CUENTA RETO DEL MILENIO
NICARAGUA

MILLENNIUM CHALLENGE CORPORATION
REDUCING POVERTY THROUGH GROWTH

Guidelines and Procedures for Pest and Disease Management in Agriculture

Environmental and Social Impact Division
MCA - Nicaragua

September, 17 - 2007

Guidelines and Procedures for Pest and Disease Management in Agriculture

Environmental and Social Impact Division
MCA - Nicaragua

September, 17 - 2007

ENGLISH ABBREVATIONS

1. **AIP** Acute Intoxication from Pesticides.
2. **ANIFODA** Asociación de Formuladores y Distribuidores de Agroquímicos.
3. **CTE** Executive Technical Council.
4. **UNEP** United Nations Environment Program.
5. **MCA-N** Millennium Challenge Account-Nicaragua.
6. **MCC** Millennium Challenge Corporation.
7. **IGRs** Insect Growth Regulators.
8. **INTA** Nicaraguan Institute of Agriculture Technology.
9. **IPM** Integrated Pest Management.
10. **MAGFOR** Ministry of Agriculture and Forestry.
11. **MARENA** Ministry of the Environment and Natural Resources.
12. **MIFIC** Ministry of Industry and Commerce.
13. **MINSA** Ministry of Health.
14. **MSDS** Material Safety Data Sheets.
15. **OECD** Organization for Economic Cooperation and Development.
16. **PCPs** Polychlorinated Biphenyls.
17. **PERSUAR** Preparation of the Pesticide Evaluation Report and Safer Use Recommendations.
18. **PIC** Prior Informed Consent.
19. **POPs** Persistent Organic Pollutants.
20. **RUP** Restricted Use Product.
21. **USEPA** United States Environmental Protection Agency.
22. **WHO** World Health Organization.

CONTENTS

I.INTRODUCTION AND REGULATORY FRAMEWORK

1.1 Introduction

Crops, forests and domesticated animals are susceptible to harm or destruction due to pests, including viruses, bacteria, fungi, plants, insects, mites, nematodes, birds and other organisms. Crop loss due to pests in the field and after harvest is as high as 25% to 50% around the world and perhaps even more severe in developing countries. Post-harvest loss due to pest outbreaks frequently has devastating effects against the sustenance of farmers and communities. The pests responsible for diseases among animals may also infect humans; chronic illnesses transmitted by insects cause pain and suffering and reduce affected individuals' capacities to work (United Nations Environment Program - UNEP, 1992.)

- Synthetic pesticides —such as herbicides, fungicides, insecticides and other methods of control involving synthetic chemicals— have been the dominant means used to control pests in industrialized countries for more than fifty years.

In León y Chinandega, the main farm crops are maize, sesame, sorghum, sugarcane and peanut. Other important crops include beans, bananas (*musaceae*), cucurbits and vegetables (mainly tomato and sweet pepper.) According to several studies, acute intoxication is common in this region as a result of exposure to pesticides during their handling and application.

1.2 Regulatory Framework

All MCA-N activities must comply with the MCC Environmental Guidelines where Section 605(e)(3) of the Millennium Challenge Act of 2003 prohibits MCC for providing assistance for any project that is "likely to cause a significant environmental, health, or safety hazard". Specifically the MCA-N Program will not be involved with the production, procurement or intentional release of:

- Persistent Organic Pollutants (POPs) that the United States Environmental Protection Agency (USEPA) has identified as of greatest concern to the global community. These include: Aldrin, Chlordane, Dieldrin, Endrin, Heptachlor, Hexachlorobenzene, Mirex, Toxaphene, DDT (DDT may continue to be used specifically for malaria control via interior residual spraying if local regulations permit), Polychlorinated Biphenyls (PCBs), Dioxins, and Furans;
- Any pesticide or industrial or consumer chemical that is listed by the USEPA as "banned" or "severely restricted" under the Prior Informed Consent (PIC) Program; or
- A product (including an emission of effluent) that is prohibited or strictly regulated via Restricted Use Product (RUP) status in the United States because of its toxic effects on the environment, or creation of a serious public health risk

In this sense, any project that includes the purchase or use of pesticides with funds from MCC will need an action plan for the safe use and handling of pesticides, since this activity is considered to require special management due to the potential risks to humans and the environment. Each plan must also include an annexed environmental assessment which includes reference to Good Agriculture Practices (soil & plant health/analyses and water management) for each crop and "off the shelf" Integrated Pest Management (IPM) tactics used successfully in other countries. If the specific pesticides to be used on a determined crop cannot be identified at the time when the initial environmental assessment is prepared, then a prudential time period for its submission will be negotiated.

These guidelines and procedures should be reviewed and updated, if necessary on an annual basis – in particular, the list of banned pesticides.

1.3 Ability of the Applicant Country (Nicaragua) to Regulate or Control the Distribution, Storage, Use and Elimination of Required Pesticides.

Nicaragua's Law for Safety in the Use and Handling of Pesticides was published in 1982. In 1993, Decree #32-93 created the National Commission on Agrochemicals as an inter-institutional body to coordinate all aspects related to advising, consulting and support for the application of existing norms involving the registration, use and handling of pesticides. The Central Registry of Agrochemicals and Related Substances was also established under the Ministry of Agriculture and Forestry (MAGFOR).

The new Law #274 (Basic Law for the Regulation and Control of Pesticides and Toxic and Dangerous Substances) was published in the official daily *La Gaceta* #30 on February 13, 1998. Decree #49-98, published in july 1998, stipulates the specific rules and procedures for implementation of Law #274. The complete text of the law can be found at the following website: www.dgpsa.gob.ni

In general, Decree #49-98 includes chapters covering: general dispositions; the Application Authority and the national system for regulation and control; the national registry; registration and requirements for the issuance of licenses to individuals and legal entities; oversight and control system; quality control; labeling; formulation and general dispositions on transport, storage, use and handling; importation and exportation; control over distribution and sale; final waste disposal; protection of human health; and protection of the environment. The full text of this document can be found at the following website: www.dgpsa.gob.ni

The following are key points of the new law:

- The national Application Authority is supported by the Executive Technical Council (CTE), conformed by representatives from MAGFOR, the Ministry of the Environment and Natural Resources (MARENA) and the Ministry of Health (MINSA).

- Responsibilities are defined for the government ministries, municipalities and autonomous governments within the framework of the law.

- For the first time in Nicaraguan history (and as an exceptional case in Central America), a positive health report and a positive environmental report are required for each substance for which registration in the country is requested.

- It is stipulated that revenues from the different tariffs must be part of the budget available to the CTE so that it may implement oversight and control actions. This aspect is considered critical for sustainability and will be difficult to ensure.

In addition, the Ministry of Industry and Commerce (MIFIC) National Commission On Technical Regulation and Quality prepared and published NTON 02 010-02: "Technical Environmental Regulations for the Toxicological Classification and Labeling of Pesticides and Toxic, Dangerous and Other Substances." (See: www.mific.gob.ni)

Nevertheless, in Nicaragua —as in the majority of countries in Latin America— there is a lack of necessary resources and a limited operating structure to ensure completion of the laws and regulations regarding pesticides. Therefore, it is the responsibility of each project or program to supervise and promote pesticide manipulation in accordance with national laws. In the specific case of the CRM's Rural Business Program, the regulations established by the US Environmental Protection Agency (USEPA) and Millennium Challenge Corporation (MCC) must also be fulfilled.

Certain important achievements to reduce contamination:
In addition to the POPs and PIC treaties and seeking to help reduce the number of harmful pesticides and thus to reduce contamination, an international campaign entitled "The Dirty Dozen" was launched in 1985 to reduce the use of the twelve most common and most dangerous pesticides, some of which had also been prohibited in the United States by that country's Environmental Protection Agency (USEPA). The Dirty Dozen list has since grown from 12 to 18 products, and it provided original impetus for development of the POPs Treaty. (Allan check with PAN)

This new list of 18 "Dirty Dozen" pesticides includes: Aldicarb, Aldrin, BHC (Benhexachlor, a gamma isomer of HCH, also called Lindane), Camphechlor, Chlordane, Chlordimeform, DBCP (1,2-**D**i**B**romo-3-**C**hloro**P**ropane), DDT (**D**ichloro-**D**iphenyl-**T**richloroethane), EDB (**E**thylene **D**i**B**romide), Endrin, Heptachlor, HCH (1,2,3,4,5,6-**H**exa**C**hlorocyclo**H**exane, generally a mixture of isomers), Methyl Parathion, Paraquat, Parathion, **P**enta**C**hloro**P**henol (PCP), and 2,4,5-T (2,4,5-**T**richlorophenoxyacetic acid).

