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Eco-Impacts of Toxic Pesticides

By

Col. Mumtaz Hussain

ECO-IMPACTS OF TOXIC PESTICIDES

Mumtaz Hussain[1]

ABSTRACT

The pesticides are used universally in order to protect the main crop against the harmful insect pests and the weeds so as to obtain the more and better output. Most of the pesticides contain environmentally hostile components which damage both "friend and foe". The unjust use of the agricultural chemicals is being realized all over the world. New scientific and legal ways are being explored to make effective employment of the natural chemical, biological and practical methodologies. Like other third world countries Pakistan needs to adopt effective national policy to avoid import of unnecessary pesticides and waste the extremely hard earned and scarce foreign exchange at the hands of the exploiting manufacturers.

INTRODUCTION

The yield of crop suffers from a two pronged attack. Firstly, the birds, insects, pests, microscopic flora and fauna, animals, parasites etc. damage the crops at various stages of growth directly or indirectly. Secondly, the weeds which grow at the expense of the actual crops are responsible for decreasing the crop output. The harmful pests number in hundreds and they cause reduction in the yield from 20 to 40%. Similarly there are more than 40,000 weeds in the world which harm the crop from 20 to 50%. The use of pesticides is universal and all countries are applying them for obtaining increased agricultural production. A report of the United Nations States that 793 million tonnes of pesticides were applied in the year 1987 in the world. Environment Protection Agency of the United States of America has reported that today more than 0.4 Kilogram of pesticide is manufactured and applied for every man, woman and child. It can correctly be said that human is exposed to lethal effects of chemicals right from the time of the conception in the womb of the mother till the death.

The business of pesticides is still flourishing. The Third World countries are lured to buy more and more quantities from the industrialised nations. The top ten pesticides manufacturing companies of the world earned the enormous profits from the sale of the lethal stuff in the year 1990 as given in table 1.

Table 1: Sales of Pesticides

Company	Country	Sales (Million Dollars)
Ciba-Geigy	Switzerland	2,704
ICI	Britain	2,522
Bayer	Germany	1,989
Rhone Poulenc	France	1,917
Du Pont	USA	1,755
Monsauto	USA	1,508
DonElanco	USA	1,500
Hoechst	Germany	1,346
BASF	Germany	1,224

[1] Director General Publications & Public Relations, Institution of Engineers Pakistan, Lahore.

Schering	Germany	897

Pakistan imported 7,083 tonnes and 20,647 tonnes pesticides in the years 1980-81 and 1986-87 respectively. Pesticides worth rupees 1.3 billions were imported in the year 1988-89 and this amount increased to rupees 6 billions in the year 1993-94.

The pesticides have been stacked in about 1900 dumps which are of fairly large size. These dumps pose constant threat to life and property. The stacking/storage has not been done properly and there is hardly any safety or security measure adopted. Many of these dumps had been created 35-40 years ago but the chemicals have not been issued for use so far. These chemicals, in the present state are mostly the rotten toxic stuff. One kind of such dumps is located in Malir Extension which has approximately 37,000 Kilograms of solid pesticides and 470,000 litres of liquid toxic materials. Another toxic waste dump exists near village Chanan Pir in District Bahawalpur. More hazardous materials are being added to this dump from Faisalabad, Sheikhupura and other places. The populace around is experiencing serious environmental threat.

CHEMISTRY OF PESTICIDES

The pesticides are toxic chemicals. Most of the pesticides are poisonous by chemical composition and others become baneful when applied in higher doses than those specified.

About 1,000 chemicals are formulated as pesticides in the world. In Pakistan 250 pesticides are in use, out of which 40 are not recommended by the World Health Organization for any application.

"Pesticides Action International" has launched a campaign against "Dirty Dozen" pesticides which are extremely hazardous in nature. These are enlisted below in Table 2.

Table 2. Dirty Dozen Pesticides

- Compheclor
- Chlordane/heptachlor
- Chlordimeform
- Dibromochlor propane
- DDT
- The drins (aldrin/dieldrin/endrin)
- Ethylene dibromide
- Lindane/HOH
- Paraquat
- Ethyl Paration
- Pentachlorophenol
- 2,4.5 - T

Harmful Effects of Pesticides

Almost all the pesticides are toxic in their actions. These chemicals are injurious for the health of human beings, and other organisms. These are a double edged weapon and both the enemy and friendly pests are affected.

According to a study conducted by Food and Agriculture Organization only 5% component of the applied pesticides fall on the plants and most of the remaining quantity goes into air to contribute towards atmospheric pollution.

The pesticides affect the exposed parts of the body, wounded portions and the genital organs with comparative ease. The main entrants are:-

Mouth	Oral digestion
Nose	Inhalation and breathing
Skin	Dermal absorption

The use of the agricultural chemicals is not suitably regulated in the developing countries. The doses are not calculated, manufacturer's instructions are not followed, the required safety precautions are not observed and the operators are not equipped with technical know-how.

Farmers are the worst hit due to pesticides. Their families, livestock, water sources, food, etc come next in the ladder of affectees. This fact is verified, on the basis of a United Nations report which says that one farmer dies every minute in the developing world due to pesticide poisoning.

