

A CASE STUDY

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Impact of indiscriminate use of insecticide on environmental pollution

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ABSTRACT

Insecticide use is an important and integral component of crop production system. Insecticide use increased substantially over the years. Insecticide consumption increased by 2158.6 per cent in 2004 over 1982, but now there is declining trend in their use. Indiscriminate use of insecticides also lead to several diseases in human health. Concentration of insecticide in surface and ground water is also a major factor for environmental pollution. Insecticide like Diazinon shows the maximum concentration in surface and ground water. Therefore, the concentration of Diazinon should not be more than the recommended limits *i.e.* 0.003 µg/l to protect the fresh water aquatic life and also eliminate the lethal effects of insecticide residues in ground water. The status of the insecticide residue in lake water *i.e.* the areas that were not involved in vegetable or horticultural farming is highest in chlorpyrifos ethyl (which was above WHO limit) while the residual levels of endosulfan sulphate and endosulfan ether found in agricultural soil were higher than those of alpha and beta endosulfan, which indicates that degradation reactions take place mainly in agricultural soil.

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INTRODUCTION

Insecticides are chemical substances used to kill or control insects. Indiscriminate use of this chemical leads to various environmental pollution. Pollution is an undesirable change in the physical, chemical or biological characteristics of our air, land and water. This change may or will harmfully affect human life or that of desirable species, living conditions and cultural assests. Pollutants are residues of the things we make use and through away.

Since the insecticides are poisons and if are intentionally applied on the agricultural crops for protecting them against noxious insects, the problem is then increased many fold. The insecticides may accumulate in the environment and contaminate all the systems *i.e.* air, water, soil, plants, animals, non target pest etc. by being transported from one system to another. Although they are protecting the crops from pests for boosting up the agricultural produce but bring out ecological disturbances and pollution.

Usage of insecticides in India :

The pattern of pesticide usage in India is different from that for the world in general (Fig. 1). As can be seen in Fig. 1, in India 76 per cent of the pesticide used is insecticide, as against 44 per cent globally (Mathur, 1999). The use of herbicides and fungicides is correspondingly less heavy. The main use of insecticides in India is for cotton crops, followed by paddy and wheat.

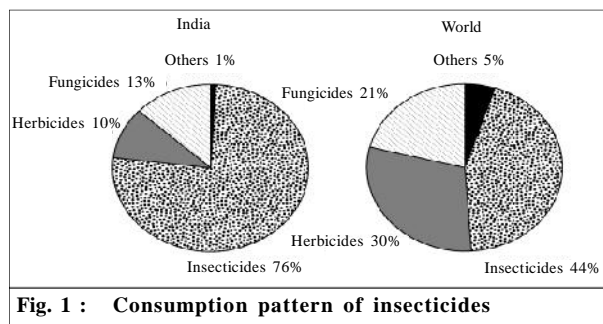


Fig. 1 : Consumption pattern of insecticides

Hazards of insecticides :

If the credits of pesticides include enhanced economic potential in terms of increased production of food and fibre, and amelioration of vector-borne diseases, then their debits have resulted in serious health implications to man and his environment. The side effects of insecticides are effects on non target insects. Residues remain in the soil, air and on or in harvested produce after the application of a insecticides may pollute the environment. As insecticides are toxic chemicals, they have the potential to be toxic to humans, livestock, and wildlife. Repeated use of a single insecticide may lead to develop insect resistant to the insecticide. Insecticide effectively kills the target insect, but also kills beneficial insects like parasitoids, predator and pollinators which lead to increase the population of pest to a level higher than the level preceeding the application. The phenomenon is so called pest resurgence.

Different groups of insecticides :

- Inorganic insecticides:
Eg:- Arsenicals, Arsenates, Fluorine compounds.
- Natural occurring insecticides:
Eg:- Rotenone, Pyrethrum, Neem, Nereistoxin,
etc.
- Organochlorines:
Eg:- DDT, BHC, Aldrin, Dieldrin, Endosulfan,
etc.

- Organophosphates:
Eg:- Dichlorvos, Monocrotophos, Parathion,
diazinon etc.
- Carbamates:
Eg:- Phenyl Carbamates, Carbaryl, Aldicarb,
Carbofuran, Aminocarb, etc.
- Synthetic Pyrethroids:
Eg:- Allethrin, Fenvalerate, Permethrin,
Cypermethrin etc.
- Miscellaneous Insecticides:
Eg:- Rodenticides, Formamidines,
Organosulphurs, etc.
- New isecticides group:
Eg:- Neonicotinoids (Imidaclopid,
Thiamethozam, Thioclopid), Phynyl pyrazole, Spinosyn
insecticides, etc.
- Boipesticides:
Eg:- NPV, *Bacillus thuringiensis*, *Verticillium
lecanii*, etc.

Table 1 : Insecticides restricted for use in India

Sr. No.	Name of pesticides
1.	Aluminium Phosphide
2.	DDT
3.	Lindane
4.	Methyl Bromide
5.	Methyl Parathion
6.	Sodium Cyanide
7.	Methoxy Ethyl Mercuric Chloride (MEMC)
8.	Monocrotophos
9.	Endosulfan
10.	Fenitrothion
11.	Diazinon
12.	Fenthion
13.	Dazomet

Source: Mannca on Wed, 06/24/2009 - 11:15

Impact of insecticides on humans :

The world-wide deaths and chronic diseases due to pesticide poisoning number about 1 million per year (Environews Forum, 1999). The high risk groups exposed to insecticides include production workers, formulators, sprayers, mixers, loaders and agricultural farm workers. During manufacture and formulation, the possibility of hazards may be higher because the processes involved are not risk free. In industrial settings, workers are at increased risk since they handle various toxic chemicals including pesticides, raw materials, toxic solvents and

inert carriers.

