6. Prevention of pesticide poisonings

6.1 Why prevent?

Pesticides are used because they can be effective and economical. In many cases when pesticides are used properly they can provide more consistent control of weeds and pests with less labor and lower costs (1). However when handled improperly it is not only uneconomical, but their misuse causes public concern due to the negative effects of pesticides on health and the environment (1). It is estimated that in parts of the developing world, pesticide poisoning causes more deaths than infectious diseases (4).

The use of pesticides has contributed to the 'Green Revolution' seen in many parts of the world from 1960 to 1990, due to easy and labor effective control of pests and weeds, thus improving yields considerably (see fact sheet 1: Introduction).

But the widespread use of pesticides has also created serious new problems, including:

1. Hazards to human health (see fact sheet 2: Health effects of pesticides).
2. Damage to the environment (see fact sheet 1: Introduction to pesticides).
3. Increased resistance of pests to some pesticides (1).

Therefore future agricultural practice should aim at reducing pesticide use to a minimum (4).

6.2 How to prevent?

It is essential to know how to use pesticides as safely as possible, legally and effectively, and therefore the main principle in prevention is the education of farmers in how to protect themselves from pesticide poisonings and to use alternatives to pesticides.

There are different strategies to minimize the hazards of pesticides:

1. 'Safe use concept' is promoted by the pesticide industry.
2. Integrated Pest Management (IPM) is promoted by FAO and WHO.
3. Ecological farming (elimination of pesticides) is increasingly requested by the consumers, and promoted by political parties and interest groups concerned about the widespread use of the poisonous pesticides hampering health and environment in most parts of the world.

6.3 The 'Safe Use Concept'

In June 1991 the pesticide industry (the Global Crop Protection Federation (GCPF)) launched the Global Safe Use Campaign which initiated pilot projects to reduce pesticide poisonings in three countries; Guatemala, Kenya and Thailand (5).

The project focused on a variety of training and education activities developed for a wide variety of groups (agricultural technicians, distributors, users, school children, housewives, etc.) (5).

The 'Safe Use Concept' includes (5, 6):

1. The use of personal protective equipment (PPE) when producing, mixing and spraying.
2. Safe storage, adequate destruction of used containers and obsolete pesticides.
3. Adequate instruction in rational use, dosification and safety measures.

6.3.1 Critique of the safe use concept

In the safe use concept pesticides are still used and therefore if not used properly (PPE, correct dosification and safety measures) there's a great risk that both health and environmental effects will occur.

- There is no convincing evidence that 'the safe use concept' has substantially decreased adverse pesticide impact (5, 7).
- The use of pesticides is not adjusted to local pest patterns and the accessibility of less dangerous alternatives (nonchemical or chemical) in the area has not been reduced. Instead of just using pesticides first one should consider whether there is a real need for a certain pesticide. If so, it must be evaluated whether the use conditions guarantee that no health and environmental damage will occur (7).
- Pesticides are expensive to purchase for the farmers (8).

For further reading about the 'Safe Use Concept':

- Murray DL, Taylor PL. Claim No Easy Victories: Evaluating the Pesticide Industry's Global Safe Use Campaign. World Development. 2000;28(10):1735-49
- Wesseling C, Ruepert C, Chaverri F. Safe use of Pesticides: a developing country's point of view. Encyclopedia of Pest Management. 2003;1(1):1-4

6.4 Integrated Pest Management (IPM)

Integrated Pest Management (IPM) is a concept launched by the Food and Agriculture Organization (FAO) in 1980. IPM programs aim at reducing pesticide use to a minimum, lessening the negative impact of agro-chemicals on the environment and health, and decreasing production costs, by combining different management strategies and practices (9).

The FAO definition of IPM: 'Integrated Pest Management means the careful consideration of all available pest control techniques and subsequent integration of appropriate measures that discourage the development of pest populations, keep pesticide use and other interventions to levels that are economically justified and reduce or minimize risks to human health and the environment. Integrated pest management emphasizes the growth of a healthy crop, with the least possible disruption to agro-ecosystems, and encourages natural pest control mechanisms. Integrated pest management can be applied to both agricultural and non-agricultural settings, such as the home, garden and workplace (9)[1].