Most of the pesticides are highly persistent. These remain active for long duration keeping the environment polluted for times to come.

The agricultural chemicals are biaccumulative in the food chain. Their effectiveness does not diminish rather it continues to be escalated. Also the quantities of the injurious substances get added in different organs of the body, ultimately causing their serious malfunctioning.

The process of biodegradation of the pesticides in the soil is extremely slow thus disturbing the ecosystem. Certain substances biodegrade and new compounds are formed. The newly "born" chemicals further add to the hazardness by commencing actions and reactions in their turn.

Certain chemicals when combined with others produce much more accumulative poisonous effect. This effect is called "SYNERGISM". Chlordane and heptachlor are the two synergistic pesticides and the new by-product is more injurious than the individual components.

Elements present in the chemicals keep on adding in the fat cells of animals and human beings. The net result is the development of fatal diseases of brain, liver and kidneys and orthiritis and Cancer. Even the memory is lost under severe exposures. The chemical components enter the seeds, fruits and stones of plants which when taken by the organisms cause health degradation.

The pesticides are washed with the agricultural run off. This action results in pollution of both surface and under ground water resources. The surface water bodies are deprived of their aquatic life due to intake of water containing chemicals. Water samples from wells and tube-wells installed in the areas where the crops had been sprayed with excessive chemicals, contain the injurious salts.

A United Nations report reveals that annual death toll due to handling of pesticides in the world is as high as 80,000. Similarly about two million people are poisoned. In addition to these

figures, a large part of world population suffers from acute and chronic ailments. In Pakistan it is feared that at least 1000 people lay their lives every year due to lethal insecticides. Also 500,000 individuals are poisoned.

The scientists have found that the chemicals affect the fertility among the human beings as well as the animals. In the industrialized countries this problem is more pronounced. Certain chemicals like AIKYLPHENOLS and DDE have acted as female hormone oestrogen. In fact these chemicals have feminished the males reducing the number of sperms in the semen and finally the reproductive system. Researchers in the United Kingdom have observed certain fishes with both the male and female organs. Also the male alligators have exhibited feminish characteristics. Chemicals containing radioactive substance like Uranium affect the reproductive potential.

The herbicides group "Agent Orange" was extensively used by the Americans during the war against Vietnam. These herbicides were used for defoliation purpose. Dioxin is the by-product which causes birth problems and Cancer. Many troops of both the United States of America and Vietnam have been suffering from the after effects of the defoliant herbicides.

Certain chemicals enter the bodies of animals and human beings through various entry routes especially during hot and humid weather. These pesticides get transferred from one body to the other thus causing a chain reaction of damages. In case of acute cases mutation of various body parts also takes place. The severe effects of the chemicals may not appear soon after their application but these may develop after lapse of many years. The organophosphorous compounds are more persistent than the Organochlorines.

Organophosphorous chemicals affect the central nervous system including the "Parkinson Disease". Also these pesticides cause the disease of "Immune Depression".

SAFETY PRECAUTIONS AGAINST PESTICIDES

In Pakistan about 35% losses of the crops are due to pests. With the use of pesticides these losses are expected to decrease. The yields of Cotton and Wheat have increased due to use of pesticides against the insect pests and the weeds respectively.

Application of the pesticides is unavoidable. However, efforts be made to regulate their use. The present "free for all situation" needs to be curbed iron handedly. "Agricultural Pesticides Ordinance" was promulgated in the year1971. For the implementation of this Ordinance "Agricultural Pesticides Technical Advisory Committee" had been framed. These steps have not proved to be affective against the use of the agricultural chemicals.

"Eco-Toxicology Research Centre" had been established under the aegis of National Agricultural Research Council, Islamabad in the year 1994. It is a great breakthrough towards the goal of safe application of chemicals. The objectives of this premier organization are :-

1. To study the adverse effects of pesticides on environment and of pesticide residues on water, soil and food chain, as well as effects on microorganisms, natural enemies of insect pests, fish, fauna, birds and other wildlife.

2. To plan and promote safe use of pesticides.

Instructions While Using Pesticides

Prepare the chemical in a manner as advised by the manufacturer keeping in view the dose, concentration level, time of preparation, etc. Presence of the expert is mandatory while handling the chemicals. Smoking and eating are strictly forbidden.

During the application of the pesticides wear protective clothing including the hand gloves, face shields and masks. Respirator be used when handling the dusty and powdery chemicals so as to avoid their inhalation. The exposed parts of the body should not be in contact with the pesticide.

Position should be such that wind does not bring back the sprayed material towards the operator of the equipment.

After the application process is complete, the operator must wash the body properly especially the exposed parts.

The wastes must be suitably disposed or stacked after each day's operation.

NEW REGULATORY TECHNIQUES

In the United Kingdom the Department of Agriculture had devised system under which reduction in use of the chemicals had been achieved upto an extent of 20%. The governing factors are weather conditions, life cycle of pests, kind and variety of crops, rotation of crops, nutrient requirement of the plants, type and dose of the chemical, etc. The farmers have found this system to be useful giving the desired yields of crops and the diseases, pests and germs have also been controlled.