1.4 Impacts of Pesticides

1.4.1 Potential Impacts of Pesticides on Health and the Environment

-Intrinsic Dangers. Almost all synthetic pesticides are potent and dangerous chemicals. Many, especially those used in large quantities in developing countries, are very toxic for human health and harmful to the environment (UNEP, 1984). In other words, their effects are always *unspecific* to the pests against which they are applied, causing broad and unexpected effects against *many* types of living creatures, from beneficial insects and birds that act as natural pest controllers, to human beings.

Acute and chronic exposure to pesticides can be extremely harmful.[1] Those at greatest risk include individuals who are exposed to larger quantities of pesticides, such as manufacturers, farmers, farm workers and their families. These groups are almost always among society's poorest sectors. Acute and chronic effects vary according to the type and grade of pesticide.

The effects of acute exposure to certain pesticides include vomiting, strong headache, skin afflictions and even death.

Chronic exposure, combined with other factors, can lead to the development of cancer, fetal mutations, reductions in fertility, sterility, chronic degenerative diseases like Parkinsons, and permanent damage to the eyes, lungs, liver and other organs. Among the synthetic pesticides used today, some compounds are *known* to cause these effects.

In certain cases, the most generalized and unexpected serious effects do not appear until many years after the agent has been introduced. In this respect, DDT is perhaps the most famous case; it was found to bioaccumulate in the food chain and cause unexpected toxic effects against reproduction. When this occurs, the respective pesticides are generally prohibited in industrialized nations (programs). However, many continue to be sold legally and illegally in developing countries.

-Deficient Quality Control. Almost one third of all pesticides sold in developing countries are of poor quality, containing impurities or excessively high concentrations of active ingredients (FAO/WHO, 2001).

-Inappropriate Usage. The impact of synthetic pesticides on developing countries is intensified by the way in which they are used. These pesticides must be handled by personnel trained to target identified pest problems, with materials specific to said pests, special application equipment, special protective gear and clothing, and with careful attention to directions in terms of the quantity, frequency and time of application for each affected crop. These controls are almost never respected in developing countries.

[1] Acute exposure involves the inhalation, ingestion or absorption through the skin of large doses of pesticide within a short period of time. Chronic exposure involves small quantities of pesticide that enter the organism over longer periods of time.

-Resistance to Pesticides and Increasing Use Cycles. The use of any synthetic pesticides against organisms that have developed resistance leads to a cycle in which new and increasingly costly pesticides are required to control the pest.

1.4.2 Health and Environmental Impacts due to Pesticide Use – The Case of Nicaragua

Acute Intoxication from Pesticides (AIP): In Nicaragua, the inappropriate use of agrochemicals causes some 1,500 cases of intoxication per year. However, with the agrochemical distributors' application of the International Code of Conduct for Pesticide Distribution and Use, efforts will be made to reverse this trend (Núñez, 2006).

According to the Pesticide Commission, agrochemical intoxications have decreased in the country from 1,600 cases in 2000 to 1,400 cases in 2005. In the author's opinion, this reduction is due to the constant educational campaign that different institutions have implemented at the national level, along with restrictions placed on the most dangerous products, such as "Fosfina." The consumption of this famous tablet to cure grains formerly caused the deaths of 200 out of 1,000 people affected. In 2005, however, the mortality rate dropped to 45 (Salmeron, 2006).

In 1997, 226 intoxications were reported in the department of Chinandega alone, and 39 in León.

The pesticides most commonly involved in AIPs include: **methamidophos**, **methomyl**, **aluminum phosphide** and **chlorpyrifos**, and to a lesser extent **deltamethrin**, **cypermethrin**, **paraquat, propoxur** and **methyl parathion**.[2] The spraying of crops (maize, beans and coffee) is the most frequent activity (66%).

Pesticides in Human Plasma. Studies have been carried out on organochlorine pesticide contamination in human blood, breast milk, dairy milk and foods in general, water and sediments (Klein et al. 1987) in Chinandega and León, finding toxaphene values ranging from 0.19 to 21 micrograms per liter. The highest concentrations of pesticides were found among inhabitants of Chinandega (El Viejo). CNDR/MINSA (1989) found organochlorine pesticide residuals in 50% of dairy derivative samples (N=20), including alpha-BHC, pp-DDE, pp-DDT, chlordane and toxaphene. This is 4% higher that the maximum permissible level in Europe.

Triazines (anticryptogamics or herbicides). These are the herbicides most used in farming. They also severely contaminate the environment, can enter ground drinking water sources, and cause intoxication among humans and animals. Non-selective, total or absolute, Gramoxone, and Reglone, contact Gramoxone and Surcopur, translocation: 2,4-D Trifluralin, 2,4,5-T dalapon (Carrazana and Rodríguez, 1979).

[2] The pesticides in bold type were used in Nicaragua even after they had been banned internationally.

Many large bodies of water, such as the Gulf of Fonseca and San Juan River, have been contaminated by the drainage of pesticides from surrounding agricultural zones. This resulted in the deterioration of health and the environment in many areas of Central America during the 1990s, including a high rate of sickness due to pesticides (PAHO/WHO, 1996).

In direct interviews carried out by Zamorano specialists with farmers in León and Chinandega in 2001, the farmers expressed concern about the increase in suicides caused by the ingestion of paraquat and especially aluminum phosphide tablets. The farmers were aware of the sterility problems caused by DBCP in the past, as well as the possible chronic effects of pesticide use. In their own words, they said that "*insecticide kills you little by little.*"

Table 1. Main pest-related problems in the Northern Pacific Region – Leon and Chinandega[3]

Crop	Insects	Insecticides	Diseases	Fungicides	Weeds	Herbicides
Corn	Gallina ciega Chicharrilla Cogollero Gusano alambre Gorgojo	Carbofuran* Chlorpyriphos Methamidophos Deltamethrin Terbufos* Aluminum phosphide*	Achaparramiento Pudrición de mazorca	-	Coyolillo Lechosa Flor amarilla Rottboellia Zacate gallina Bledo	Atrazine Paraquat* Metolachlor Pendimethalin
Sesame	Chinches Maya Gallina ciega Gusano cuerudo o falso alambre Gusano peludo	Chlorpyriphos Methamidophos Deltamethrin	Pata negra Anthracnose	Benomyl* Mancozeb Copper * oxychloride Cyproconazole	Coyolillo Lechosa Ipomoea Zacate gallina Bledo	Trifluralin Paraquat*
Soybeans	Spodoptera Anticarsia	Chlorpyriphos *Bacillus thuringienis*			Lechosa Jalacote Flor amarilla Bledo	Imazaquin Metolachlor Trifluralin
Sorghum	Mosca	Chlorpyriphos Methamidophos Deltamethrin. It is important review the concentration)	-	-	Coyolillo Zacate Johnson Lechosa Flor amarilla Rottboellia	Atrazine[4] Paraquat* Metolachlor Pendimethalin
Dry Beans	Mosca blanca Diabróticas (maya) Chinche Gusano peludo Gorgojo	Methamidophos Deltamethrin* Aluminum phosphide*	Mancha angular Mosaico Anthracnose Mustia Hilachosa	Mancozeb* Benomyl*	Zacate chompipe Flor amarilla Manga larga Bledo Mozote	Paraquat*

*Not recommended by MCA-N

[3] Source: Environmental Impact Assessment for Pesticides in Nicaragua. USDA-USAID/Zamorano. 2001 updated November 2006.
[4] Could be an issue in groundwater.

