

Pesticides: compounds, use and hazards



Agrodok 29

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Foreword

Agromisa emphasizes that wherever possible, non-chemical protection measures are to be preferred against any threat of pest infestation or diseases to crops and domestic animals. In cases where pesticides are needed, Agromisa endeavours to make its expertise and best practices on pesticide use available for small-scale farmers.

This revised Agrodok edition takes into account the rapid changes in current agro-pesticide use and expected trends and developments in future use. It contains information on pesticide suppliers and retailers, for producers and consumers of crops, for agricultural advisors, field study groups, students, resource and documentation centres.

This Agrodok is a major revision of the 1989 edition by Wilma Arendsen et al., that was written at a time marked by the start of great changes in crop protection chemicals throughout the world. Since then the agro-industry, research institutes, consumer health organizations, FAO, WHO and other UN organizations, civil society organizations such as PAN and many other stakeholders have undertaken efforts that have led to major improvements in safety.

Nevertheless, major challenges still lie ahead. The risks and hazards related to toxicity of pesticides remain as serious as ever, in spite of the implementation of many programmes for enhancing safe use and wide distribution of practical extension materials.

The terms (*agro-pesticide* and *crop protection product*) are used synonymously in this Agrodok. The Agrodok adheres to the FAO Code of Conduct on the distribution and use of pesticides and is intended to complement national laws and regulations. Agromisa accepts no liability regarding the use of the information contained in this booklet, which is accurate to the best of our knowledge at the time of publishing.

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1 Introduction

1.1 Responsible crop protection

Agromisa would like to stress from the start that use of chemical pesticides should be completely avoided wherever possible. All options for using alternative, non-chemical methods of crop protection should be explored first. Only if none of these are possible should chemical control be considered as a last resort.

It can be very difficult for an individual farmer or advisor in the field to gain a clear understanding of all the aspects of pesticide use. This Agrodok defines principles of correct and effective application for user, environment and consumer of the harvested product. Risks of human poisoning and risks of environmental damage can be minimized if everyone involved in the trade, distribution and application of pesticides knows how to handle and apply them safely.

Unfortunately, the sobering reality is that health and safety policies to convince pesticide users to operate safely under dangerous conditions have very often failed. Assumptions that information systems and health and safety measures are present and used, are often overrated and too optimistic. Very often the information has not reached the people who are applying the pesticides.

It is important that any user of pesticides, after being informed correctly, remains responsible for handling and applying these chemicals according to the instructions. If everybody assumes this responsibility at each level of the food production chain, then pesticides can be used with a minimum of negative effects for the user, environment and consumer. Farmers should combine the knowledge they have gained through experience with the information they receive on proper use of pesticides.

The effectiveness and hazards of most pesticide applications have been tested under temperate climate conditions. The risks of agrochemicals in general, and more specifically of pesticides, are greater in warm climates than in temperate climates, for both humans and domestic animals. This is because the effects of poisoning occur more

quickly in hot temperatures. In hot weather the human body tends to absorb toxic substances faster, especially when it is insufficiently protected by protective clothing. Protective clothing is often absent; Sometimes it is not used because the heat makes it uncomfortable to wear, or it is not used properly in accordance with the instructions. Farming in temperate climate zones is largely done by richer farmers who are generally less exposed to risks than farmers in the (sub)tropics.

1.2 History

The knowledge and skills for protecting crops against pests and diseases have greatly improved over the centuries. People have always employed botanical and inorganic chemicals in their efforts to restrict damage from pests and diseases in their crops and animals

A dramatic breakthrough in insect pest control was achieved in 1939 with the discovery of the insect-killing properties of DDT, which led to the devel-



Figure 1: It is most important for a farmer to be properly informed about use of pesticides

opment of chlorinated hydrocarbon and organophosphate pesticides during the Second World War (1940-45). Their remarkable efficacy in reducing the loss of human and animal lives and the increase in crop yields brought immediate commercial successes in the United States and Europe. When agricultural labour was scarce or expensive, herbicides saved farmers' time for laborious weed control. Since then pesticides have become widely accepted as essential in producing food for an expanding global population.

Chemical companies continued the synthesis of numerous new compounds and their screening on properties for pesticide use. They in-

vested heavily in marketing. From the early 1960s pesticide use also soared in Asia and South America, after international research institutes introduced high-yielding varieties of wheat, rice and maize in an effort to counter the regional food shortages. High-yielding varieties (HYV) were distributed to farmers on a large scale as part of subsidized Green Revolution input packages that contained HYV seeds, fertilizers, credit facilities and also pesticides. But insect and fungus attacks grew more serious, and more difficult to control, as a result of the application of nitrogen-fertilizers and the ensuing denser crop foliage. Also, some high-yielding varieties were strongly attacked by viruses, fungi and insects, because they were said to retain too little of the natural pest resistance found in parent varieties. Widespread pesticide use led to the decimation of natural enemies, and as other pest protection measures were neglected, outbreaks of these pests became more frequent.

Thus, a vicious circle seemed to develop, in which more frequent applications and higher dosages were seen as the unavoidable answer to increasing pest occurrence, 'the pesticide treadmill'.

During the 1950s, some scientists became aware of unexpected, dangerous consequences of unrestrained pesticide use. In 1962, Rachel Carlson roused public opinion with her book 'Silent Spring' that exposed the harmful impacts of modern pesticides on human and animal health, beneficial organisms and the environment. Her warning set off a chain of consumer-oriented actions and led to new research on hazard avoidance. Also governments and industry started to recognize that pesticides should be better targeted and their use more restricted. Treatment thresholds of pest infestation were introduced, mainly in Integrated Pest Management systems and programmes.

Measures included a reduction of the number of applications, development of less toxic, more selective pesticides, improvement of formulations and application technology and equipment, and the use of insect pathogens, pheromones and growth inhibitors. During the 1990s, governments and international agencies introduced policy guidelines for pesticide reductions and tightened the requirements for product registration and admission. As a result, the field of chemical pesticides has become much more strictly regulated. In view of the

current trends of globalization and international trade agreements, these developments have had consequences for all countries, including the less developed ones. As an example, we mention the International Code of Conduct on the Distribution and Use of Pesticides (see App. 1).

New pesticides are constantly being developed. Before these are admitted for marketing, rigorous testing is carried out and a registration process needs to be completed. Registration of pesticides is different for each individual country, but there are some international guidelines to which individual countries must adhere.

Summarizing, health and environmental problems arising from irresponsible pesticide use and storage in developing countries still require continuous attention. In addition to the direct harm pesticides can cause to human health and the environment, they also affect local economies and the workforce: medical costs are incurred for treatment and an increasing number of people are less able to live, work, care and earn an income in a sustainable way. It is to be hoped that these negative consequences of pesticide use will become better manageable in the future with the development of safer pesticides, the promotion of alternatives, and finally training, adequate information and extension for pesticide users.

1.3 Outline of contents and target group

The principles of pesticides and their safe application are explained to farmers and field workers in understandable language in this Agro dok. The booklet follows modern ideas on pesticide use combined with other effective traditional and new means of pest control: see also Agro dok 30, Integrated Pest Management. We cover application technology and equipment, while taking into account the limited supply of good products and sprayers in developing countries. We presume a serious lack of training opportunities for farmers, agricultural workers and pesticide dealers on modern agriculture, knowledge of crops, seeds and pest control. We also take into account shortcomings in the implementation of regulations, product quality control and an unreliable supply of essential agricultural inputs and funds.