Guidance On the Implementation of Policy Directive B.10

Pest and Pesticide Management

Inter-American Development Bank

Environmental Safeguards Unit (VPS/ESG)

Environment, Rural Development Disaster Risk Management Division (INE/RND)

TECHNICAL NOTE

No. IDB-TN-743

December 2014

Guidance On the Implementation of Policy Directive B.10

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Cataloging-in-Publication data provided by the
Inter-American Development Bank
Felipe Herrera Library

Guidance on the implementation of policy directive b.10: pest and pesticide management / Inter-American Development Bank.
p. cm. (IDB Technical Note; 743)
Includes bibliographic references.
1. Pesticides-Environmental aspects-Latin America. 2. Pesticides-Risk mitigation-Latin America. 3. Water quality management-Latin America. I. Inter-American Development Bank. Environmental Safeguards Unit. II. Title. III. Series.
IDB-TN-743

JEL Codes: Q16; Q25; Q24; N56
Keywords: Pesticide Use, Pesticide Management, Agriculture, water-supply, Public Health

Acknowledgments:

This technical note is based on a report prepared by Sandra Whiting under the supervision of and with the inputs from the Environment, Rural Development Disaster Risk Management Division (INE/RND) and the Environmental Safeguards Unit (VPS/ESG) of the Inter-American Development Bank.

http://www.iadb.org

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Acronyms

ASTI: Agricultural Science and Technology Indicators
CATIE: Centro Agronómico Tropical de Investigación y Enseñanza (Costa Rica)
CIAT: Centro Internacional de Agricultura Tropical (Colombia)
CGIAR: (formerly known as Consultative Group on International Agricultural Research)
EA: Environmental Assessment
EIA: Environmental Impact Assessment
ESMP: Environmental and Social Management Plan
FAO: Food and Agriculture Organization (United Nations)
FONTAGRO: Fondo Regional de Tecnología Agropecuaria
GEF: Global Environment Facility
IDB: Inter-American Development Bank
IFC: International Finance Corporation
IICA: Inter-American Institute for Cooperation on Agriculture
INIFAP: Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias (Mexico)
INTA: Instituto Nacional de Tecnología Agropecuaria (Argentina)
IPM: Integrated Pest Management
IRAC: Insecticide Resistance Action Committee
IVM: Integrated Vector Management
LAC: Latin America and the Caribbean
LD_{50}: Lethal Dose needed to kill 50% of a test animal population for determining acute toxicity
NGO: Non-governmental organization
OECD: Organization for Economic Co-operation and Development
OP: Operating Policy
PAHO: Pan-American Health Organization
PIC: Prior Informed Consent Procedure (Rotterdam Convention)
PMP: Pest Management Plan
POPS: Persistent Organic Pollutants (Stockholm Convention)
USAID: United States Agency for International Development
USEPA: United States Environmental Protection Agency
WHO: World Health Organization

1. Introduction

1.1. Background and purpose

Pesticides are heavily used in LAC countries, and some studies state that their use is on the rise.[1,2] Based on data from the United Nations' Food and Agriculture Organization (FAO), over 100,000 tons of active pesticide ingredients per hectare were used in LAC in 2009.[3] In addition, many extremely and highly hazardous pesticides (classes Ia and Ib, as classified by the World Health Organization[4]) that are banned or restricted in the U.S. and Europe are routinely used in some parts of Latin America for crop and animal production. Such pesticides may be used on both crops grown for export and those consumed locally.

The Inter-American Development Bank (IDB) makes efforts to minimize the use of pesticides and ensure their proper management in the projects it funds. Policy Directive B.10, which focuses on hazardous materials, of the IDB's Environment and Social Safeguards Compliance Policy (OP-703) requires that operations "avoid adverse impacts to the environment and human health and safety occurring from the production, procurement, use and disposal of hazardous materials, including … pesticides." The IDB has also published Implementation Guidelines for the Environment and a Social Safeguards Compliance Policy (referred to in this document as Safeguard Guidelines).

The purpose of this technical note is to provide further guidance on implementing Policy Directive B.10 as it relates to pesticide use, and to propose incorporating the FAO's International Code of Conduct on Pesticide Management as a further standard to be considered in the design and implementation of IDB-financed operations. This guidance applies to projects in all sectors where the Bank directly finances the acquisition, production and use of pesticides; these sectors may include, for example, education, housing and transport. In addition, given that one key aspect of both the Policy Directive and the International Code of Conduct is to promote and encourage the use of Integrated Pest Management (IPM) and Integrated Vector Management (IVM), this technical note provides background information and guidance on fostering their use.

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[1] CATIE, 1990

[2] Belotti et al., 1990

[3] FAO, 2014

[4] WHO, 2009

1.2. Benefits, risks and issues related to the use of pesticides

1.2.1. Definition and characteristics of pesticides

Pesticides are synthetic or naturally derived chemicals intended to prevent, repel or kill pests. "Pesticide" is an umbrella term that includes all types of treatment for a whole range of possible pests (insects, weeds, fungi, etc.) and includes insecticides, fungicides, herbicides, acaricides, rodenticides, molluscicides, larvicides, nematicides, algaecides and antimicrobial agents. They differ from one another in their toxicity, mode of action, target pest, persistence and fate in the environment and tendency to bioaccumulate in the food chain.

1.2.2. Benefits of pesticide use in agriculture and public health

The use of pesticides provides many public health and agricultural benefits to society. They:

- are the only effective way to control pests in some cases;
- benefit consumers by leading to wider selection, higher quality and lower prices for food and clothing;
- benefit farmers by reducing crop loss;
- protect buildings against damage from termite and other insect infestations;
- contribute to improved human health by preventing vector-borne disease outbreaks; and
- disinfect kitchens, hospitals, clinics and laboratories, as well as the instruments therein. [5]

These benefits reflect the advantages of working with pesticides: namely, they have a wide range of uses and are cost-effective, practical, fast-acting and flexible.

1.2.3. Disadvantages and risks of pesticide use

Pesticide users can experience adverse health effects if they improperly manage pesticides or fail to use appropriate personal protection. Farmers and populations surrounding agricultural areas can suffer side effects from pesticide use, as can the general public, in the latter case from pesticide residues in agricultural products.

