guidance for the design and operation of key components of AW-IPM programmes. This guidance covers many of the key elements that are integral components of all AW-IPM programmes. For example, ISPM No. 6 (Guidelines for Surveillance) provides valuable information on how surveillance programmes should be designed and executed, and covers basic sampling techniques (FAO 1997b). The pest risk analysis standards address how biological information on pests should be gathered and analysed. Although the design of AW-IPM programmes does not necessarily include a risk assessment component, there is considerable overlap in the type of information needed to make accurate judgements (FAO 1996a, FAO 2004). ISPM No. 14 provides extensive guidance on the integrated use of different types of pest risk management options to reduce pest risk. A national plant protection organization could accept the use of an AW-IPM approach for a specific pest to implement a phytosanitary measure, either independently (if it reduced risk to an acceptable level) or combined with other phytosanitary measures as part of a systems approach (e.g. treatments, seasonal shipping, etc.) as necessary (FAO 2002a). Finally, several standards discuss eradication, pest freedom and low pest prevalence – all potential outcomes of AW-IPM. They provide both scientific and technical guidance as to how such programmes may be developed, the types of information that should be gathered and analysed, the requirements for certain

procedures (e.g. surveillance) and how pest freedom can be officially recognized by other countries (FAO 1996b, 1998, 1999, 2005b). Each of these standards can contribute significantly to AW-IPM programmes. However, it is important to note that these standards are not meant to be used alone; rather, each one of these standards builds upon others to form a comprehensive system for plant protection. Similarly, the successful implementation of standards relies heavily on all countries actively participating in the standards process. All countries – when exporting and importing – should accept phytosanitary measures that are based on standards, including AW-IPM programmes where appropriate. More to the point, all countries should also actively participate in the development of new standards. For instance, a country, or group of countries, can recommend priorities for the development of new standards to the ICPM. This is especially important for certain pests that are the target of AW-IPM programmes, where the development of a specific international standard could add scientific and technical guidance and provide valuable impetus to a given programme.

4. Other Trade Considerations

It should also be noted that other factors related to agricultural trade could play a pivotal role in whether a country decides to invest its resources in AW-IPM programmes. The adoption of the Montreal Protocol, requiring the reduction in use or elimination of ozone depleting substances, may lead to decreased future availability of methyl bromide, an important quarantine treatment (UNEP 2000). Although the use of methyl bromide for quarantine purposes is exempted from the protocol, there is still a desire on the part of many countries to scale back their use of methyl bromide. In the absence of suitable alternatives, the application of AW-IPM approach for a specific pest, involving the area-wide rather than local integration of phytosanitary measures, will become increasingly important to countries wishing to trade agricultural products. Likewise, market forces and food safety standards are leading to acceptance of lower and lower levels of pesticide residues (maximum residue limits) in food, with a concomitant reduction in the reliance on certain pesticides in the field.

Concurrently, it is becoming widely recognized that the operational standard of "*Probit-9*" for quarantine treatments is not a technically justifiable requirement for many, if not most, pests. *Probit-9* security refers to the level of efficacy of a phytosanitary treatment and converts to 32 surviving individuals for every one million individuals treated (Follet, this volume). For more than 50 years, it has been assumed that this level of security was sufficiently protective, especially for fruit fly pests. However, as pest risk analysis continues to evolve, it has become evident that for many pests, *Probit-9* may be too stringent of a requirement; in some cases, *Probit-9* may not afford enough security. In either case, national plant protection organizations are re-evaluating the need for *Probit-9* security and AW-IPM programmes may prove to be suitable alternatives to long used point of origin-, in transit- or post-entry quarantine treatments (Liquido et al. 1997).

5. Implications for AW-IPM Programmes

Evidence exists that countries can benefit significantly when AW-IPM programmes are implemented for the purpose of enhancing trade opportunities, thus meeting requirements of standards. Chile eradicated Mediterranean fruit fly *Ceratitis capitata* (Wiedemann) from most of its territory integrating the sterile insect technique (SIT) and benefited through increased trading opportunities with the USA and many other countries (Liquido et al. 1997, Mumford 2002). Other countries that have initiated AW-IPM programmes for the purpose of increasing trade opportunities (and reducing phytosanitary requirements on exports) include Argentina, Australia, Brazil, Mexico and South Africa (Liquido et al. 1997, Mumford 2002). Most of

these programmes are for fruit fly pest suppression, containment or eradication, but other major quarantine pests, such as codling moth *Cydia pomonella* (L.) have also been targeted (IAEA 2004).

Nonetheless, it should be noted that not all pests are suitable targets for AW-IPM programmes (and in particular where the objective is eradication), even when there could be clear benefits with regard to trade. As mentioned at the beginning, many factors will affect the decision to undertake such a programme. Importantly, social, political, biological, physical and economic considerations, in addition to trade opportunities, must be taken into account before deciding to aim for area-wide pest management. These factors must also be considered in determining whether the goal of a programme might be suppression, prevention, containment or eradication (Myers et al. 1998, Hendrichs et al. 2005).

AW-IPM programmes may be resource-intense, require long-term commitment from a wide range of interest groups (growers, exporters, governments, researchers, etc.) and may run for several years or more. Even highly successful programmes can be expensive for long periods of time. Costs of eradication of Mediterranean fruit fly from California in 1975 are estimated at USD 328 million, with continuing costs for prevention, survey and detection (Mumford 2002). The present Mediterranean Fruit Fly Preventive Release Programme in California's Los Angeles basin, is the result of a conversion from a reactive to a proactive approach with a significant reduction of cost, is another example of an AW-IPM programme using the SIT. Myers et al. (1998) examined historical eradication and suppression programmes, including benefit/cost analyses. It was determined that, in some cases, eradication was an expensive choice and the relative benefits of some eradication programmes were not worth the costs. However, in others cases the benefit/cost ratio of eradication programmes is highly favourable (Dyck et al. 2005).

Over the past 50 years, a wealth of information has been accumulated on AW-IPM programmes. There is a growing understanding of the biological and epidemiological aspects of such programmes. Likewise, there is a better understanding of the importance of evaluating the economics and socio-political implications of these programmes (Dyck et al. 2005). As our experience continues to grow, we will develop a clearer understanding of the costs and benefits of such programmes. This will lead to improved decision-making with regard to when, and under what circumstances, to undertake AW-IPM programmes. These programmes represent a significant commitment of resources in the form of time, money and expertise; in some cases, however, this commitment of resources may prove to be a valuable and wise investment.

6. Conclusions

All of the factors identified above – increased agricultural trade, increased risks for the movement of pests, requirements for reduced pesticides residues and for international harmonization, evolving science – are leading national plant protection organizations to rethink phytosanitary requirements and seek alternative solutions to reducing pest risk. This means the need for AW-IPM programmes, rather than local IPM approaches, will likely increase in the future. However, complacency is not an option for anyone involved in these programmes. Scientists and researchers must understand the political, social and economic factors that may negatively or positively affect AW-IPM programmes. At the same time, decision makers and regulatory officials need to be open to alternative pest risk management strategies, including the wider application of AW-IPM programmes as stand-alone measures or as parts of systems approaches. By looking toward the horizon, instead of business as usual, all countries can benefit from enhanced agricultural trade while assuring phytosanitary security. The judicious implementation of AW-IPM programmes will play a vital and continuing role in this process.

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