The main principles in IPM are to:

- Identify the most toxic pesticides and those with greatest local resistance
- Restrict their use
- Implement a regimen of decreased applications to protect natural enemies of the pests

Box 6.1 Integrated Pest Management:

1. Integrated: refers to the use of multiple control tactics integrated into a single pest control strategy. At its highest level, IPM incorporates interactions among pests, the crop, and the environment within the context of a social, political, and economic matrix (3).
2. Pest: a species that conflicts with our profit, health, or convenience. If a species does not exist in numbers that seriously affect these factors, it is not considered a pest (1).
3. Management: a way to keep pests below the levels where they can cause economic damage. Management does not mean eradicating pests. It means finding tactics that are both effective and economical and that keep environmental damage to a minimum (1).

[1] Integrated Vector Control (IVC) is a similar method of controlling vectors. The WHO definition of IVM: 'Integrated vector management is a process for managing vector populations to reduce or interrupt transmission of disease. Characteristic features of integrated vector management include methods based on knowledge of factors influencing local vectorbiology, disease transmission and morbidity; use of a range of interventions, often in combination and synergistically; collaboration within the health sector and with public and private sectors that impact on vectors; engagement with local communities and other stakeholders; and a public health regulatory and legislative framework' (2).

It has been proved that this strategy results in reduced pesticide use, increased productivity and profitability and fewer deaths from poisoning (4).

6.4.1 Types of control in IPM (1)

1. Cultural control: includes crop rotation, crop diversity, timing of planting, sanitation and creation of buffer zones.
2. Biological control: the use of pest's natural enemies (predators, parasitoids, diseases, and herbivores). Strategies to do this: create a welcoming environment for natural enemies or release natural enemies into the environment.
3. Mechanical and physical control: devices and machines can be used to control pests or to alter their environment: traps for rats, light to attract repel pests, sound to kill, attract, or repel pests, barriers, cold or heat, etc.
4. Legal control: actions can be taken under federal, state, or local laws to lower or stop the spread of certain plant pests, especially those that are brought in from other areas. These actions include quarantine, inspections, compulsory crop or product destruction, and eradication of pests (see fact sheet 4: Availability of pesticides).
5. Chemical control: pesticides are used only when they are really needed.
6. Other forms of control: ethological control (use of lamps and colored screens in field), soil solarization controls, etc.

For further reading on IPM:

- http://www.fao.org/agriculture/crops/core-themes/theme/pests/ipm/en/
- http://www.extension.umn.edu/pesticides/pat/ppatman/18_3_manual/18_3_private_all1.pdf
- http://psep.cce.cornell.edu/Tutorials/core-tutorial/module11/index.aspx
- Zalom FG. Pesticide Use Practices in Integrated Pest Management. In: Krieger R, editor. Hayes' Handbook of Pesticide Toxiology. Third ed: Elsevier; 2010. p. 303-13. (can be accessed through sciencedirect.com as an e-book).

6.4.2 Community based IPM

Community IPM is a strategy in which the field school is a first step in the development of the sustainable management by a community of its shared agricultural and ecological resources. The goal of this strategy is to institutionalize IPM at the local level. The three basic elements of community IPM are learning, knowledge-generating and organizing (10).

In the community IPM farmers (10):

- Act upon their own initiative and analysis
- Identify and resolve relevant problems
- Conduct their own local IPM programs that include research and educational activities
- Elicit the support of local institutions
- Establish or adapt local organizations that enhance the influence of farmers in local decision making
- Create opportunities for all farmers in their communities to develop themselves and benefit from their IPM activities
- Promote a sustainable agricultural system

For further reading on Community based IPM:

- http://www.fao.org/docrep/005/ac834e/ac834e06.htm#bm06

6.4.3 Advantages of IPM

- Reduces the use of the most toxic pesticides (2).
- Reduces pesticide resistance to crops: when a target organism becomes resistant to a pesticide, a higher dose is needed to control the pest. Resistance can therefore lead to excessive use of pesticides. By not using or avoiding the use of the most toxic pesticides IPM impedes resistance to crops. This prevents the loss of the effectiveness of pesticides which is important for securing food suppliers and managing vector-borne diseases (2).

Box 6.2 Example of pesticide resistance:

Secondary pests and resistance occured in the 1970s in Sudan when the cotton whitefly, a minor pest in the past, became a major one after DDT was sprayed against jassids attacking the cotton plants. The spraying also resulted in resistance of malaria mosquitoes to DDT and dieldrin, seriously hampering malaria control efforts (2).