Use of broad-spectrum pesticides; incorrect mixing and application procedures; and failure to properly store and dispose of pesticides and empty pesticide containers can all cause

[5] Modified from U.S. EPA's "Ag 101" website (EPA, 2014).

environmental contamination and adverse effects on non-target populations. For example, the use of many insecticides is believed to have adversely affected native pollinator and honeybee populations. In recent years, many countries have banned or limited the use of certain insecticides (such as neonicotinoids) in order to protect pollinators.

Improper use of chemical and even biological pesticides may include making an excessive number of applications without taking into account pest populations, applying pesticides at the wrong rate or repeated use of the same pesticide. Such misuse has led insects, weeds and other pests to develop pesticide resistance. For example, there is now a widely observed incidence of resistance to the fungicide benomyl among the fungus that causes black sigatoka, a disease endemic in bananas.[6] Meanwhile, herbicide-resistant weeds have become a problem for many crops,[7] and insect resistance to insecticides has been documented for years, most recently by the Insecticide Resistance Action Committee (IRAC). Insecticide-resistant pests include the melon and cotton aphid, which can be found worldwide and have become resistant to several classes of insecticides.[8] Insecticide resistance has also been seen in vectors of human disease, such as in the mosquito *Aedes aegypti*, a species that spreads dengue fever and other ailments. *Aedes aegypti* has developed resistance to all four classes of insecticides (carbamates, organochlorines, organophosphates, and pyrethroids) that are commonly in use to control mosquito populations.[9] Pesticides also can affect non-targeted species, such as honeybees and other pollinators, as well as any natural enemies of a targeted pest.

Exports from LAC countries of agricultural products containing pesticide residues have also been responsible for economic losses. When pesticide concentrations exceed the standards of a receiving country, shipments end up being rejected, which also creates losses for the farmers who are further down the supply chain.

The availability of pesticides that are unregulated, unlabeled, improperly packed, counterfeit or even banned is also a problem in some developing countries. Such products are not only possibly ineffective, but also may present significant risks to human health and the environment.

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[6] Marín et al., 2003

7 According to data compiled in an international survey of herbicide-resistant weeds (Heap, 2014), there are currently 437 unique cases among 238 species of herbicide-resistant weeds globally. Weeds have evolved resistance to 155 different herbicides, and herbicide-resistant weeds have been reported in 82 crops across 65 countries.

[8] IRAC, 2014

[9] Ranson et al., 2010

1.3. Classification of pesticides in relation to toxicity

The World Health Organization (WHO) has recommended classifying pesticides based on how toxic their technical-grade active ingredients are. Acute oral or dermal toxicity is determined through laboratory tests that calculate the lethal dose required to kill 50% of the test animal population (a metric abbreviated as LD_{50}).[10,,11] The WHO classifications are:

- Extremely Hazardous – Ia
- Highly Hazardous – Ib
- Moderately Hazardous – II
- Slightly Hazardous – III
- Unlikely to present acute hazard – U

The WHO pesticide classification process generally does not take into account chronic toxicity (exposure to small amounts of chemicals over time), inhalation toxicity (such as from fumigant use) or environmental toxicity. The WHO is, however, very precise about the toxicity it does measure, using standards for acute toxicity and other relevant information that come from the UN's Globally Harmonized System of Classification and Labelling of Chemicals. The Harmonized System has compiled data on potentially toxic chemicals for countries to use when formulating chemical management policies.[12]

The WHO classification system excludes fumigants[13] such as methyl bromide, phosphine and others, which are used on stored grains and soil and to sanitize crops and other materials being exported.The Montreal Protocol on Substances that Deplete the Ozone Layer proposes phasing out methyl bromide altogether. Many of the most toxic pesticides have already been banned for importation and use in LAC countries. These bans stem from the countries' participation in the Rotterdam Convention on the Prior Informed Consent Procedure for Certain

[10] WHO, 2009

[11] WHO classifications as of 2009 were based on the United Nations Economic Commission for Europe's Globally Harmonized System for Classification and Labelling of Chemicals.

[12] The data, as well as updates on new chemicals, are maintained in an OECD database (eChemPortal: http://www.echemportal.org/echemportal/propertysearch/treeselect_input.action?queryID=PROQak1). The database can be searched by several environmental variables, such as environmental fate (bioaccumulation), aquatic toxicity and sediment toxicity, among others.

[13] Listed in Table 8 of the WHO's classification report.

Hazardous Chemicals and Pesticides in International Trade[14] and the Stockholm Convention for Persistent Organic Pollutants (POPs, a category that includes some pesticides).[15]

2. Integrated pest and vector management

The development of Integrated Pest Management (IPM) and Integrated Vector Management (IVM) has grown out of an attempt to balance the necessity of certain pesticides against the problems that excessive reliance on pesticides can cause. The concepts of IPM and IVM consider pesticide use as just one of several pest management options, and they prioritize using non-chemical methods. The following sections define IPM and IVM and provide examples of their application in LAC countries.

2.1. Integrated pest management

Guidelines established by the University of California's Statewide Integrated Pest Management Program define IPM as follows:

> Integrated pest management (IPM) is an ecosystem-based strategy that focuses on long-term prevention of pests or their damage through a combination of techniques such as biological control, habitat manipulation, modification of cultural practices, and use of resistant varieties. Pesticides are used only after monitoring indicates they are needed according to established guidelines, and treatments are made with the goal of removing only the target organism. Pest control materials are selected and applied in a manner that minimizes risks to human health, beneficial and nontarget organisms, and the environment.[16]

Examples of IPM technologies are presented in Figures 1 and 2.

[14] All LAC countries except Haiti have ratified the Rotterdam Convention, but each country's actions regarding the different pesticides listed in Annex III of the Convention differ. See http://www.pic.int/TheConvention/Chemicals/AnnexIIIChemicals.

[15] All LAC countries except Haiti have signed and ratified the Stockholm Convention (Haiti has signed but not ratified it), thus banning the manufacture, importation and use of the following: aldrin, chlordane, DDT, dieldrin, endrin, heptachlor, hexachlorobenzene, mirex, toxaphene, chlordecone, alpha hexachlorocyclohexane, beta hexachlorocyclohexane, lindane, and pentachlorobenzene . See http://chm.pops.int/TheConvention/ThePOPs/The12InitialPOPs/tabid/296/Default.aspx.