Integrated Pest Management

To regulate the use of agricultural chemicals, "Integrated Pest Management Programme" has been introduced. IPM is the comprehensive approach to reduce pest damage to tolerable levels through a variety of techniques including predators and parasites, genetically resistant hosts, natural environmental modifications and when necessary and appropriate chemical pesticides (US Presidential Message to Congress, 1979). By adopting this programme significant reduction in application of pesticides has been achieved in case of many crops, of course, maintaining the desired output.

Application of Photosensitizers

With a view to minimize the environmental pollution the use of Photosensitizers is being encouraged these days. These chemicals control the effectiveness of the main pesticide so that the latter may loose the persistence after a certain specified period. Some of these agents are Retenone, Anthracene, Xanthone, Beovzil and Carbazole.

IMPROVEMENTS IN AGRICULTURAL PRACTICES

1. Irrigation to the field be done when the pests are attacking the crop. Most of the pests will fall into the water and die.
2. The affected crop be destroyed when attacked by pests. This action will help in destruction of the harmful pests for undertaking he subsequent attack of crops.
3. Pest resistant varieties of crops be developed.
4. The agricultural fields should be well ploughed so that the roots and other parts of the plants are removed from soil and burnt. The parts of plants may contain harmful substances and eggs.
5. Encourage the use of radiation and other materials for destruction of the specific portions of the life cycle of organizms. Such chemicals be used with care so that the desired effect is obtained. It is more useful to destroy the eggs and the newly hatched larvae.

ALTERNATIVES TO AGRICULTURAL CHEMICALS

Alternatives to Pesticides

Most of the agricultural chemicals are not cost effective. These are lethal for the friendly insects and animals as well. Many research centres in the world are endeavouring to find out the alternatives so that the environment may be protected from the ill effects of the harmful chemicals. Like other Third World countries Pakistan spends huge sums of extremely precious foreign exchange on import of the pesticides which do no yield the desired result. Agricultural scientists must be encouraged to devise the techniques and evolve the materials which can replace the hazardous pesticides.

Biological Measures

These measures are based on the employment of the living organisms for controlling the population of the pests. These techniques are also known as "BIOCONTROL". Certain birds, micro-organisms, other organisms and virus are enemies of particular species of pests. The predator organisms are specific to their targets. By introducing a particular predator in a population of its prey, the desired destruction of the pest is achieved. Examples are given below:-

The "Citrus Scale Insect" in California State of the United States of America was controlled by introduction of "Australian Ladybug".

The introduction of sterile males in the prey population has also been successful in producing the desired results. In this case, the eggs produced lack fertility. Thus the perpetuation of the further generations is significantly hindered. This is comparatively a difficult technique requiring close monitoring.

Use of Hormones

The use of juvenile hormones is gaining popularity in the United States and some European countries. The hormone produces a major change in a body part or metabolic activity. The juvenile

hormones have negative effect on the life cycle of the prey. Thus the normal growth cycle of the target pest is jeoparadized.

Some hormones are used to kill mosquitoes and insects which interfere with comfort of the humans and other animals. It must be borne in mind that the organic chemical compounds of hormones kill or incapacitate the pests in their infancy age before reaching the adult state or else kill the adults so that the future generations are controlled.

Soil Solarisation

It is essentially a natural mulching method of pest control. It is a hydrothermal phenomenon which takes place in a moist soil covered with a transparent plastic film and exposed to sunlight. Most of the pathogens and pests are mesophilic and are therefore killed/weakened at temperatures above 31-32 degrees Celcius. The process entails occurrence of physical, chemical and biological action in the soil leading to increased plant growth and yield.

EFFECTIVE LEGAL AUTHORITY

Pakistan is a luring market for many industrialized nations for the disposal of their injurious agricultural chemicals. In the garb of attractive advertisements on the electronic media, the western countries sell a large variety of hazardous pesticides through local dealers to the simple farmers. Sometime they sell their wastes, at lucrative rates in the local market. Many of these products remain unidentified and unregistered with Government of Pakistan.

According to "Agricultural Pesticide Ordinance, 1971" and "Agricultural Pesticide Rules, 1973", the registration of a pesticide is required with the Government of Pakistan prior to its marketing. The complete process entails a time span of two to three years. The criteria for selection of a chemical are given in the following:-

Effectiveness 40%

The pesticide should have wide range of activity and should be capable of providing minimum 80% control of pest against which it is used.

Hazards Toxicity 27%

The insecticides should be safe to handle for the workers and its fish and bird toxicity should be nil at the recommended doses.

Tolerance 8%

The pesticide should be safe from the consumer's point of view on the basis of residues left on food products after spraying.

Phototoxicity 3%

It should be non-phototoxic when used.

Accumulative Toxicity 7%

The pesticide should not possess any accumulative hazards to mammals and should break down to non-toxic substances after serving its purpose.

Economic 15%

The cost of the pesticide should be within the reach of the farmers.

(Source: Environmental Profile of Pakistan, 1988)

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