EPA standards (Kole and Bagchi, 1995).

Impact of insecticides on surface and ground water:

Insecticides can reach surface water through runoff from treated plants and soil. Contamination of water by insecticides is widespread. Groundwater pollution due to insecticides is a worldwide problem. During one survey in India, 58 per cent of drinking water samples drawn from various hand pumps and wells around Bhopal were contaminated with organo chlorine pesticides above the

Impact of insecticides on soil fertility (beneficial soil micro-organisms) :

Heavy treatment of soil with insecticides can cause populations of beneficial soil microorganisms to decline. According to the soil scientist Dr. Elaine Ingham, "If we lose both bacteria and fungi, then the soil degrades. Overuse of chemical fertilizers and insecticides have effects on the soil organisms that are similar to human

Table 2 : Some common illness effects and diseases caused by insecticides

Insecticides	Suspected Diseases/ Effects
DDT	Chronic liver damage, reproductive disorders, Cytogenic effects, Breast cancer.
HCH	Chronic liver damage, Reproductive Disorders, Allergic dermatitis, Breast cancer.
2,4 - D	Twofold excess of all cancers, Lymphoma
Chordane	Brain cancer, Lymphoma, Reproductive disorders
Heptachlor	Reproductive disorders, Blood dyscrasias
Lindane	Brain cancer, Lung cancer
Aldrin	Lung cancer, Liver diseases
Dialdrin	Liver diseases
Diazinon	Lymphoma
Malathion	Lymphoma
Nicotine	Lymphoma

Source: Development toxicity and safety Industrial toxicology Research Centre, Lucknow, India.

Table 3 : Residual levels of chlorinated hydrocarbon insecticides in the fat of human milk

Insecticides	No. of sample analysed	% of positive samples	Average residue levels (ppm)	Range of detected residues (ppm)
Lindane	106	0	ND	ND
Heptachlor	106	10.4	0.00392	0 – 0.1530
Heptachlor - epoxide	106	70.8	0.01951	0 – 0.8230
Aldrin	106	30.2	0.00113	0 – 0.0455
Dieldrin	106	41.5	0.02222	0 – 0.0173
Eldrin	106	0	ND	ND
DDT	106	100.0	0.50000	0.56 – 15.71

Source: Tropical Agriculture Research Series Gwo – Chen Li No. 16

Table 4 : Average concentrations of organophosphorus insecticides in surface and ground water

	Diazinon (µg/l)	Chloropyrifos (µg/l)	Ethion (µg/l)	Edifenphos (µg/l)
Surface waters	0.041	0.007	0.009	0.005
Rivers	0.054	0.007	0.012	0.004
Wetlands	0.047	0.006	0.005	0.003
Reservoirs	0.031	0.007	0.009	0.006
Ground waters	0.019	0.016	0.012	0.012
Wells	0.017	0.006	0.014	0.025
Springs	0.019	0.020	0.010	0.006

Source: World Applied Sciences Journal Zahedah Rakmanikhah, Abbas Esmaili sari, Nader Bahramifar and Zahra shoki Bousjien 9 (2): 160 – 166, 2010

Table 5 : Insecticides residues in the soil ($\mu\text{g/g}$) dry soil.					
	Sample 1	Sample 2	Sample 3	Average	Standard deviation
Endosulfan alpha	0.0276	0.346	0.224	0.282	0.061
Endosulfan beta	0.415	0.511	2.814	0.411	0.102
Endosulfan sulfate	2.491	0.307	1.830	2.378	0.502
Endosulfan lactone	1.107	1.038	0.739	0.961	0.196
Endosulfan ether	1.660	1.976	1.230	1.622	0.374
Sum	5.949	4.178	6.837	5.654	1.235

Source: Water Environment Research, Hicham El Bakouri, Abdelhamid Ouassini, Jose Morillo. Aguado, Jose Usero Garcia 79 (13).

overuse of antibiotics.

Some destructive impact of insecticide in India :

Bhopal disaster or Bhopal gas tragedy:

The world's worst ever industrial catastrophes is the Bhopal disaster or Bhopal Gas Tragedy. Occurred on the night of December 3, 1984 at Union Carbide India Limited (UCIL) pesticide plant in Bhopal, Madhya Pradesh in India. It is due to the exposure of the population to toxic chemical vapours (mainly methyl isocyanides). Resulted in 3 adverse outcomes: mortality, mobility and disability. The exact number of people who died due to this disaster remains unknown. Most deaths occurred in 48 to 72 hours of the disaster

Great impact of chemical pesticide on human being:

500 people died due to pesticide poisoning in Warangal (Andhra Pradesh) in January, 2002

Endosulfan poisoning in Kasargod, Kerala, India:

More than twenty years of aerial spraying of endosulfan for cashew nut production, in the government owned plantation Corporation of Kerala has been link to the massive health problems – from horrendous birth defects to cancers and deaths – in the communities around Kasargod District, Kerala. People residing in the villages within the plantation have been afflicted with different kinds of illness. People also noticed the death of fishes, honeybees, frogs, birds, chicken and even cows.

Conclusion :

Misuse or overuse of insecticides should be avoided as it leads to the increase in various ill effects and

hazardous diseases in human health and also in the decreasing population built up of the many biological agent. Insecticides concentration in ground water, surface and its residue in different region like water surface, soil etc. also lead to the environmental pollution. Hence, indiscriminate use of insecticide should be avoided but the application of insecticide should be fitted on need based application in IPM Programme where other methods of suppression of pest population are being us. The insecticides use for the management of insect should be of compounds which are needed at low doses, fast degradable and creating no pollution problem yet effective to the insect and be well fitted in IPM without any hazards to parasitoids, predatory insects, entomophilic pathogens and pollinators.

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