[16] UC Davis, 2014

Figure 1. IPM for athracnose in mango production[19]

The State of Colima, Mexico, teamed with INIFAP, Mexico's federal agricultural authority, to develop an IPM approach for controlling anthracnose to reduce the use of fungicide and yield more marketable and higher-quality mangos. The key practices are:

- Planting resistant varieties (those with thick-skinned fruit).
- Pruning trees to remove infestations on branches, flowers and fruits.
- Pruning trees to promote light penetration and ventilation (reducing damp conditions favorable to the fungus), using chemical control only when appropriate for optimal fungal control (during flowering and fruit development).

Figure 2. IPM for coffee cherry borer[20]

The Inter-American Institute for Cooperation on Agriculture (IICA), through its coffee production modernization program, PROMECAFE, developed an approach for controlling this insect in coffee production under shade:

- Pruning for ventilation and light and to reduce humidity within plant.
- Sanitation — cleanup & disposal of all ripe, dried and unripe cherries after harvest and pruning.
- Trapping using attractants (18 to 20 per ha) between March and June to capture females (note: in some IPM approaches, traps are only used for monitoring to decide if and when additional control actions are needed).
- Biological control using parasitic insects or a pathological fungus (*Beauvaria bassiana*).
- Chemical insecticide as last resort (no particular type is specified at the outset).

2.2. Integrated vector management

Integrated Vector Management (IVM) is a decision-making process for managing vector populations, with the goal of reducing or interrupting the transmission of vector-borne diseases.[21] Vector-borne diseases are infectious diseases that are transmitted by organisms such as insects, snails and rodents.[22] The IVM approach involves, to quote Pan-American Health Organization guidance:

- Selection of methods based on knowledge of local vector biology, disease transmission and morbidity;
- Utilization of a range of interventions, often in combination and synergistically;
- Collaboration within the health sector and with other public and private sectors that impact on vector breeding;
- Engagement with local communities and other stakeholders;
- A public health regulatory and legislative framework;
- Rational use of insecticides; and

[19] INIFAP, 2008

[20] IICA/PROMCAFE, 2007

[21] PAHO, 2014

[22] Van den Berg et al., 2012, p. 1

- Good management practices.[23]

Methods typically used in IVM include biological, chemical, environmental and mechanical approaches. Biological control uses botanical or biological larvicides or focuses on conserving the vector's natural enemies. Chemical controls use the least toxic but most effective pesticides, either deployed in human or animal living quarters (for example, the use of pesticide-laden bed nets) or used as repellants. Environmental controls involve modifying living quarters and managing waste. Mechanical methods include trapping and using mechanical devices to interrupt breeding (for example, polystyrene beads in areas where water-borne insects breed).

Applying IVM can result in environmental, health and budget benefits because doing so improves the management of insecticides and other vector control chemicals, reducing negative health and environmental impacts in the process; reduces the development of insecticide resistance among pests; better coordinates actors involved in vector, at the same time putting scarce resources to better use; and maximizes the effectiveness of vector control interventions.[24]

Figure 3 illustrates the application of IVM for controlling malaria in Central America. To further illustrate the concept of IVM, Annex 3 to this document contains a table developed by USAID summarizing IVM procedures for various vectors.

[23] PAHO, 2014

[24] USAID/RTI

Figure 3. Example of IVM for Control of Malaria[25]

The Global Environment Facility (GEF) partly financed a project to demonstrate the application of IVM to combat malaria, in collaboration with the Pan-American Health Organization and eight Central American country governments. Prior to implementing the project, the standard practice was to spray homes and bodies of water with DDT. The project included a focus on community participation and interdisciplinary and multi-sector (health, education, environment) collaboration. It achieved a 63% reduction in malaria cases overall and an 86% reduction in the malarial parasite that causes the most severe infections. Techniques employed in the IVM project included:

- Rapid diagnosis and treatment of the infected human population, including counseling and education;
- Reduction of contact between mosquitos and the population using treated bed nets, screens on doors and windows, liming of households and planting of repellant trees (such as neem);
- Reduction of mosquito breeding sites by draining stagnant water ditches, clearing vegetation and using biological controls;
- Elimination of areas around homes that shelter or attract mosquitos through cleaning and hygiene education.

3. Policies on pesticide management, IPM and IVM

3.1. International standards

3.1.1. International Code of Conduct on Pesticide Management

With the International Code of Conduct on Pesticide Management,[27] the FAO and WHO establish voluntary standards for pesticide management among public- and private-sector entities involved in the distribution and use of pesticides. The standards are for governments, manufacturers, importers/distributors, users, consumer groups, researchers, lending institutions and donors. The intent is to help countries evaluate the adequacy of their regulations and programs intended to manage pesticides; guide the judicious and safe use of pesticide in order to reduce potential risks; and ensure efficiency and efficacy. The standards are designed to promote IPM in agriculture and IVM in public health. The Code is accompanied by a series of technical guidance documents related to monitoring for compliance with the Code. The documents also address personal protection, pesticide application, registration programs, labeling, advertising, methods of determining pesticide efficacy and aspects of pesticide management.

One important standard for pesticide management established in the Code pertains to the selection of pesticides and personal protection for pesticide users. Pesticides whose handling and application require the use of personal protective equipment that is uncomfortable, expensive or not readily available should be avoided, especially for small-scale users in tropical climates.

[25] GEF, 2009

[27] FAO/WHO, 2014

Preference should be given to pesticides that require inexpensive personal protection and application equipment and whose application procedures are appropriate to the conditions under which the pesticides are to be handled and used.

Under the Code, governments have the primary responsibility in regulating the availability, distribution and use of pesticides and should allocate adequate resources accordingly. Among these responsibilities are the need for policies, regulations and programs that accomplish the following:

- Implement a pesticide registration and control system, which should include risk evaluation procedures and establish methods of detection and control of illegal trade in pesticides;
- Adopt standards for packaging, repackaging, labeling, storage, disposal and advertising;
- Establish a licensing system for the sale of pesticides that ensures adequate training for vendors so they can advise purchasers about risk reduction and efficient use;
- Carry out health surveillance, data collection and education programs related to pesticide exposure and poisoning;
- Monitor pesticide residues in food and the environment;
- Adopt standards for, and promote the use of, appropriate and affordable personal protective equipment;
- Ensure that educational materials on appropriate pesticide are disseminated to users;
- Adopt engineering and operating standards for pesticide manufacturing;
- Inventory obsolete or unusable stocks of pesticides and used containers and implement an action plan for disposal or remediation of contaminated sites;
- Consider prohibiting the importation and sale of highly toxic and hazardous products; and
- Develop and promote the use of IPM and IVM.

