

INTEGRATED PEST MANAGEMENT AND THE FUTURE OF INSECTICIDES

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The history of pest control in the twentieth century clearly shows, that our present pest problems arise from the exclusive reliance on one control method, the use of pesticides.

Ever since man has changed the natural environment for systematized agriculture, cultivated crops have been subjected to attacks by various pests and diseases. These included insect and other invertebrate pests, pathogens such as viruses, bacteria and fungi as well as many weed pests. As long as they remained in small numbers, the damage caused was negligible.

Once man realized the necessity of increasing food production to cater to the needs of rapidly expanding populations, he started on intensifying the agricultural output. This resulted in a drastic disturbance of the 'natural balance' in the environment. With new agricultural technologies, man was able to enhance crop production. But at the same time they tend to increase pest problems by making the crop environment most favourable for the rapid increase of pest populations.

It is true that in the early days, before the discovery of organic insecticides, man has used rather simple chemicals such as kerosene, arsenic compounds, sulphur etc. and some compounds derived from plants such as nicotine and pyrethrum to control

pests. But these chemicals were not very effective and they were not applied in large scale. Also, the technology used for their application was not very advanced and there was emphasis on traditional agricultural practices.

However, since the development of modern insecticides after World War II, farmers stopped using these cultural practices. They placed almost exclusive reliance on the new toxic chemicals. In the farmers' point of view, the results gained by the use of insecticides were most spectacular, as they were capable of killing a broad range of pests in vast numbers using small doses. At the same time more efficient pest control was achieved by improved spraying methods, controlled irrigation, improved artificial fertilizers and systematic use of herbicides. Suddenly farmer found that pest control was so easy and spraying insecticides became the universal answer to all pest problems.

Consequences of the Use of Insecticides

There is no doubt that, from the stand point of human welfare insecticides have been a great benefit to mankind. But as is often the case, this has been a mixed blessing, as serious problems have arisen to detract from the benefit gained from these poisonous chemicals. Without any doubt the use of pesticides has been a major cause for several environmental problems we have to face today.

Also, many insecticides leave residues on or in crops, in soil or flow into streams, rivers and other water bodies and cause serious hazards to man and animals. It has been found that substantial amounts of these residues may persist in the body tissue of man and other organism for years. This may cause cancer, sterility, birth defects and many other health hazards.

Insecticides are poisonous to a large number of animals such as pollinators, wild life and nature enemies of pests apart from the target species. Also, pests may recover from the action of pesticides and their populations may arise to extremely higher levels than before. Furthermore, other non-target species may increase in number and become serious pests following insecticide applications. This was the case with some tea pests in Sri Lanka. The use of DDT to control the shot hole borer which is a serious tea pest, (*Xyleborus fornicatus*) has led to the emergence of the mites in tea plantations to economic pest levels.

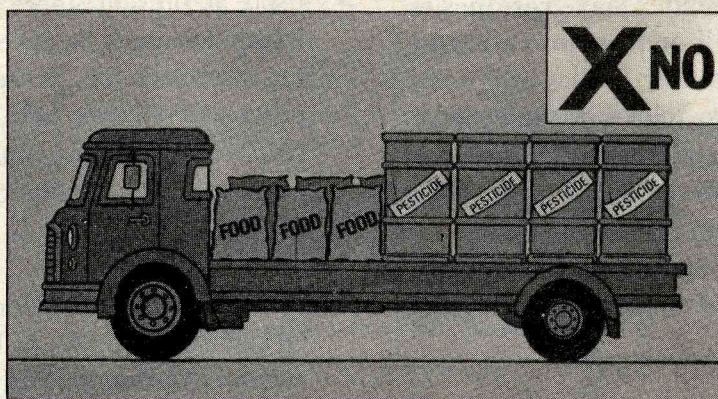
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Apart from the above, a very serious problem created by the use of insecticides is the development of pesticide resistance in pest species. As we already know, mosquitoes and house flies have developed resistance to DDT and some other insecticides. In Sri Lanka, the use of DDT to control mosquitoes had to be discontinued due to their resistance to it. Even though more powerful insecticide malathion is being

used at present, there is a suspicion that mosquitoes may be developing resistance to this insecticide too. It seems likely that most pests and vectors will eventually develop resistance to most insecticides if these chemicals are continuously used against them.