II. INTEGRATED PEST MANAGEMENT

2.1 Integrated Pest Management (IPM) Philosophy

There are many different definition of integrated pest management (IPM). In General, IPM can be considered a philosophy as well as a long-term preventive strategy that combines various compatible practices —with insignificant or minimal negative effects against human health and the environment— to reduce the populations of organisms to levels that do not cause significant economic loss among crops (Hilje, 1993). This is different from "supervised control," which involves the use of pesticides only when necessary (Edwards, 1993).

The World Bank definition is clear and concise:

"The integrated pest management approach focuses on the farmer and on his or her knowledge of intensive techniques to promote the natural control of pests. Its objective is to anticipate causal problems and prevent them from reaching economically damaging levels. Appropriate techniques are applied, such as intensifying the activity of natural enemies, cultivating pest-resistant species and adapting cultural management. As a last resort, sensible pesticide use is applied" (Organization for Economic Cooperation and Development – OECD, 1999).

These guidelines seek to assist project designers and managers who, in turn, provide technical assistance for small-scale agricultural activities. It does *not* constitute a technical guidebook for integrated pest management. Rather, its purpose is to present important aspects and elements of the program. It is based on the document entitled *Beyond Compliance: Guidelines for Promoting Safe and Effective Pest Management in the Developing World* (Hruska, 2000). This document, together with the other resources cited at the end of these guidelines, should be consulted in order to obtain more detailed information.

The definition of IPM has broadened to include a wide range of visions and goals, from supervised chemical applications to organic production. In this way, the term IPM has been adapted to accommodate contrasting objectives, from those who hope to increase pesticide sales to those who would rather eliminate pesticides completely.

Among the central or fundamental ideas of IPM that constitute the basis of its implementation are 1) a necessary knowledge of the components of the respective agro-ecosystem (pests, their natural enemies, plant & soil health, water management), and 2) an understanding of crop phenology and physiology, the main focus of plant protection. However, it is not strictly necessary to have expert knowledge about all aspects in order to carry out IPM practices. Most farmers lack the time, know-how and financial resources to implement complicated pest management plans. Indeed, a majority of producers feel comfortable with chemical pesticides, since they are effective, fast acting, easily available, relatively simple to use, and profitable. Farmers tend to view IPM as a complicated strategy that involves too many tactics that must be executed at unusual times of year and that require too much information.

The strategies for plant protection differ among producers according to their levels of technology. The predominant strategy for low-income subsistence farmers (0.5-2 manzanas) is co-existence; in other words, pest control is left preferably to natural forces, and a large part of the damage caused by pests is tolerated (CATIE, 1990). Other strategies more common in farming systems with greater resources involve prevention, responding to the uncertainty about the possible presence of pests and their effects.

Management strategies are implemented through the use of techniques that, when balanced rationally, constitute IPM programs. These techniques include biological control, genetic control, cultural practices, physical or mechanical control, quarantine or legal measures, autocide control, ethological control and chemical control.

IPM does not negate the possibility of using pesticides. However, their use must satisfy several criteria, minimizing their impact on human health and the environment. One of IPM's expectations is precisely to reduce pesticide use substantially without reducing productivity and profitability.

2.1.1 Program Design in the Sector

Integrated pest management (IPM) is a program promoted throughout the world as an alternative in pest management. Its essential elements include:

- minimizing the use of pesticides; and
- minimizing risks against health and the environment when pesticides are used.

There are many definitions of an integrated pest management program. However, all variants must be developed with a clear idea of the groups toward which they are directed and of standardized practices. Small land owners in Latin American countries generally share the following characteristics:

- Use of synthetic pesticides. Several studies in Latin America have found that almost 90% or more of farmers who cultivate different species use pesticides. The reason is simple: synthetic pesticides have the impression of being efficient, fast acting and economical; they are easy to obtain and use and are culturally acceptable.
- Use of dangerous pesticides. Organophosphates and carbamates, two families of broad-use pesticides, are among the pesticides that small farmers use most frequently.
- Organophosphates and carbamates cause acute and chronic neurological sequelae. The World Health Organization has classified some of these insecticides as very dangerous, including methamidophos and methyl parathion (class 1 according WHO classification).

- Use of synthetic pesticides in dangerous forms. Small land owner do not respect "safe management" practices (which advise using protective gear and clothing, etc.)

- Due to economic and educational situations in developing countries, the "safe use" paradigm becomes a waste of time in the best of cases and a dangerous myth in the worst-case scenarios (Hruska, Bustamante 2001). In addition, pesticides are applied in excessive quantities.

- Small farmers know very little about the biology and ecology of many pests, and especially those that are microscopic; however, they may know a great deal about larger pests. It is common for them not to recognize or understand the pests that they cannot see, such as viruses, bacteria and insects that live in hidden habitats. This lack of knowledge may also give rise to pesticide abuse.

2.1.2 Conditions for the Adoption of Integrated Pest Management

In order for integrated pest management to be adopted by small farmers, it must be commercialized effectively. IPM must not only be *superior* to current practices, but it is also necessary to *convince* the public toward which it is directed of this superiority. The name "integrated pest management" is an obstacle in itself, suggesting a very complicated process.

What does "superior to current practices" mean? What most interests a farmer with limited resources is that the type of integrated pest management being promoted will improve pest control, or that it at least be equally effective and not require more time, energy or implementation costs than the current practice.

Concerns over the negative impacts of pesticide use against health within the family and community —and perhaps the local environment— may awaken significant interest in the adoption of integrated pest management. This is especially true if these impacts on health and the environment are communicated in a graphic and moving manner. In addition to its health and environmental benefits, following are among the strongest points in selling IPM:

- Integrated pest management is more sustainable than synthetic pesticides in the long term.
- Integrated pest management requires less capital investment.
- Integrated pest management can be used preventively and to eliminate or minimize the need for reactive controls (the application of pesticides after the pest outbreak, when damage has already been done.)

2.1.3 Effective Activities to Promote Integrated Pest Management

Several activities have proven to be effective in promoting integrated pest management in developing countries.

Training Programs Based on Learning Through Practice or Discovery. The adoption of new techniques occurs more easily when participants acquire the respective knowledge and skills through personal experience, observation, analysis, experimentation, decision making and practice.

Most of the knowledge and skills necessary to apply an integrated pest management program (for example: pest identification; the understanding of pest biology, parasitism, depredation and alternative hosts; the identification of plant disease symptoms; population size sampling; plant and soil analyses, water management, and seedbed preparation) are better learned and understood through practice and observation.

Promotion of Bio-pesticides and Natural Enemies. The use of microbe-derived, plant-derived and insect hormone-derived (IGRs—Insect Growth Regulators) pesticides (many of which are permitted for organic certification schemes), and parasitoids and predators (many of which can be purchased live and are also permitted for organic certification schemes) must be promoted in training as an alternative to reduce the use of synthetic pesticides.

Recovery of Collective Memory. Pest problems frequently arise because traditional farming methods are modified in one way or another, such as moving from diverse inter-cropping to row-cropping monocultures. These problems can often be eliminated if the situation is reversed. In this sense, the focus is on identifying, through group discussions, which changes may have incited the current pest problems.

Support for Small Land Owners and Discussion Groups. During the harvest season, it is often useful to organize weekly meetings with small land owners in order to discuss pests and related problems and to share any successful control methods.

Demonstration Projects or Plots. Subsidized experiments and field tests on selected farms can be very effective in promoting integrated pest management within a local community. Such pilot projects demonstrate the program in action and allow for comparisons with traditional crops supported by synthetic pesticides. Standardized protocols must be prepared with counterparts, accompanied by specific training from extension agents on parcel management and the analysis and interpretation of results.

Educational Material. It is essential to prepare or obtain basic written guidebooks, illustrated with photographs, to identify pests and explain specific management techniques. Videos showing moving interviews and graphic scenes of the effects of acute and chronic exposure to pesticides can also be particularly effective. One study in Nicaragua found that such videos are the most important factor in motivating farmers to adopt integrated pest management.