The Code also proposes that lending institutions and donor agencies (in collaboration with governments, industry and other stakeholders) should do the following:

- Support the development of national IPM policies and improved IPM concepts and practices using strategies that promote increased participation of farmers, extension agents and researchers;

- Promote the research and development of pesticide alternatives that pose fewer risks, such as biological controls and pesticides that are target-specific, biodegrade into innocuous products or are of low risk to humans and the environment;
- Consider helping establish or strengthen analytical laboratories in pesticide-importing countries; and
- Give high priority to assisting countries that lack facilities and expertise for pesticide management and control systems.

3.1.2. The WHO IVM Policies

The WHO recommends IVM as the preferred strategy for controlling disease vectors and preventing and controlling vector-borne diseases. IVM should improve the efficacy, cost-effectiveness, ecological soundness and sustainability of vector control. The WHO urges the establishment of national IVM strategies and has issued a Guidance on Policy-Making for Integrated Vector Management[28] and a Handbook for Integrated Vector Management[29]. The former document provides guidance on formulating policies and plans for governments and organizations responsible for vector-borne disease management. The latter provides background information and an operational framework for IVM. It emphasizes the importance of developing policy instruments using evidence-based decision making; this approach combines vector control interventions (taking into account legislation and regulation related to pesticide management), inter-sector collaboration and community empowerment.

3.2. National policy and legislation

3.2.1. Pesticide management and compliance with the International Code of Conduct on Pesticide Management

The implementation of pesticide registration and control requirements is usually the responsibility of ministries of agriculture, while monitoring and tracking the prevalence of pesticide-related toxicity is generally the purview of ministries of public health. Regulation of the use of personal protective equipment sometimes falls under ministries of labor, through their

[28] Van den Berg et al., 2012

[29] WHO, 2012

departments of occupational safety and health, though it is worth noting that these rules generally apply only to employees of organizations and businesses, not to individual farms. Pesticide disposal requirements, where they exist, may fall under the hazardous waste management responsibilities held by ministries of agriculture or the environment.

As previously mentioned, the International Code of Conduct provides voluntary standards for governments to establish policies, regulations and programs to control pesticide registration, labeling, packaging, sale, transport, storage and handling. The Code also includes standards concerning education, health surveillance, monitoring of residues in foods and the environment and management of obsolete or unusable pesticide stocks. Most LAC countries have taken steps toward improving pesticide management, thus achieving some consistency with FAO and WHO standards. Legislation and regulations have been adopted in most countries for the registration, labeling, sale, transport, storage and handling of imported and manufactured pesticides at the national level.[30] Progress has been made in developing national action plans for managing pesticides; developing local capacity; organizing networks of laboratories for pesticide testing; carrying out awareness and farmer training programs; and harmonizing pesticide regulations on a regional level in the Andean and Caribbean regions.[31]

However, there are still areas for improvement, particularly in enforcement capacity; control of non-registered or banned pesticides; use of proper protective equipment; pesticide treatment and disposal; and development of laboratory capacity for testing pesticides and pesticide residues.

Programs (often carried out by pesticide trade organizations) to educate farmers on the correct use of pesticides and personal protection are often piecemeal, with little follow-up or supervision of pesticide users. Observations in the field in various countries have shown that farmers seldom use any protective equipment for pesticide application, even if they have received training.[32]

Capacity for managing adequate storage and preparation of pesticides, storage and disposal of unused pesticides and management of empty pesticide containers is limited in some LAC countries. Inspections of agricultural experiment stations and plant sanitation laboratories

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[30] WHO, 2010

[31] FAO/WHO, 2013

[32] CIAT, 2005

in several LAC countries have shown that adequate facilities for mixing and storing pesticides are lacking.[34,35,36]

While some LAC countries have conducted inventories of obsolete pesticides or developed plans to clean up sites contaminated with pesticides, there is a clear lack of management resources, as well as adequate treatment and disposal facilities.[37,38]

Health surveillance of pesticide users is also limited in some countries. Some monitoring takes place for public and private sector laboratory technicians exposed to pesticides and other chemicals. Public health agencies do maintain data on instances of pesticide poisoning as reported by hospitals, but reporting is not always systematic.[39]

Monitoring of environmental contamination from pesticide use is generally minimal in LAC countries and, if performed, is carried out on a one-time basis, only when special projects are funded by international organizations. The lack of laboratories with the capacity to conduct pesticide testing on environmental samples is a serious limiting factor for environmental monitoring.

3.2.2. IPM and IVM

While there have been many projects in LAC to carry out research and development and train farmers in IPM techniques, there are few policies or regulations that have been adopted at the national level.[40,41]

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[34] IDB, 2012

[35] IDB, 2009

[36] IDB, 2004

[37] Servicio Nacional de Calidad Agroalimentaria (SENASA) in Argentina has inventoried pesticides in the facilities it operates; characterized their storage conditions; planned for long-term safe storage until disposal can be arranged; and identified possibly contaminated sites and developed plans for their clean-up. FAO has worked in Bolivia and Paraguay to inventory obsolete pesticides and develop plans for management, as well as arrange for treatment and disposal of a portion of the pesticides.

[38] Red de Centros, 2005

[39] Murray et al., 2002

[40] An exception is a law adopted in Peru in 1997 (CONAP, 1997) and a corresponding regulation adopted in 2000. They were built to promote the use of IPM, creating an advisory commission and establishing that implementing agencies would develop strategies for investigation, training and technical assistance in IPM. The regulations also tie IPM projects to the environmental assessment process and the preparation of environmental management plans.

[41] Both the Comunidad Andina and Mercosur have adopted policies to harmonize the pesticide regulations of their member countries, but there are no overarching policies related to the use of IPM or IVM (meanwhile, members of the Caribbean Community and Common Market have not adopted any such policies at all). However, there is some attention paid to IPM, as illustrated by Mercosur countries' adoption of a policy for the integrated risk management of canker in citrus, a policy that includes IPM approaches such as cultural controls (Mercosur, 2005).