6.4.4 Barriers in the application of IPM

There is a number a technical, financial, educational, institutional, and social constraints in the use of IPM (3):

- Farmers may consider the alternative approach in IPM too costly because it can be time-consuming and less effective in eradicating pests if not used properly (11).
- Lack of knowledge and distrust of the efficacy of alternative approaches is a major constraint to their adoption (11).
- The pesticide industry may discourage the use of IPM by paying salespeople on a commission basis, with increased sales being rewarded with increased earnings (4).

6.5. Organic agriculture

Organic agriculture does not use synthetic pesticides and integrates other principles of sustainable land use. Many of the methods used in organic agriculture are components of the Integrated Pest Management (IPM).

Organic agriculture has been pointed out by industry as being a too radical strategy and to be unsustainable because of lower yields, which would force farmers to extend agricultural land use. However, studies show that organic agriculture can produce similar yields as traditional pesticide-dependent cropping and may be more profitable on the longer term due to sustainable methods (7).

The total elimination of pesticides is promoted by some consumer groups, scientists and other activists e.g. in networks or NGOs (6).

For further reading on organic farming:

- http://ec.europa.eu/agriculture/organic/home_en
- http://www.epa.gov/agriculture/torg.html
- http://www.i-sis.org.uk/FAOPromotesOrganicAgriculture.php

6.6 Plagbol - a concrete example

Plagbol (Plaguicidas Bolivia) is a project in Bolivia founded by the Danish NGO Dialogos in 2001 and financed by Danida (until mid 2010). The project aims at improving agricultural production by using less hazardous pesticides and organic practices and improving diagnosis, treatment and registration of acute pesticide poisoning through the implementation of a model of Municipal Management for Pesticides (12).

The Municipal Management Model for Pesticides is based on the strategy of information, education and communication (IEC). IEC is a preventive strategy that focuses on creating awareness, increasing knowledge and changing attitudes in a community by mobilizing and empowering people (13, 14). It is a Primary Health Care approach providing tools to access and implement strategies that are socially acceptable in changing undesirable behavior and reinforcing desirable behavior (13-15).

6.6.1 Main strategies

Plagbols work is mainly based on the promotion of IPM and on the counseling of other organizations and authorities in the field of pesticides, health and the environment. A key principle in the promotion of IPM is the education of local farmers as promotors in IPM, who then spread their knowledge to other farmers, and the education of health personnel in prevention and treatment of pesticide poisoning. Plagbol works in various municipalities all over Bolivia, where an agreement has been made on cooperation and joint funding of project activities (12).

The practical implementation of the project is done in collaboration with a number of public and private Bolivian institutions, such as the ministries of agriculture, health and education, the universities, the national boards of health and agriculture, and local peasant organizations, etc.

6.6.2 The current state of the project

So far, some smallscale farmers have adopted the IPM methods or have become organic farmers, the ministry of agriculture and the ministry of health have adopted the Plagbol materials and strategies, several health and agricultural educational institutions and primary schools have integrated IPM and the prevention of poisonings and environmental contamination into their curricula. Although the costs have been modest it has proved to be possible to influence the policy in a country substantially by showing methods for reducing pesticide use and giving information on how to spread knowledge in a sustainable way (12).

For further reading about the Plagbol-project and IEC:

- http://www.dialogos.dk/projekter/plagbol/
- http://plagbol.org.bo/
- WHO. Information, Education and Communication: lessons from the past; perspectives for the future: WHO, World Health Organization; 2001

Educative session

Educative video

Prevention of pesticide poisonings - safe alternatives:

- Three farmers from Bolivia, educated in IPM, show an example of how to use ethological control to control the pests in their field. They tell about why they prefer to use alternative methods instead of pesticides.
- Omar Huici, agronomist at the Fundación Plagbol, tells about the overall principles of the Plagbol project.
- Esmaralda Choquehaunca, promotor in IPM, tells about her work and why people are skeptical about the use of alternative methods.

Study questions

- Mention some of the advantages and disadvantages of IPM.
- According to you, what is a preferable method of preventing pesticide poisonings in developing countries taking into account factors that affects the farmer's behavior and the present conditions in Bolivia?

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15. Ministry of Health and Child Welfare, Zimbabwe National Family Planning Council. IEC reference manual for health programme managers. Harare, Zimbabwe; 1998