Education for Youth. Another effective factor is to promote and improve the quality of programs for youth who are studying in rural technical schools, where integrated pest management and the risks of synthetic pesticides are covered in the curriculum. In addition to being future farmers, these students can bring informed opinions back to their communities.

Incentives for Participation in the Organic Food Market. Promoting organic food certification in order to gain access to this rapidly growing and lucrative market can also be a strong incentive toward the adoption of integrated pest management.

Land Tenancy. The safer a farmer feels about ownership of the cultivated plot of land, the more dedication he or she will put towards its care and administration.

Shared Vision of Integrated Pest Management in Associations. Organizations may create associations based on common commitments to integrated pest management, only to discover —too late— that they have very different visions about what this program entails. It is important for partners to develop a common and detailed vision of integrated pest management, focusing on the crops and conditions they will encounter in their specific projects.

Share Vision with Input Supply Businesses:Businesses:: MCA-N will coordinate training and other activities with input supply businesses in order to educate them on proper storage and use of pesticides. Fully engaging these businesses will be important for the entire value chain to be integrated and share the same values during and after the project. This task will be incorporated into the TORs for the cluster firms, as well as part of the contract with each of the short term consultants the RBO (write out acronym) is working with RBDP is employing in the interim.

2.1.4 The Process of Integrated Pest Management[5]

There are many varieties of integrated pest management programs. Many of them exclude the use of synthetic pesticides and prioritize the use of physical and biological controls. Others apply a more pragmatic approach and seek to minimize the use of synthetic pesticides in general, and particularly the most dangerous pesticides, although not to the point of imposing unreasonably complex or costly controls that would undermine farmers' confidence in integrated pest management *(See Annex 1: The IPM Evaluation and Implementation Process).*

2.2 Pesticide Evaluation Report and Safer Use Recommendations [6]

The Pesticide Evaluation Report and Safer Use Recommendations (PERSUAR) applies available risk-reduction options to the specific circumstances of a particular project and stipulates how the management plan will be implemented in the field. The Action Plan produced by the implementers put recommendations made in the PER into actionable plans for implementation of environmental and human risk mitigation measures.

[5] Based on *Un árbol de decisiones* [*A Decision Tree*] by Mario Pareja.
[6] Adaptation of the environmental regulations for agricultural projects financed by USAID, 22 CFR 216, which has been validated in Nicaragua. August 2004.

2.2.1 Criteria for the Selection and Use of Pesticides[7]

a) Pesticides used in agriculture must be safe for the human populations and domestic animals that live within the application area and outlying zones, as well as for the personnel who apply them.
b) Their effectiveness against the target species must be demonstrated.
c) They must have minimum effects against "beneficial" species and the environment. The objective is that the pesticide application methods, times and frequencies minimize the harm to natural enemies.
d) Their use must take into account the need to prevent pests from developing resistance to determined pesticides that is they must rotate pesticides by group.

2.2.2 Guidelines for the Preparation of the Pesticide Evaluation Report and Safer Use Recommendations (PERSUAR)

A PERSUAR is a document that examines the pesticide system in a country and determines relative risks, and then evaluates each proposed pesticide by 12 important factors. The following is an example of the contents of a PERSUAR:

I. Introduction/Background

Background about the use of pesticides in the zone or country.
Description of the organization's principles with respect to social, market, and environmental performance (for example: organic production, good agricultural practices, etc.)
Description of project activities.

II. Implementation Strategies

Evaluate pest impact before deciding on control.
Evaluate management options such as: biopesticides, cultural or mechanical control or use synthetic pesticides.

III. Action Plan for Integrated Pest Management (IPM) Implementation

Use of live barriers, compost, mulches, crop diversification and rotation, soil and water conservation, etc.
Modification of conditions to create conditions unfavorable to pests, such as: cultural practices, soil preparation, altering crop dates and seasons, etc.
Cultivation of pest- and disease-resistant varieties.
Use of plants as repellants (of pests.)

[7] Operational Policy 4.09: Pest Management: World Bank and MCC Environmental Guidelines.

Direct elimination of pests: use of pesticides approved by the US Environmental Protection Agency (USEPA) and Nicaraguan Ministry of Agriculture and Forestry (MAGFOR).

IV. Pesticide Evaluation Report and Safer Use Action Plan (PERSUAR)

The following are factors to be considered for pesticide use:

a) The status of the requested pesticide in the registries of the US Environmental Protection Agency (USEPA) and the registries of the Nicaraguan Institute of Agricultural Technology (INTA/MAGFOR). All procedures stipulated in Nicaraguan legislation regarding the use, storage, transport and disposal of pesticides must be fulfilled. Pesticides are registered by the EPA according to their formulation and active ingredients. Based on these two criteria, the registration status" of a pesticide may be: 1) registered, 2) never registered or 3) cancelled.

b) The basis for the selection of the requested pesticide. This refers to the economic and environmental reasons for choosing a particular pesticide. In general, the least toxic but effective pesticide must be selected.

c) The extent to which the use of the proposed pesticide forms part of an integrated pest management program. The Millennium Challenge Account – Nicaragua abides by the policy of promoting, developing and using integrated pest management whenever possible.

d) The proposed application method(s), including the availability of safe and appropriate application equipment. This section analyzes, in detail, how the pesticide will be applied, and the measures to be taken to ensure its safe use.

e) Any acute and long-term toxicological danger associated with the proposed pesticide use, either to humans or to the environment, and the available measures to minimize this danger. This section of the environmental analysis refers to information on any acute toxicological effects to the skin, lungs and eyes as well as chronic issues that are associated with the proposed pesticide. In addition, the mitigation measures taken to prevent or minimize any identified toxicological effects are addressed in this section, such as training, the use of protective clothing and equipment, and the safe storage and disposal of containers. Because Nicaragua still does not have a system to ensure the appropriate final disposal of empty containers, it is recommended that containers be washed three times, perforated with three holes, and buried.

Note: MCA-N is working with the *Asociación Nicaraguense de Formuladores y Distribuidores de Agroquimicos* (ANIFODA) and MARENA in order to achieve the goal for improving the final disposal of containers.

f) The requested pesticide's effectiveness for the proposed purpose. This section requires information similar to that provided under subparagraph b). However, this section is more specific with respect to the real conditions under which the pesticide will be applied. In addition, it considers the risks of the pest developing resistance to the proposed pesticide.

g) **The compatibility of the proposed pesticide with ecosystems within and outside of the targeted area.** This section analyzes potential effects against other beneficial organisms, such as any effects on honeybee colonies within the application zone. The concern for species that are not the target of pesticide application also includes birds, fish, and aquatic ecosystems. All possible negative effects on beneficial species must be identified and monitored in order to mitigate adverse impacts.

h) **The conditions under which the pesticide will be used:** climate, flora, fauna, geography, hydrology and soils. Aspects related to the contamination of superficial and ground waters are analyzed.

i) **Availability and effectiveness of other pesticides or control methods that are not based on chemicals.** This section analyzes other options to control pests, and their advantages and disadvantages.

j) **The capacity of the country to regulate or control the distribution, storage, use and elimination of the requested pesticide (including the disposal of empty containers.)** This section analyzes the existing infrastructure and human resources of the host country (Nicaragua) to manage the proposed pesticide use. If the host country's capacity to regulate the use of a pesticide is inadequate, then the use of said pesticide may result in significant environmental damage.

k) **Dispositions for the training of personnel who will use and apply the pesticide.** Safety training is an essential component of programs that support pesticide use. The need for training is particularly sensible in developing countries, where the levels of education of those who apply pesticides are usually lower than in developed countries. Training should be continuous to impact behavior modification.

l) **Disposition issued for supervision and monitoring of pesticide use and effectiveness.** Evaluation of the risks and benefits of pesticide use should be a permanent and dynamic process. To the greatest possible extent, monitoring programs must investigate the following aspects:

- Effectiveness of the information, educational materials and activities to promote the safe management, use and disposal of products.
- Adverse effects against health and the environment, and the frequency and severity with which they occur.
- Control of the quality of products (pesticides).
- Effectiveness of selected products and alternative options, including when resistance to the product is or is not created and rotation of pesticides among pesticide classification groups.
- Safe and effective use of the pesticide and good practices for the handling of pesticides both for the program's technical personnel and for those who apply pesticides. *(See Annex 3: List of Permitted and Non-permitted Pesticides.)*

III. SAFETY MEASURES FOR PESTICIDE USE AND MANAGEMENT

3.1 Safety Measures

Material Safety Data Sheets (MSDS) will provide, for each pesticide, all important safety data for all aspects of handling, storage, environmental risks, user risks, and more. It is essential to know and understand the appropriate ways to handle pesticides at all phases:

- Retail purchase
- Storage
- Warehouse
- Transport
- Product application
- Clean up
- First aid
- Disposal
- Understanding of re-entry and pre-harvest interval periods

In addition, it is important to take into account basic measures with respect to:

- Work hygiene
- Maintaining safety fact sheets on pesticides, indicating: the type of product, means of absorption and lethal doses
- Procedures in case of accident
- A worker training program.