Most LAC countries have developed technological IPM packages that address specific pest problems in specific crops. This has been accomplished via governmental or semi-autonomous agricultural research and development institutions; national and international private and trade-group research institutions; and some universities. In some cases, the IPM approach has been limited to pest monitoring to determine when to use pesticides, rather than crafting a total package of alternative approaches intended to avoid the use of pesticides.[42]

IPM packages are typically transferred to farmers through publications or workshops. However, as a recent IDB publication explains:

> …there is still a considerable need for further investment in extension services. As a result, small and medium-sized farmers in particular are not getting basic and critical information about new technologies and practices that can help raise their productivity levels and help them become better stewards of the natural resource base.[43]

IVM policies exist in most of the Bank's beneficiary countries, but their implementation varies. A survey conducted by the WHO in 2010 found that 78% of the 21 LAC countries that responded have national integrated vector management policies. In terms of implementing those policies, 13 countries stated that they do so throughout the country, while another six implement them in specific locations and two have not implemented them at all.[44]

A WHO report on the subject considers the following specific examples:

> An intensive programme for interrupting transmission of Chagas disease in Central America by 2010 has raised awareness of the problem. In South America, Chagas control combines indoor residual spraying with house improvement. Guatemala has a programme to reduce reliance on indoor residual spraying for malaria control by community-based larval control. Multiple approaches to control dengue vectors are being utilized in Brazil.

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[42] For example, a manual that Argentina's Instituto Nacional de Tecnología Agropecuaria (INTA) published in 2005 on integrated management of tomatoes only focused on monitoring pests in order to determine when to use chemicals (including very toxic insecticides) but contained no procedures for alternatives to insecticides. Similarly, on its website, Colombia's Centro Nacional de Investigaciones de Café (Cenicafé) presents an IPM approach to controlling the coffee berry borer (broca), which can devastate coffee crops if left unchecked. The approach monitors flowering to determine when to apply insecticides, though it does not offer any alternatives that would replace the chemicals with biological, cultural or mechanical solutions. In contrast, the primarily Central American coffee production modernization initiative PROMECAFE has developed a more complete IPM approach that does include such alternatives. For some cropping systems with a traditionally high use of very toxic pesticides — rice for example — IPM technologies have been developed in a few countries for specific pests, but this sector continues to rely heavily on the use of pesticides.

[43] Zeigler et al., 2014, p. 29

[44] WHO, 2010

Two key challenges to IVM in the region are the lack of human capacity and the limited attention to evaluation.[45]

4. Challenges for pesticide management and implementation of IPM and IVM

LAC countries generally lack the resources and capacity to cover all aspects of pesticide management. These can include importation, storage and handling, use of safety equipment, testing for residues in food, measurement of environmental contamination and control of obsolete pesticides.

Promoting the use of IPM is complicated by the fact that countries typically do not have overarching policies in place to require or prioritize it.[46] Further, technological IPM packages have not been developed for all crops or pests. Even in cases in which an IPM package has been developed for a pest or vector in one country, it may not be directly transferable in another country without validating and modifying the methods, all of which require time and resources. In addition, cultural attitudes, agricultural extension resources, institutional capacity and the advice pesticide distribution companies provide to farmers may all influence the ability to implement IPM.

Funding for agricultural research and development in Latin America and the Caribbean is low relative to worldwide spending.[47,48] Without sufficient resources that are locally adapted and accepted, IPM and IVM techniques are unlikely to compete with competing research projects.

Various studies have noted a lack of effective methods of transferring IPM programs to farmers; therefore, the studies have found, these is technologies have seen limited adoption. Some studies have shown that IPM programs are not adopted because they are too complex (e.g., determining the economic threshold of damages) or too costly (e.g., requiring imports of pheromones, natural insecticides or biological controls).[49] One of the challenges in implementing

[45] WHO, 2007

[46] Norton et al., 2005

[47] Agricultural Science and Technology Indicators (ASTI) estimated that, in 2006, public-sector agricultural research spending in this region came to US$3 billion (Stads and Beintema, 2009).

[48] An Institute for Trade, Standards, and Sustainable Development (ITSSD) report indicated that research spending in 2000 in this region was less than US$3 billion in the public and private sectors combined — significantly lower than spending on the international level that year (US$23 billion in the public sector and just over US$13 billion in the private sector) (IAASTD, 2009).

[49] Rodriguez and Niemeyer, 2014

an IPM technique is ensuring that, once research findings and technical packets are developed, well-trained extension agents transfer them to farmers. Even more important is ensuring that farmers are involved in the development of IPM for the crops they produce, so that there will be full buy-in and understanding. The FAO has been testing some innovative approaches to technology transfer and extension through “farmer field schools,” which have seen some success.

Another challenge associated with IPM approaches is the need to develop biological controls that are suited for local conditions and that take advantage of existing natural predators. In addition, commercialization of locally developed biological controls is a limiting factor.[50] The Brazilian Agricultural Research Corporation, or EMBRAPA, a state-owned research institute in Brazil, experienced this problem after it developed an effective biological control for an insect pest but was unable to find an interested private-sector company to commercialize the product and make it available to farmers.

IVM is also affected by the low implementation of IVM national strategies and policies and institutional capacity in Bank beneficiary countries. In addition, management of pesticides used for vector control is an issue. Based on a 2010 pesticide management survey, the WHO stated the following:

> Capacity-strengthening for sound management of public health pesticides has become a priority. This is a consequence of the increased use of insecticides for vector-borne disease control and personal protection; the increasing challenges of managing these chemicals under decentralized health systems; the depleting arsenal of safe and cost effective insecticides; the need to extend the useful life of pesticide products currently in use; and the inadequacy of national regulatory frameworks and of human and financial capacity to regulate the availability, sale and use of public health pesticides.[51]

5. Bank policy requirements

As stated in the Bank’s Policy Directive B.10, Bank-financed operations should avoid adverse impacts to the environment and human health and safety that occur from the production, procurement, use and disposal of hazardous materials, including organic and inorganic toxic substances, pesticides and persistent organic pollutants (POPs).