According to the Food and Agricultural Organization (FAO) of United Nations, the number of arthropod pest species resistant to various insecticides have reached up to 392 in 1980. The World Health Organization (WHO) in 1980, has listed 136 species of public health vectors as resistant. This includes 47 species of Anopheles resistant to dieldrin, 34 to DDT and 10 to malathion. Also there are 42 species of Colicine mosquitoes that have developed insecticide resistance.

The export of insecticides to the developing countries from the developed has been increasing dramatically over the past few decades. In Sri Lanka, at least 117 of these chemicals in various formulations are freely available in the local market. As they are used in agriculture and public health programmes frequently without any discrimination, many direct risks are bound to arise. According to WHO, there are more than 500,000 poisonings and 5,000 deaths that can be directly attributed to pesticide use each year in developing countries. In Sri Lanka, it is reported that an average of about 13,000 people are acutely poisoned by insecticides. Also as described before, the majority of these chemicals are of high mammalian toxicity presenting serious risks to man, other organisms and to the environment. There is clearly an urgent need for bringing in insecticides in a suitable manner into integrated pest management systems.



Pesticides must not be loaded on the same vehicle as foodstuffs.

Integrated Pest Management Concept

We have already experienced how insecticides can cause havoc to human life and to the environment. It has now become absolutely necessary to look for a fresh approach to pest control. Also, this should be based on a biological and ecological understanding. It is clear that we must combine all control methods, whether they are chemical, biological or cultural in a environment compatible manner, so as to maintain pest populations below the economic injury level and at the same time cause the least possible disruption to the ecology. This is the basic concept of integrated pest management.

For successful pest management, a good understanding of the biological system of which the pests are a part is very essential. Also the most important aspect the farmer has to be made aware of is, that a pest does not necessarily have to be eradicated in order to be economically controlled.

Future of Insecticides

As we know well, insecticides are highly toxic chemicals. They offer a quick and immediate solution to our pest problems. They are highly effective and economical to use. Also they can quickly be marshaled especially in large areas to arrest pest

damage immediately. It is quite obvious that pesticides are a powerful tool in insect pest control and definitely will continue to play a major role in pest management programmes. But the critical question was, how best can we use insecticides to obtain their maximum benefit, while at the same time minimizing their adverse effects.

Integrated pest management does not advocate a total ban on the use of insecticides. Neither does it place insecticide use as the central feature of pest management. It rather allows the use of these chemical in a compatible way with other control methods.

Whenever possible, pesticides must be integrated with other control methods. This should be done in such a way that there is minimal disruption to the ecosystem. Also pesticides must be used in a minimal quantity and only when the need to use them is clearly established. As very few insecticides are selective, the mortality of non-target organisms may be minimized by using appropriate formulations and application techniques. Furthermore, pesticides must never be used as routine, prophylactic treatment in agro-ecosystems. Also they must be used only after the prevailing

Unfortunately, developing countries like Sri Lanka have to face some major difficulties in developing well-coordinated integrated management schemes for pests. One such difficulty is the general ignorance of the details of biology, ecology and behavioural patterns of most pests and their natural enemies. Also in countries like ours, there is a shortage of trained people to provide the necessary research and other services needed for an effective pest management.

Finally, most developing countries do not have enough, well co-ordinated organizations and institutions for dealing with major pest problems. Because of inadequacies such as these, their reliance on insecticide use is extremely high. Hopefully with the development of relevant research on insect pests and vectors, there will be less dependence on insecticides alone and more utilization of integrated control in future.



The farmers sprayed the pesticides from airplanes. These poisons killed the insect pests, and the farmers' crops were saved. But using poisons raises many questions.