3.2 Pesticide Use and Handling

The following are guidelines for personal protection from pesticide risks

Protect yourself from poisoning: If it is necessary use synthetic pesticides, then measures must be taken to reduce risks related to toxicity and exposure.

1. Use less toxic chemicals in order to minimize pesticide toxicity
2. Reduce time and level of exposure before, during and after use of pesticides
3. Develop an appropriate evaluation and control system

Loading and unloading must be safe. Dispose of all empty containers and collect all broken containers. Because Nicaragua still lacks a system for the final disposal of empty containers and other wastes, projects that receives Millennium Challenge Account (MCA) assistance must apply a policy ensuring that empty containers are washed three times, perforated with three holes, and buried, until a safer solution is found.

Note: MCA-N will work with vendors to collect the empty containers.

(See annex 2: Use and Management of Synthetic Pesticides)

3.3 Risk Prevention in the Handling of Pesticides

In Case of Intoxication

If the pesticide applicator has the following symptoms, applicator may be suffering from pesticide intoxication: diarrhea, nausea, vomiting, abdominal cramps, heavy perspiration, heavy salivation, blurry vision, headache, weakness and/or dizziness. Symptoms may begin during the day while you are applying the pesticides. Intoxicated applicator's reaction may be immediate or delayed, depending on the toxicity of the product.

First Aid in Case of Intoxication

It is essential to keep a safety fact sheet for each pesticide, indicating: the type of product means of absorption, lethal doses, and instructions in the event of poisoning. This data is found in the MSDS.

Always keep in mind the steps to be followed: bathe, change clothes (have clean clothes at hand), take an antidote[8] and, once the product has been identified, take it to the nearest health center.

Note: *Field technicians, extension agents and MCA-Nicaragua technical personnel will receive training on these topics, using different existing manuals and practical examples that, when necessary, have been adapted and validated to local conditions of the region.*

3.4 Special Considerations

Exceptions in complying with pesticide procedures (for which an official memorandum is always required):

- When a pest or epidemic has broken out or a pest outbreak is imminent;
- When serious health problems exist (among humans or animals) or severe economic problems will arise if the proposed pesticide is not applied; and
- In projects that include the purchase and/or use of pesticides for research and evaluation purposes on limited fields and under the supervision of project personnel.

Any of these cases will need approval of MCA- N.

[8] Be careful with antidote atropine, may work for carbamates and OPs, but not for synthetic prethroids. In fact, if used for wrong pesticides, antidotes can injur or kill.

3.5 The Responsibility of Project Technicians in Recommending Pesticide Use

Under no circumstances should extension agents, promoters, field advisers and other project personnel use, provide, recommend or supervise the application of any prohibited pesticides by USEPA and/or MAGFOR. These personnel also have the responsibility to respect —and ensure that others respect— the indications for use stipulated on pesticide labels, as well as all Nicaraguan laws related to pesticides. Under no circumstances should projects advise, promote, participate in or supervise the application of any pesticide considered illegal, or the application of a pesticide for any use other than that stipulated on its label.

Project personnel, especially field advisers, must remain informed about the situation or status of agrochemicals and the regulatory framework (both national legislation and guidelines set by the USEPA) of the pesticides used on the crops they cover. If a pesticide becomes restricted or is prohibited, then project personnel must immediately eliminate its use in the project.

Reference Materials

1) EPA PIC list (must be reviewed and updated annually):
http://www.epa.gov/oppfead1/international/piclist.htm
2) UN PIC list hyperlink:
http://www.pic.int/
3) The specific PIC list can be found at: http://www.pic.int/en/Table7.htm
4) http://www.catie.ac.cr/cicmip

- USAID´s Environmental Guidelines for Development Programs in Latin American and the Caribbean, USAID/LAC Environmental Guidelines. EPIQ. Updated in August 2004.

- Evaluación de Impacto Ambiental de Plaguicidas en Áreas Cubiertas por el Programa de Reconstrucción Post-Mitch y Programa de Pequeños Productores de USAID-Nicaragua [Environmental Impact Assessment of Pesticides in Areas Covered by the USAID-Nicaragua Post-Mitch Reconstruction Program and Small Producers Program]. USDA/USAID/Zamorano. Nicaragua, 2002.

- Ley Básica para la regulación y control de plaguicidas, sustancias toxicas, peligrosas y otras similares [Basic Law for the Regulation and Control of Pesticides and Toxic, Dangerous and Other Substances]. *La Gaceta* #30, February 13, 1998.

- Decree #49-48. Regulations of Law 274. *La Gaceta* #142, July 30, 1998.

- El Ambiente, los Plaguicidas y los Patógenos: Manual de Orientaciones sobre el Uso de productos agroquímicos [The Environment, Pesticides and Pathogens: Instruction Manual on the Use of Agrochemical Products]. 69pp. Instituto de Desarrollo Rural. Carazo, Nicaragua. May 2005.

- Inventario Nacional de Plaguicidas en Nicaragua. MARENA/Proyecto Habilitante COP/PNUD/MARENA. Nicaragua, Diciembre 2004.

- Alternativas MIP para Sustituir a Doce Plaguicidas incluidos en el Acuerdo No. 9 de la XVI Reunión de la RESSCAD. Comité Nacional de Manejo Integrado de Plagas (CNMIP) y Red de Acción de Plaguicidas y sus Alternativas en América Central (RAPAC). Nicaragua, Septiembre, 2004.

- Plan Nacional de Aplicación del Convenio de Estocolmo sobre Contaminantes Orgánicos Persistentes PNA 2006-2026. Ministerio del Ambiente y de los Recursos Naturales – MARENA. Nicaragua, 2005.

Sources Online:

Community IPM.

- This is an excellent source of information on the FAO Asia Farmers' Field School methodology, with many interesting and valuable downloadable documents. Online: www.communityipm.org

Consortium for International Crop Protection.

- The Consortium offers a very good portal to a host of IPM resources, including searchable databases, Radcliffe's IPM World Textbook, periodicals (including back issues of *IPMnet News*), reviews of recent publications, and more. Very well organized. Online: www.ipmnet.org

Cornell University—*Biological Control: A guide on Natural Enemies in North America.*

- An excellent guide to natural enemies. Limited geographically, but great photos and summary of biology and ecology. Online: www.nysaes.cornell.edu/ent/biocontrol.

EPA (U.S. Environmental Protection Agency).

- The EPA's pesticide site is a goldmine of information. Thousands of technical documents are available, including the new edition of *Status of Chemicals in Special Review*. Online: www.epa.gov/pesticides

- *The Pesticide Management Resource Guide* lists resources at the EPA and elsewhere available to help national pesticide authorities in the decision-making process. Online: www.epa.gov/oppfead1/pmreg/.

EXTOXNET (Extension Toxicology Network).

- EXTOXNET is an excellent source for searching for information by substance. Online: ace.ace.orst.edu/info/extoxnet .

Radcliffe's IPM World Textbook.

- This great resource text is constantly updated and improved. The *IPM World Textbook* is excellent for students, teachers, and extensionists who want a concise presentation of thematic areas, or the state of the art in IPM by crop. Online: http://ipmworld.umn.edu.