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[50] IITA/CGIAR, 2008

[51] WHO, 2010

Furthermore, Directive B.10 promotes the use of IPM and IVM to reduce reliance on synthetic chemical pesticides and states that harmful pesticides should be avoided. When pesticides have to be used, operations should use those with the least adverse effects on human health and on non-target species and the environment. More toxic pesticides may be considered only where such approaches have been shown to be ineffective for disease vector control in health-related projects. The Bank will not finance operations involving toxic pesticides — as defined by the WHO classes 1a, 1b and II — except where adequate restrictions and sufficient capacity exist within the context of the operation for their proper and safe handling, storage and application.

Other key OP-703 Policy Directives that must be considered are B.2 – *Country Laws and Regulations*; B.3 – *Screening and Classification*; B.4 – *Other Risk Factors*; B.5 – *Environmental Assessment* (including environmental and social management plan requirements; B.6 – *Consultation*; B.7 – *Supervision and Compliance*; and B.9 – *Natural Habitats and Cultural Sites*.

The Bank's Safeguard Guidelines provide further direction for complying with Policy Directive B.10, as summarized below:

1. Identify potential use of significant quantities of pesticides in the safeguard screening form (Policy Directive B.3).
2. Prepare an Environmental Impact Assessment (EIA) or Environmental Assessment (EA) and an Environmental and Social Management Plan (ESMP) for the operation, depending on the evaluation of project impact (Policy Directive B.5).
3. Prepare a Pest Management Plan (PMP) when significant quantities of pesticides are used.[52] The PMP should include at minimum:
    - Proposed applications;
    - Handling activities;
    - Disposal of wastes;
    - Identification of potential impacts based on toxicity, including effects on human health; target species; non-target species; natural environment; and environmental risk; and
    - Responsibilities and budget.

[52] Note that the Guidance does not specifically require a PMP for pesticides classified by the WHO as Ia, Ib, or II. Nevertheless, Directive B.10 implies that a PMP is necessary for these classes of pesticides if there is not sufficient local capacity to manage them. Directive B.5 refers to the preparation of the ESMP.

The Safeguard Guidelines also indicate that in cases where local pesticide management standards have not been sufficiently developed, the IDB should request that the implementing agency or borrower follow recognized international standards, such as the FAO's Guidelines for Packing and Storage of Pesticides and Guidelines on Good Labeling Practice for Pesticides. As the Safeguards Guidelines does not include reference to the International Code of Conduct, this technical note recommends that it also be used to help strengthen pesticide management in the context of Bank operations.

6. Supporting implementation of the International Code of Conduct on Pesticide Management

As the Bank works to apply the International Code of Conduct on Pesticide Management to its operations and in support of its clients, there are a series of actions it could promote to encourage local adoption and implementation of the Code. These include:

- Capacity building, by helping borrowers strengthen enforcement capacity and laboratory capabilities.
- Supporting research and development to promote development of IPM programs, by financing the research necessary to create IPM technical packages that are cost effective and easy to apply and that take into account farmers' needs.[53] Research should be conducted on biological pesticides and ways to promote natural enemies, with the aim of reducing chemical pesticide use.
- Supporting technology transfer and extension programs to help bring IPM and IVM packages to farmers and communities, by financing the design and implementation of effective agricultural extension techniques that involve farmers in a proactive manner (such as farmer field schools).
- Supporting disease vector control programs, by financing research into vector behavior and environmental/cultural characteristics of vectors, as well as development and evaluation of vector controls.
- Incorporating pesticide use into project impact monitoring. Baseline data collection should include information on types and volumes of pesticides used before a project

[53] Increasing Bank support of research is also a recommendation of the Bank's Sector Framework on Agriculture and Natural Resources Management, from May 2013.

begins, as well as any safeguards used by farmers. Evaluation of project impacts should measure how farmer behavior changes in relation to the types and quantities of pesticides used; it should also address any changes in safe handling procedures.

- Ensuring that infrastructure projects consider local vector issues when designing new or retrofitted irrigation, water and wastewater projects, in order to reduce the likelihood of creating new habitats for water-borne vectors.

7. Conclusions

Adequate management of pesticides is crucial for long-term agricultural sustainability, human health and the protection of the environment. The FAO/WHO International Code of Conduct on Pesticide Management, along with its supporting technical guidance documents, provides a solid framework for IDB borrower countries to adopt and implement pesticide management practices. Additionally, one of the key goals of the Code is to promote the use of IPM and IVM approaches, which is also a Bank objective. Such approaches have been shown to be effective in reducing the rate of pesticide use, increasing the effectiveness of pesticide applications and promoting the substitution of less toxic pesticides. Therefore, as they apply the Safeguard Guidelines for Policy Directive B.10, project teams should follow the recommendations and minimum standards described in the Code when designing and implementing Bank-financed operations.

Annex 1. Useful online databases and guidance documents

FAO database of Weeds in Crops and Countries: http://www.fao.org/agriculture/crops/core-themes/theme/biodiversity/weeds/db-countries/en/

FAO Guidelines for Management of Small Quantities of Unwanted and Obsolete Pesticides: http://www.fao.org/fileadmin/user_upload/obsolete_pesticides/docs/small_qties.pdf

FAO International Code of Conduct on the Distribution and Use of Pesticides: http://www.fao.org/agriculture/crops/thematic-sitemap/theme/pests/code/en/

FAO statistics on pesticide use and other information: http://faostat3.fao.org/home/E

Integrated Plant Protection Center, Oregon State University, Compendium of IPM Definitions: http://www.ipmnet.org/ipmdefinitions/index.pdf.

Insecticide Resistance Action Committee (IRAC) pest information: http://www.irac-online.org/pests/

Montreal Protocol on Substances that Deplete the Ozone Layer: http://ozone.unep.org/new_site/en/montreal_protocol.php

OECD database of existing chemicals (searchable by chemical name, CAS number, property): http://www.echemportal.org/echemportal/propertysearch/page.action?pageID=0

University of California, Davis, IPM information: http://www.ipm.ucdavis.edu/index.html..

