

Environmentally sound production: Use and alternatives for pesticides

Introduction

The use of pesticides can have various environmental and health impacts. It is important for farmers and workers to deal with pesticides in a way that will not or less effect their health and the environment. Awareness of different ways to control pest is important: alternative methods, integrated pest management (IPM) and developments in biotechnology. If pesticides will be used it is important to take the necessary precautions.

Practical information for users of pesticides

It is important for farmers and workers to take necessary precautions when working with pesticides. Therefore the following steps are important:

- Nationally banned chemicals must not be used.
- Internationally banned chemicals must not be used.
- Extremely and highly hazardous chemicals according to the 'WHO recommended classification of pesticides by hazard' should not be used except in specific situations where no alternatives exist.
- Persistent organic pollutants (POPs) according to the UNEP Stockholm Convention must not be used
- Appropriate protective clothing and equipment must be used by all staff handling hazardous pesticides
- Information about occupational health and safety on the MSDS (material safety data sheet) must be available for staff working with pesticides.
- If no MSDS (material safety data sheet) is available ask the producer or dealer for these documents.
- If there is no information available about the pesticide better not use the pesticide or take highest prevention measures for human health and environment.

Alternative methods of pest control

Pesticides can often be replaced by non-chemical methods or by chemicals that are less damaging to the environment. For example, the conventional soil disinfectant methylbromide can be replaced by phosphine. To make it possible to feed the world in the future, it is necessary to practise sustainable (organic) agriculture. Reduction of the use of herbicides can be obtained by mechanical weeding, if necessary combined with spraying rows. For a number of crops, there is the risk of damaging the plants, which can serve as an entrance for pests and diseases. Covering the ground with straw or plastic is another way of limiting the growth of witch-weed. This method can also limit the infection with fungus.

The use of fungicides can be reduced by the use of resistant or tolerant plants, proper growing methods and sanitation, biological pest control, and crop rotation. Especially with fungi that are strongly related to a crop, crop rotation can be very effective. A crop in optimal condition is less sensitive to diseases and plagues. Optimum fertiliser and growth methods can make a large contribution to this. Although this method is applicable to all kinds of diseases and pests, the use of healthy starting material can seriously limit the chances of infection with fungus.

Of course, reduction of the use of pesticides can be obtained through the improvement and optimising of application methods and right maintenance, adjustment and use of the equipment.

Natural pesticides

Great scope exists in this field for natural-based pesticides, which appear to be safer both for people's health and the environment. For example, pyrethrum and neem oil and extract, which are supplied by developing countries, are often authorized for use in organic agriculture, even though only in the event of breakdown and not as a matter of routine prevention.

- Pyrethrum is a daisy-like size flower of the chrysanthemum family. The blooms of these plants contain six pyrethrin esters, which are natural insecticides. The product is biologically sound, specific to cold-blooded fauna, rapidly degradable in natural sunlight - leaving no residue, and safe to warm-blooded animals.
- The neem tree belongs to the mahogany family. Extracts from its seeds and leaves could make ideal insecticides - they attack pestiferous species, leaving warm-blooded animals and beneficial insects unharmed; they are biodegradable; they appear unlikely to quickly lose their potency to a build-up of genetic resistance in the pests; and they disrupt the production of growth hormones, thereby preventing insects from reproducing. Neem material can affect more than 200 insect species, as well as some mites, nematodes, fungi, bacteria and even a few viruses.

Although the possibilities of natural pesticides seem almost endless, some impediments have still to be overcome before their potential can be fully realized. First, the greatest obstacle may simply be a general lack of credibility, or even awareness concerning what these products are and what they can do. Second, the supply may not be as reliable as would be required for their expanded use.

Biological pest control

Biological pest control, such as the use of natural enemies, is very useful. In West Africa the introduction of a wasp controlled a kind of aphid in a spectacular way, which protected the cassava yield, one of the most important food of millions of people in Africa. In India the seeds of the *Azadirachta indica* (a kind of tree) are used as a natural pesticide to protect crops and stored grains. Researchers stated that the active parts of it can control more than 200 kinds of pest, such as the grasshopper, while birds, mammals and useful insects like bees are left alone. Pesticides as well as biological control can be expensive.

Competent growers have used alternatives as planting resistant cultivators, crop rotation, pest-avoiding plantings and harvest times, proper sanitation and irrigation for decades. The use of natural predators, parasites and pathogens has had some success. To date, such methods can control only a small percentage of insect pests out of about 10,000 known species. Such methods are not effective in combating fungal, bacterial, nematodal and viral diseases. But they are effective in controlling soil pathogens. Soil pathogens can best be controlled with biological pest control. The capability of the soil to exclude diseases has been demonstrated for many soil pathogens and must be stimulated. Antagonist soil organisms are an important element of the soil capability to exclude soil pathogens. This antagonist soil organism can be stimulated and introduced through sowing-seed, plant material and organic material.

Integrated Pest Management (IPM)

Integrated Pest Management, which is presently the base for the crop protection activities by the FAO, seeks to integrate all available non-chemical methods with a minimal use of pesticides, to achieve crop and livestock pest control. IPM consists of a number of measures, such as conservation of existing natural enemies, crop rotation, mixed cultures and the use of resistant species. The timely removal (and destruction) of plant residues can reduce the risk of infection in the following year. This method can also reduce the infection of present fungus and can contribute to the limitation of the leaching of nitrate. Pesticides can be used selective and to a small degree.

Bio-controls including IPM are methods which have been developed over recent years and which are now adopted by virtually all growers of fresh products. IPM requires regular checking of the incidence of pests and noting an increase of their numbers in any crop. Following, accurate diagnosis a decision is taken on whether the problem can be solved by introducing a colony of natural predators to feed in the pest, or by using other bio-control that trap harmful insects. It may still be necessary to use a pesticide and the grower chooses which pesticide and what dosage is needed to reduce the pest or disease to an acceptable level, rather than

wiping it out completely. Fewer pesticides are needed in this system and, as scientists develop more disease and pest specific pesticides, even less will be needed.

Integrated or biological pest control as well as the use of protective insect meshes, are effective methods for reducing the use of insecticides. Modern, highly sophisticated insect-control measures involving the release of large quantities of sterile males, the use of sex-attractant pheromones and the application of physiologically disruptive pest hormones show some promise and, in certain cases, have accomplished phenomenal results. Such measures are highly specific, limited in number, often expensive and must be applied continuously over broad geographic areas to be fully effective.

Five years after the introduction of IPM, the yield of rice in Indonesia was 13% higher, while the use of pesticides decreased with 60%. The first two years the government saved US\$ 120 million on subsidies on chemicals. Also in Sudan, the results with IPM were positive while the use of pesticides decreased with 50%. For example, the use of integrated pest management, the cultivation of pest-resistant plant species, the maintenance of predator populations, reduced reliance on single crop or 'mono-culture' systems, which are particularly susceptible to pest outbreaks, may be less costly and more ecologically sound in controlling pest populations than the routine use of pesticides.

Biotechnology

The next wave in fighting agricultural pests may come from biotechnology, where genes for resistance to specific insects or viruses are being inserted into plants, so as to eliminate the need for pesticides. New plant species are developed, mostly based on genes from wild species, which have a resistance built in. For example, genes of wild plant species are used to protect the coffee yield in Brazil. The Mexican wild maize contains natural resistance against seven important diseases.

Biotechnology is not widely allowed and accepted yet. In Europe many consumers are against the use of genetically modified organisms (GMO) in food because of the still unknown but possible impacts on the environment and the consumers health. However, in the US the use of GMO is widely accepted.