UNEP (U.N. Environment Program) and WHO (World Health Organization).

- The joint UNEP and WHO website offers wealth of authoritative information on many international programs and agreements, such PIC and POPs. Online: http://irptc.unep.ch.

WHO (World Health Organization).

- The most authoritative resource on human health effects of pesticides, the WHO offers a very good Web site that includes the International Programme on Chemical Safety. Not all documents are online yet, but the WHO Recommended Classification 1998–99 is one of the most cited sources of acute toxicity information. Online: www.who.int/pcs.

Complementary Annexes

1. The IPM Evaluation and Implementation Process
2. Use and Management of Synthetic Pesticides
3. List of Permitted and Non-permitted Pesticides
4. Pesticide Classification and Toxicity (USEPA and WHO)
5. Monitoring of selection, use and storage of pesticides

Annex 1. ***The Integrated Pest Management Evaluation and Implementation Process***

1. **Evaluate pest impact before deciding on control:**

- Identify the pest
- Determine the biology of the pest
- Determine the extent of the problem caused by the pest
- Evaluate available natural controls (for example: the types and numbers of natural enemies)

  Determine whether a primary or secondary pest

2. **Evaluate management options (without first using pesticides):**

- ***Prevention***
  - **Selection of plants**
    - Choose pest-resistant varieties
    - Diversify plant varieties / crops
    - Provide habitats for natural enemies
  - **Site preparation and planting**
    - Choose planting dates that are free of pests
    - Provide or improve shade for crops that require it
    - Ensure crop rotation or rest periods
    - Create buffer zones with physical barriers or non-harvested plants harvest, or both
  - **Plant care**
    - Test and improve plant and soil health
    - Use appropriate planting densities
    - Test plant nutrition and soil water tension and fertilize and irrigate appropriately
    - Eliminate weeds
- ***Responsive (curative) interventions***
  - **Physical and mechanical control**
    - Sanitation by pruning or removal of diseased plants or plant parts
    - Eliminate weeds by hand weeding and hoeing
    - Install insects traps
  - **Biochemical control**
    - Pheromones (very efficient but currently costly and not easy to obtain)
    - Homemade biological pesticides

Annex 2. Evaluation and use of synthetic pesticides:

If it is necessary use synthetic pesticides, then measures must be taken to reduce risks related to toxicity and exposure. Reducing these risks means selecting less toxic pesticides that result in lower levels of exposure before, during and after their use.

The following steps reduce risks to the greatest extent possible:

- ***Use less toxic chemicals in order to minimize pesticide toxicity***
  - Use only USEPA and Local registered pesticides
  - Do not use pesticides listed by the WHO as class "Ia" or "Ib" (www.who.int/pcs/docs/pcs98-21rev1.pdf)
  - Do not use pesticides that are not registered with the Organization for Economic Cooperation and Development (OECD)
  - Do not use pesticides that are on the Prior Informed Consent (PIC) lists (www.pic.int) or named in the Convention on Persistent Organic Pollutants (POPs) found at (http://www.pops.int/)
  - Follow WHO directives (www.who.int/pcs)
- ***Reduce the time and level of exposure***

  Before use:

  - **Transport and Storage:**
    - Separate pesticides from other transported materials
    - Avoid private distribution; this is a very dangerous practice
    - Follow FAO (UN Food and Agriculture Organization) standards
    - Design strict rules and directions for storage in towns and communities
  - **Packing:**
    - Follow national and international standards and directions
    - Use packaging that meets requirements
    - Dispose of materials used in packing; do not re-use them
  - **Labeling:**
    - Follow and respect national standards
    - Follow and respect FAO standards
    - Use appropriate language and approved pictograms
    - Use and respect the color bands corresponding to toxicology

- ♣ **Formulation:**
  - Use appropriate types and concentrations

During use:

Do not inhale products.
Do not touch your eyes.
Do not eat while handling pesticides

- ♣ **Training**
  - Training should be continuous
  - Determine the complexity of the training and identify toward whom it should be directed (distributors, large farmers, campesinos, transporters, etc.)
- ♣ **Use appropriate equipment for application**
  - Adapt to the needs and possibilities of users
  - Ensure the maintenance and availability of parts and services, and
  - Always keep equipment well calibrated.
- ♣ **Use protective equipment and clothing**
  - Protect yourself from poisoning: use protective clothing and equipment (mask, hood, cap, gloves and boots)
  - Adapt gear and clothing to local climatic conditions
  - Adapt gear and clothing to the needs and possibilities of users (budgets)
  - Do not reduce but rather avoid exposure
  - A specific site must be established for the mixing of pesticides in the field. It must be at least 30 meters from any household and far from any body of water. The best option is to prepare a cement floor to prevent and control spills.
- ♣ **Focus on "buffer zones"**
  - Living areas, lodgings
  - Environment: water, areas that are easily affected

After use:

- ♣ Determine, respect and comply with the exclusion periods after application
- ♣ Ensure the appropriate cleaning and washing of:

- The equipment of personnel who apply pesticides
- Clothing of personnel
- Application equipment

♣ Store products in a dry, clean and safe place (preferably in a room outside of the house and far from the reach of children.)

Develop an appropriate evaluation and control system for:

- Monitoring of national and international policies related to pest management and pesticides
- Human toxicology, focusing on those who apply products, public health (epidemiology) and the health of domestic animals
- The effectiveness against targeted pests
- Impacts on the environment: water, soil, etc.
- The elimination of pesticide residues and containers.

Annex 3. List of Permitted and Non-permitted Pesticides [9]

Table 1: Permitted Pesticides

Permitted Pesticides	Observations
Fungicides	
Azoxistrobina (Amistar 80)	
Sulfer	
Benomil (benomyl is not presently EPA registered)	
Bitertanol	
Bromuconazol	
Captan (captan 50) (along with carboxin, is on non-permitted list)	
Carbendazin	
Cymoxanil	
Cymoxanil (Curzaten72 WP)	Permitted use of Cimoxanil is limited to its application as a seed treatment for cut potato seed pieces and as a foliar spray for plants to control "tizón tardío" *(Phytophthora infestans*).
Ciproconazol	
Clorothalonil	
Copper (Bravo 50 SC)	
Dimetomorfo	
Difenoconazol (Alto 1D SL)	
Epoxiconazol	
Famoxadone (Equation Pro 52.5 SC)	
Fenamidon (Sereno 60 WG)	
Flusilazol	
Ferban (Ferban Granuflo 76 WG)	
Folpan 48 SC	
Flutolanil	
Fosetil-Al	
Hexaconazol (Anvil 25 SC)	
Hidróxido de cobre	
Imazalil (Magnate 75 SP)	
Iprodiona (Rovral 50 SP)	
Isoprotiolano	
Kasugamicina	

[9] Environmental Impact Assessment of Pesticides in Nicaragua, prepared by Zamorano (Hruska-Bustamante) in 2001 to be used in USAID-financed projects. This is a reference list that must be revised and updated by comparing it with registries of the US Environmental Protection Agency (EPA).