USAID, Globalizing Integrated Pest Management: http://pdf.usaid.gov/pdf_docs/PNADS394.pdf

USAID, Integrated Vector Management: http://www.ivmproject.net/

USDA, IPM regional centers — information on IPM studies, pesticides, pest alerts: http://www.ipmcenters.org/

USEPA guidelines for fertilizer and pesticide storage facilities: http://www.epa.gov/oecaagct/ag101/pestfertilizer.html

WHO Guidance on Policy Making, IVM: http://whqlibdoc.who.int/publications/2012/9789241502795_eng.pdf

WHO Handbook for IVM: http://whqlibdoc.who.int/publications/2012/9789241502801_eng.pdf

WHO, Recommended Classification of Pesticides by Hazard: http://www.who.int/ipcs/publications/pesticides_hazard_2009.pdf?ua=1

Annex 2. References cited

Bellotti, A., Cardona, C., and Lapointe, S. 1990. "Trends in Pesticide Use in Colombia and Brazil". *Journal of Agricultural Entomology*. 7(3): 191-201.

Centro Agronómico Tropical de Investigación y Enseñanza (CATIE). 1990. "Guia para el Manejo Integrado de Plagas de Tomate". Turrialba, Costa Rica.

Centro Nacional de Investigaciones de Café (Cenicafé). 2011. "Recomendaciones para el Manejo de la Broca del Café". *Brocarta*, No. 42. <http://www.cenicafe.org/es/index.php/cultivemos_cafe/plagas>.

Centro Internacional de Agricultura Tropical (CIAT). 2005. "Reducción del Uso y Desarrollo de Resistencia de Plaguicidas en el Cultivo de Arroz y Frijol en Colombia, Venezuela y Ecuador". Cali, Colombia.

Comisión Nacional de Plaguicidas (CONAP). 1997. "Ley 26744, Sobre el Manejo Integrado sobre el Control de Plagas.". Lima, Peru. <http://www4.congreso.gob.pe/comisiones/1996/ambiente/lib05/LEY26744.HTM>.

Food and Agriculture Organization (FAO)/World Health Organization (WHO). 2013. Event: "7th Joint Meeting on Pesticide Management and 9th Session of the FAO Panel of Experts on Pesticide Management". Geneva, Switzerland.

----. 2014. "International Code of Conduct on Pesticide Management". Rome, Italy.

FAO, Statistics Division. 2014. "Pesticide Use in LAC Countries, 2009". Online. <http://faostat3.fao.org/faostat-gateway/go/to/search/Pesticides use 2009/E>.

Gallagher, K., Ooi, P., Mew, T., et al. 2002. "Integrated Pest Management In Rice". *International Rice Commission Newsletter*. v. 51.

Global Environment Facility. 2009. "Countries Move Toward More Sustainable Ways to Roll Back Malaria". Geneva, Switzerland / Nairobi, Kenya / Washington, DC, United States. <http://www.thegef.org/gef/node/2253>.

Heap, I. 2014. "The International Survey of Herbicide Resistant Weeds". Online. <http://www.weedscience.org/summary/home.aspx>.

Insecticide Resistance Action Committee (IRAC). 2014. "Pest Information". Online. <http://www.irac-online.org/Pests/>.

Instituto Nacional de Investigaciones Forestales Agrícolas y Pecuarias (INIFAP). 2008. "Guía para la Prevención y Control de Plagas y Enfermedades del Cultivo del Mango en el Estado de Colima".

Inter-American Development Bank (IDB). 2004. "Informe de Análisis Ambiental del Proyecto AGROFUTURO (BR-L1001)". Washington, DC, United States.

----. 2009. "Informe de Gestión Ambiental y Social (IGAS): Programa de Fortalecimiento del Sistema de Innovación Agropecuario (AR-L1064)". Washington, DC, United States.

----. 2012. "Programa de Investigación y Desarrollo Agropecuario (DR-L1054)". Washington, DC, United States.

Inter-American Institute for Cooperation on Agriculture/Programa Cooperativo Regional para el Desarrollo Tecnológico y Modernización de la Caficultura en Centroamérica, Panamá, República Dominicana y Jamaica (IICA/PROMECAFE). 2007. "Manejo Integrado de la Broca del Café Diseñado con Tres Componentes". Guatemala, Guatemala.

International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD). 2009. "Agriculture at a Crossroads: Synthesis Report". Washington, DC, United States.

International Finance Corporation (IFC). 2012. "IFC Performance Standards on Environmental and Social Sustainability". Washington, DC, United States.

International Institute of Tropical Agriculture (IITA)/CGIAR. 2008. "Incorporating Integrated Pest Management Into National Policies", *IPM Research Brief*, No. 6.

Marín, D., Romero, R., Guzmán, M., Sutton, T. 2003. "Black Sigatoka: An Increasing Threat to Banana Cultivation". *Plant Disease*. 87(3): 208-222.

Mercosur. 2005. "Sistema Integrado de Medidas Fitosanitarias para el Manejo de Riesgo de *Xanthomonas Axonopodis* pv. *Citri* en Frutos Cítricos". Online. <http://www.senave.gov.py/docs/resoluciones/mercosur/sistema integrado_cancro.pdf>.

Montesdeoca, F., Panchi, N., Pallo, E., et al. 2012. "Produzcamos Nuestra Semilla de Papa de Buena Calidad: Guía para Agricultores y Agricultoras". Lima, Peru: International Potato Center (CIP).

Murray, D., Wesseling, C., Keifer, M., et al. 2002. "Surveillance of Pesticide-Related Illness in the Developing World: Putting the Data to Work". *International Journal of Occupational and Environmental Health*. 8(3): 243-248.

Norton, G., Heinrichs, E., Luther, G., Irwin, M., editors. 2005. *Globalizing Integrated Pest Management — A Participatory Research Process*. Ames, Iowa, United States: Blackwell Publishing.

Pan-American Health Organization (PAHO). 2014. "Integrated Vector Management". Online. <http://www.paho.org/hq/index.php?option=com_content&view=article&id=2640>.

Ranson, H., Burhani, J., Lumjuan, N., Black IV, W. 2010. "Insecticide Resistance in Dengue Vectors". *TropIKA.net*. 1(1). Online. <http://journal.tropika.net/scielo.php?script=sci_arttext&pid=s2078-86062010000100003>.

Red de Centros, Convenio de Basiliea Latinoamerica y Caribe. 2005. "3rd Progress Report, Project 'Survey of Capacity for the Destruction of Obsolete Pesticides and Remediation of Contaminated Sites in Latin America and the Caribbean'".

Rodríguez, L., Niemeyer, H. 2014. "Integrated Pest Management, Semiochemicals and Microbial Pest Control Agents in Latin American Agriculture". Santiago, Chile: University of Chile.

Stads, G., and Beintema, N. 2009. “Public Agricultural Research in Latin America and the Caribbean”. Washington, DC, United States: Agricultural Science and Technology Indicators (ASTI).

U.S. Agency for International Development (USAID)/RTI International. “Integrated Vector Management Project”. Online. <http://www.ivmproject.net/About/>.

U.S. Environmental Protection Agency (EPA). 2014. “Benefits of Pesticide Use”. Online. <http://www.epa.gov/oecaagct/ag101/pestbenefits.html>.

University Of California, Davis. 2014. “Statewide Integrated Pest Management Program”. Online. <http://www.ipm.ucdavis.edu/GENERAL/ipmdefinition.html>.

Van den Berg, H., Mutero, C., and Ichimorik K. 2012. “Guidance on Policy-Making for Integrated Vector Management”. Geneva, Switzerland: WHO Press.

World Bank. 1998, “OP 4.09” Pest Management”. Washington, DC, United States.

World Health Organization (WHO). 2007. “Report of the WHO Consultation on Integrated Vector Management (IVM)”. Geneva, Switzerland: WHO Press.

----. 2009. “The WHO Recommended Classification of Pesticides by Hazard”. Geneva, Switzerland: WHO Press.

----. 2010. “Public Health Pesticide Registration and Pesticide Management Practices by WHO Member States”. Geneva, Switzerland: WHO Press.

----. 2012. “Handbook for Integrated Vector Management”. Geneva, Switzerland: WHO Press.

Zeigler, M., Truitt Nakata, G. 2014. “The Next Global Bread Basket”. Washington, DC, United States: Inter-American Development Bank.

Annex 3. Table of chemical-based and nonchemical vector control methods

Control Method	Brief Description	Disease Targets	Major Vectors Targeted
Chemical-Based Vector Control Methods			
Adulticides			
Indoor residual spraying	Timely application of long-lasting chemical insecticides on the walls and ceilings of houses in order to kill the adult vectors that land on these surfaces.	Malaria, lymphatic filariasis, visceral leishmaniasis (kala-azar), Chagas disease	Indoor biting/resting female *Anopheles* mosquitoes; phlebotomine sand flies; reduviid bugs
Long-lasting insecticidal nets	Sleeping under a net made of insecticide-impregnated polyethylene, polyester or cotton to prevent bites from disease-baring insects.	Malaria, lymphatic filariasis, visceral leishmaniasis (kala-azar)	Indoor biting/resting female *Anopheles* mosquitoes; phlebotomine sand flies
Other insecticide-impregnated materials	Use of insecticide-impregnated clothing, coverings (blankets), window blinds, etc. to prevent human-vector contact and bites.	Malaria, dengue, lymphatic filariasis, cutaneous leishmaniasis, African trypanosomiasis (sleeping sickness), onchocerciasis	*Anopheles, Aedes, Culex* mosquitoes; phlebotomine sand flies; tsetse flies; *Simulium damnosum* black flies
Molluscicides	The use of molluscicides and insecticides to kill disease vectors in the adult stages.	Schistosomiasis, lymphatic filariasis, dengue	Freshwater snails (*Biomphilaria, Bulinus, Onchomelania*); *Anopheles, Aedes, Culex* mosquitoes
Insect traps	Insecticide-impregnated traps targeting flying vectors; may also have an attractant (color or light).	Malaria, African trypanosomiasis (sleeping sickness)	*Anopheles, Aedes, Culex* mosquitoes; tsetse flies
Chemical larvicides	The release of chemicals on water bodies and surfaces to kill larvae and pupae of insect vectors.	Malaria, dengue, lymphatic filariasis, onchocerciasis	*Anopheles, Aedes, Culex* mosquitoes; *Simulium damnosum* black flies

Annex 3. Table of chemical-based and nonchemical vector control methods, continued

Control Method	Brief Description	Disease Targets	Major Vectors Targeted
Non-Chemical Vector Control Methods			
Environmental			
Modification	Permanent environmental changes aimed at the elimination of local vector breeding areas.	Malaria, dengue, lymphatic filariasis, schistosomiasis	*Anopheles, Aedes, Culex* mosquitoes; freshwater snails (*Biomphilaria, Bulinus, Onchomelania*)
Manipulation	Temporary environmental changes to disrupt the reproductive cycle of a vector.	Malaria, dengue, lymphatic filariasis, schistosomiasis	*Anopheles, Aedes, Culex* mosquitoes; freshwater snails (*Biomphilaria, Bulinus, Onchomelania)*
House modification	An improvement in the housing structure to restrict entry of disease vectors.	Malaria, lymphatic filariasis, Chagas disease	Indoor biting/resting female *Anopheles* mosquitoes; reduviid bugs
Larviciding			
Larvivorous fish	Use of natural predators (tilapia and other fish) that feed on the larvae and pupae of mosquito vectors.	Lymphatic filariasis	*Anopheles, Aedes, Culex* mosquitoes;
Biological larviciding	Use of bacteria against mosquito larvae or pupae (e.g. *Baccillus thuringiensis*).	Malaria, dengue, lymphatic filariasis, onchocerciasis	*Anopheles, Aedes, Culex* mosquitoes; *Simulium damnosum* black flies
Non-larvivorous natural predators	Use of natural predators against disease vectors (e.g. molluscivorous fish, crawfish and crabs)	Schistosomiasis	Freshwater snails (*Biomphilaria, Bulinus, Onchomelania*);
Polystyrene beads	Formation of a layer on top of the body of water where breeding occurs to prevent the larvae and pupae from breathing	Malaria, dengue, lymphatic filariasis	Mosquitoes

Annex 3. Table of chemical-based and nonchemical vector control methods, continued

Control Method	Brief Description	Disease Targets	Major Vectors Targeted
Other			
Topical Repellants	Use of topical insecticides to repel biting insect vectors as a personal protection measure.	Malaria, dengue, lymphatic filariasis, African trypanosomiasis (sleeping sickness)	Mosquitoes; tsetse flies

Source: USAID/RTI, IVM Project