Mancozeb (Manzate 80 WP)
Ridomil (Gold 48 EC)
Maneb
Metalaxil
Metoconazol
Oxicloruro de cobre
Propamocarb (Previcur-N 72.2 SL
Propiconazol (Bumper 25 EC)
Propineb
Regnum 25 EC (piroclostrobin)
Sandofam
Sulfato de Cobre
TCMTB (Busan)
Tebuconazol (Folicur 25 EW. Silvacur Combi)
Tiabendazol (Mertex 50 SC)
Tiram
Tiofanate metil (Nucilate 50 SC)
Triadimefon (Bayleton 50 WG)
Tridemorfo (Calixin 75 EC)
Trifloxystrobin y propiconazole
Triflorine
Vinclozolin
Ziram (Ziram granuflo 70 WG)

Herbicides

2,4-D
Ametrina (Ametrex 50 SC)
Bentazon (Basagran 48 SL)
Meti.l – Bensulfuron
Bispiribac-sodio
Ciclosulfamuron
Cihalofop
Clefoxidim
Cletodim (Select 12 EC)
Clomazon
Diquat (Reglon 20 SL)
Diuron (Diurex 50 SC)
Fluazifop-*p*-butil (Fusilade 12.5 EC)
Fenoxaprop-p-metil (Flurore 50 SC)

Pesticides Permitted for Use by Producers Targeted by Projects

	Observations
Fomesafen	
Glifosato (Rival 68 SC)	
Hexazinona	
Imazapir (Arsenal 24 SL)	
Imazaquina	
Imazetapir	
Metil – Metsulfuron	
Metribuzina (Sencor 70 Wp)	
Napropamide (Denvrinol 50 WG)	
Nicosulfuron (Accent 75 WG)	
Oxadiargil	
Oxifluorfeno	
Pendimetalina (Prowl 50 EC)	
Pirazolsulfuron	
Propanil	
Quinclorac	
Setoxidim	
Terbutilazina	
Terbutrin	

Insecticides

Abamectina (avermectina)	Some abamectina (avermectina) formulations are classified as RUP due to their toxicity to fish, mammals and aquatic organisms.
Azadiractina	
Acetamiprida	Although there is limited information about acetamiprida, its use is approved, especially considering that the EPA has classified it as a pesticide of reduced risk and a possible alternative to organophosphate insecticides. Important uses of acetamiprida listed by the EPA include fruit gardens and leafy vegetables of the *brassicaceae* family.
Amitraz (Metac 20EC)	
Bacillus thuringiensis	Biological
Bacillus spharicus	
Carbaril	
Carbosulfan	
Cyromazine (Trigard 75WP)	

Clorfenapir	Use of Clorfenapir is limited to cotton, pursuant to EPA registries and requirements.
Diafentiuron	
Imidacloprid (Confidor 70WG)	
Fenitrotion	
Malation	
Phoxim	
Spinosad	
Sulfluramida	Permitted use of Sulfluramida is limited to bait to control ants.
Teflubenzuron	
Temefos	
Tiociclam	
V.P.N.	

Others

Metaldehyde	Due to its potential short- and long-term effects against wildlife, metaldehyde is a Restricted Use Pesticide. Because there are no ideal chemical substitutes for metaldehyde for the control of slugs in beans, its use is permitted as long as specific recommendations are strictly followed.
Kilol	
Dazomet	
Estreptomicina	
Metam-sodium	Metam-sodium is a Restricted Use Pesticide due to its dermal toxicity and teratogenicity. Its use is approved only as an alternative to methyl bromide.

Table 2. Non-Permitted Pesticides - US EPA Banned or Severely Restricted Pesticides (64):

Aldrin
arsenic oxide
asbestos (friable)
azodrin
1,4-benzoquinone, 2,3,5,6-tetrachloro-binapacryl
2,3,4,5-bis (2-butenylene) tetrahydrofurfural
bromoxynil butyrate
cadmium compounds
calcium arsenate
Camphechlor
captafol
carbofuran
carbon tetrachloride
chlordecone (kepone)
Chlordane
Chlordimeform
chlorobenzilate
CPMA **(C**hloromethoxy**P**ropyl**M**ercuric **A**cetate)
copper arsenate
2,4-d, isooctyl ester
Daminozide
DBCP (1,2-**D**i**B**romo-3-**C**hloro**P**ropane)
DDD **(D**ichloro**D**iphenyl**D**ichloroethane)
DDT (**D**ichloro-**D**iphenyl-**T**richloroethane)
di(**P**henyl**M**ercury)**D**odecenyl**S**uccinate (PMDS)
1,2-dibromoethane
1,2-dichloroethane
Dieldrin
4,6-dinitro-o-cresol
dinitrobutyl phenol
Endrin
EPN (O-**E**thyl O-(4-nitrophenyl) **P**henylphospho**N**othioate)
ethylene oxide
fluoroacetamide
gamma-lindane
HCH (1,2,3,4,5,6-**H**exa**C**hlorocyclo**H**exane, generally a mixture of isomers)
Heptachlor
hexachlorobenzene
1,3-hexanediol, 2-ethyl-lead arsenate
Leptophos
Mercury
Methamidophos

Methyl Parathion
Mevinphos
Mirex
Nitrofen
Octamethyldiphosphoramide
Parathion
PCP (**P**enta**C**hloro**P**henol)
PMO (**P**henyl**M**ercuric **O**leate)
phosphamidon
pyriminil
safrole
sodium arsenate
sodium arsenite
terpene polychlorinates (strobane)
thallium(i) sulfate
2,4,5-TP acid (silvex)
tributyltin compounds
2,4,5-trichlorophenol
2,4,5-T (2,4,5-**T**richlorophenoxyacetic acid)
vinyl chloride

***Blue Text: In both original Dirty Dozen and EPA lists**

The Dirty Dozen

A new list of the twelve pesticides known as "the new dirty dozen" and included in Agreement #9 of the XVI Meeting of the Health Sector of Central America and the Dominican Republic (RESSCAD). These pesticides are of restricted use **in Nicaragua.**

Pesticide

1. Methyl parathion
2. Terbufos
3. Etoprofos
4. Aldicarb
5. Metamidofos
6. Metomil
7. Monocrotofos
8. Carbofuran
9. Endolsufan
10. Clorpirifos
11. Paraquat
12. Aluminum phosphide

For more information, see the document entitled IPM Alternatives to Substitute the Twelve Pesticides included in Agreement #9 of the XVI RESSCAD Meeting [*Alternativas MIP para Sustituir a Doce Plaguicidas incluidos en el Acuerdo No. 9 de la XVI Reunión de la RESSCAD.*] MAGFOR, INTA/PASMA-DANIDA. Managua, Nicaragua. September 2004.

GENERIC NAME	TRADE NAME	USE
Parathion	Gramoxone, Pillarxone	Cotton, fruits and vegetables
2,4,5-T		
Paraquat	Gramoxone, herboxone, gramonol	
DDT	Anofex, Diamekta	
Aldrin/Dieldrin/Endrin	Aldrex, Endrex, Panoram D-31	
Clordimeform	Acaron, Bermat, Fundal,	Cotton and tobacco
DBCP	BBC-12, nemaset, Nemafume, Fumazone,	Cotton, fruit and vegetables *
Clordano/Heptacloro (CH)	Gypchlor, Corodane, heptagran	
Lindano/BCH	Exagama, Forlin, Gllogama	
EDB	Bromufome, Silbrom 40, Dowfuem W-45*	
Toxafeno	Attac 4-2, Camphpfene, Huileux,	
Metomil	Lannate, Nudrin	

*** Carcinogenic activity has been demonstrated.**

According to a resolution dated August 8, 1993, the use of the compounds listed in Table 6 (**CIRA sf., PAHO, 1997**) was prohibited in Nicaragua by the Department of Plant Health of the Ministry of Agriculture and Forestry (MAGFOR). In addition, chlordimeform, aldicar and partion-methyl were classified for restricted agricultural use. The reason for this prohibition is that these compounds are carcinogenic mutagens **(Ulpo et al, 2001)**.

Pesticides Prohibited between 1978 and 1993 in Nicaragua

PESTICIDE	TRADE NAME	DATE OF PROHIBITION
Leptofos	Phosval	1978
DBCP'	Nemagon, Fumazone	1979
DDT'	**DDT**	1980
Aldrin'	Aldrin,	1977
Dieldrin	**Dieldrin**	1981
Endrin	Endrin	1981
Lindano	**BHC**	1993
Dibromuro de Etilo	Dowfumw	1983
2,4,5-T	**2,4,5-T**	1983
Clordimeform	Halacrom, Fundal	1987
Heptacloro	L	1993
EDB		1993
Clordano		1993
Dinoseb		1993
Pentaclorfenol		**1993**
Parathion-Ethyl		**1993**
Toxafene		**1993**
Chlordimeform		**1993**
Aldicarb		**1993**
Methyl-Parion		**1993**

Source: Department of Agricultural Technology, DGTA/MAG, 1990

ANNEX 4. Pesticide Classification and Toxicity (USEPA and WHO)

General Toxicity

Pesticides, by necessity, are poisons, but the toxicity and hazards of different compounds vary greatly. Toxicity refers to the inherent intoxicating ability of a compound whereas hazard refers to the risk or danger of poisoning when the pesticide is used or applied. Pesticide hazard depends not only on toxicity but also on the chance of exposure to toxic amounts of the pesticide. Pesticides can enter the body through oral ingestion, through the skin or through inhalation. Once inside the body, they may produce poisoning symptoms, which are either acute (from a single exposure) or chronic (from repeated exposures or absorption of smaller amounts of toxicant).

EPA and WHO Toxicity Classifications

Basically, there are two major systems of pesticide toxicity classification. These are the US Environmental Protection Agency (USEPA) and the World Health Organization (WHO) systems of classification. It is important to note that *the WHO classification is based on the active ingredient only, whereas USEPA uses product formulations to determine the toxicity class of pesticides.* So, WHO classification shows relative toxicities of all pesticide active (or technical) ingredients, whereas EPA classification shows actual toxicity of the formulated products, which can be more or less toxic than the active ingredient alone and are more representative of actual dangers encountered in the field. The tables below show classification of pesticides according to the two systems.

1. Toxicity category

The US Environmental Protection Agency – USEPA - assigns pesticides to toxicity categories based on six acute toxicity studies and product composition. The acute oral, acute dermal and acute inhalation studies measure the lethality of a product via the designated route of exposure. The primary eye irritation and primary skin irritation studies measure the severity of irritation or corrosion caused by a product. The dermal sensitization study determines whether a product is capable of causing an allergic reaction. With the exception of the dermal sensitization study each acute toxicity study is assigned a toxicity category.

USEPA classification (based on formulated product = active ingredient *plus inert and other ingredients*)

Class	Descriptive term	Mammalian LD_{50}		Mammalian Inhalation LC_{50}	Irritation		Aquatic invert/fish (LC_{50} or EC_{50})[2]	Honey bee acute oral (LD_{50})
		Oral	Dermal		Eye[1]	Skin		
I	Extremely toxic	≤50	≤200	≤0.2	Corrosive	Corrosive	< 0.1	
II	Highly toxic	50-500	200-2000	0.2-2.0	Severe	Severe	0.11-1.0	< 2 µg/bee

III	Moderately toxic	500-5000	2000-20000	2.0-20	No corneal opacity	Moderate	1.1-10.0	2.1-11 µg/bee
IV	Slightly toxic	≥5000	≥20000	≥20	None	Moderate or slight	10.1-100	
	Relatively non-toxic						101-1000	
	Practically non-toxic						1001-10,000	> 11 µg/bee
	Non-toxic						> 10,000	

[1] Corneal opacity not reversible within 7 days for Class I pesticides; corneal opacity reversible within 7 days but irritation persists during that period for Class II pesticides; no corneal opacity and irritation is reversible within 7 days for Class III pesticides; and Class IV pesticides cause no irritation
[2] Expressed in ppm or mg/l of water

2) WHO classification (based only on active or 'technical' ingredient)

Class	Descriptive term	Oral LD_{50} for the rat (mg/kg body wt)		Dermal LD_{50} for the rat (mg/kg body wt)	
		Solids	Liquids	Solids	Liquids
Ia	Extremely hazardous	≤5	≤20	≤10	≤40
Ib	Highly hazardous	5-50	20-200	10-100	40-400
II	Moderately hazardous	50-500	20-2000	100-1000	400-4000
III	Slightly hazardous	≥501	≥2001	≥1001	≥4001
U	Unlikely to present acute hazard in normal use	≥2000	≥3000	-	-

Signal words

As part of the precautionary labeling, the US EPA also requires that a signal word be included in the pesticide label to provide the user with information regarding the potential toxicity. The signal word is determined by the most severe toxicity category assigned to the five acute toxicity studies or by the presence of special inerts such as methanol (in concentrations of 4% or more). Signal words are as follows:

Toxicity Category I	DANGER
Toxicity Category II	WARNING
Toxicity Categories III and IV	CAUTION

Based on the toxicity category of a pesticide product, EPA also requires precautionary statements and indication of personal protective equipment that must be used when applying the pesticide.

ANEXO 5. MONITOREO SOBRE SELECCIÓN, USO Y ALMACENAMIENTODE PLAGUICIDAS (AGROQUIMICO)

Nombre del Proyecto: ___________________________________ Código________
Nombre de Empresa o Productor___________________________Depto_____________
Mcipio_____________________ Dirección exacta: _________________________________

ACTIVIDADES	SI	NO	N/A	OBSERVACIONES Y/O ACCIONES REQUERIDAS
Existe una persona encargada para la supervisión en el uso y almacenamiento de plaguicidas				
Todos los plaguicidas que se usan en los cultivos están en la lista de productos permitidos por el EPA. Si no sabe favor indicarlo.				
Están almacenados en un lugar seguro lejos de las habitaciones, bajo techo, suelo revestido, con ventilación y con llave.				
Se almacenan en un sitio separado de los alimentos, botiquín de primeros auxilios o similares.				
Están almacenados en sus recipientes originales.				
Las etiquetas de todos los plaguicidas almacenados se encuentran en buen estado identificando el uso, nivel de toxicidad, precauciones.				
Se lleva un inventario de los agroquímicos, que indique, nombre comercial del producto, nombre genérico, fecha de recepción, fecha de compra, cantidad almacenada, fecha de fabricación, fecha de expiración/vencimiento del producto.				
Se calibran los equipos de aplicación de agroquímicos, si se hace, cada cuánto tiempo.				
Existe un área específica con una mesa pesada o una plancheta que no sea hecha de material absorbente para realizar la mezcla de los plaguicidas, donde no haya mucho viento, que esté a distancia de las personas, fuentes de agua, animales silvestres y mascotas.				
Los trabajadores encargados de las aplicaciones utilizan equipo de protección para evitar riesgos de contaminación (máscara, guantes, botas de hule, delantal impermeable)				
Existe un botiquín de primeros auxilios disponible en caso de síntomas de envenenamiento. Se tienen los teléfonos de emergencia o dirección de la clínica más cercana en un sitio visible				

ACTIVIDAD O CONCEPTO	SI	NO	N/A	OBSERVACIONES Y/O ACCIONES REQUERIDAS
Se hacen inspecciones periódicas al área de cultivo antes de aplicar plaguicidas para identificar y determinar la presencia de plagas				
Se lleva un registro de todas las inspecciones llevadas a cabo en donde se identifiquen fechas de inspección, problemas observados, identificación de organismos detectados, y medidas correctivas.				
Las aplicaciones de agroquímicos que se realizan durante la fase de crecimiento, son registradas, detallando al menos fecha de aplicación, producto usado, dilución o cantidad de aplicación, método de aplicación, área tratada, período en que es seguro cosechar, nombre del operador.				
Se realiza la verificación de la eficacia de las medidas recomendadas.				
Se lleva un registro de las verificaciones realizadas para determinar la efectividad de las aplicaciones y posibles recomendaciones sucesivas.				
Se han hecho análisis de residuos de agroquímicos en el producto en los últimos 12 meses para verificar que los agroquímicos se aplican correctamente.				
Se utilizan otros métodos de control de plagas, además del agroquímico, por ejemplo, control biológico, prácticas culturales (rotación de cultivos, cultivos trampas, etc.), variedades resistentes, MIP, etc. Favor explique.				
Existen riesgos que el producto cultivado se contamine con los productos agroquímicos usados. Favor explique.				
Existen riesgos de contaminación microbiana en el producto cultivado (hortalizas, plátanos, etc) por presencia de animales domésticos, ganado etc.				
Se aplica como fertilizante el estiércol de animales en forma directa o fresca. Si se hace, cómo se aplica y cada cuánto.				
En el caso de hacer abono orgánico, ya sea compost, bocashi, lombricultura etc, nombrarlos.				
Se lleva un registro de las aplicaciones de abonos orgánicos en los cultivos y las dosis o cantidades.				

Fuentes: Estudio Zamorano, 2001. PFID-MSU-USAID

Preparado por: ________________________________ Firma________________________

Fecha: ____________________