

REVIEW PAPER

Impact of Pesticide : An Overview

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ABSTRACT

India is the second largest populus country in the world after china with nearly 16 per cent of the global population. Over the last six years from financial year 2007 to 2013, the pesticide industry has observed an average annual growth rate 10.2 per cent in value terms. The term pesticide covers a wide range of compounds including insecticides, fungicides, herbicides, rodenticides, molluscicides, nematocides, plant growth regulators and others. In India pests cause crop loss of more than RS 6000 crores annually, of which 33 per cent are by weeds, 26 per cent by diseases, 20 per cent by insects, 10 per cent by birds and rodents and the remaining (11 per cent) is due to other reasons. In India insecticide use is almost 51% of the total pesticide use followed by fungicides and bactericides (33%) and herbicides (16%). Out of all the states, Uttar Pradesh, Maharashtra, Andhra Pradesh Punjab and Haryana are the states using largest quantity of pesticides. Use of biopesticides as a component of Integrated Pest Management (IPM) programs can greatly decrease the use of conventional (chemical) pesticides, while achieving almost the same level of crop yield. Out of the pesticides, the insecticide use has declined over the years as is evident from fig 1 but the use of fungicides and bactericides and herbicides has remained almost constant over the years.

**Key words** Pesticide, Herbicides, Rodenticides, Molluscicides, Nematocides, Growth regulators

As the world population is rising, it is causing a steep increase in the demand for food and fiber production. In order to meet this requirement, greater usage of pesticides is observed all over the world, which is a major hurdle in the path towards sustainable agriculture production.<sup>1</sup> The term pesticide covers a wide range of compounds including insecticides, fungicides, herbicides, rodenticides, molluscicides, nematocides, plant growth regulators and others.<sup>2</sup> In India pests cause crop loss of more than RS 6000 crores annually, of which 33 per cent are by weeds, 26 per cent by diseases, 20 per cent by insects, 10 per cent by birds and rodents and the remaining (11 per cent) is due to other reasons.<sup>3</sup> The main intention of the introduction of pesticides was to prevent and control insect pests and diseases in the field crops increased use of chemical pesticides has resulted in contaminating the environment and the long-term implications on the society are found multidimensional. Through the widespread use of irrigation, high-yielding seeds and chemical pesticides and fertilizers, the government jumpstarted the country's farmlands to alleviate poverty and hunger, ushering in a new era for India's agriculture at the same time. But that has come at a

hefty price for the environment: the sustained use pesticides have depleted the soil, and ineffective irrigation practices have caused groundwater tables to plunge in many parts of the country. For many farmers, crop yields have fallen even as India's food demand has increased.<sup>4</sup>

**Increasing Pest Attacks:** The total number of pests attacking major crops has increased significantly from 1940s. For instance, the number of pests which are harmful for crops such as rice has increased from 10 to 17 whereas for wheat have increased from 2 to 19 respectively. The increased damage to crops from pests and subsequent losses poses a serious threat to food security and further underscores the importance of agrochemicals <sup>17</sup>. (Table 1)

Table 1. Crop wise Pests attack

Crops	1940		2015	
	Total Pests	Serious Pests	Total Pests	Serious Pests
Rice	35	10	240	17
Wheat	20	2	100	19
Sugarcane	28	2	240	43
Groundnut	10	4	100	12
Mustard	10	4	38	12
Pulses	35	6	250	34

Source: Report on -Ushering in the 2nd Green Revolution: Role of crop protection chemicals

Out of the pesticides, the insecticide use has declined over the years as is evident from fig 1 but the use of fungicides and bactericides and herbicides has remained almost constant over the years. (fig.1). Out of all the states, Uttar Pradesh, Maharashtra, Andhra Pradesh Punjab and Haryana are the states using largest quantity of pesticides (9035 MT, 6617 MT, 6500 MT, 5725 MT and 4050 MT respectively) in the year 2012-13.

India, being a tropical country, the consumption pattern is also more skewed towards insecticides<sup>5</sup>. The herbicides and fungicides' application is correspondingly less heavy. The same is also evident from Fig.2 which shows that insecticide use is almost 51% of the total pesticide use followed by fungicides and bactericides (33%) and herbicides (16%). the use of plant growth regulators is almost negligible. Crop wise, cotton accounts for the maximum share of pesticide consumption i.e. around 37% followed by paddy (20%). In India together they account for around 57% of the total pesticide consumption. While the wheat and pulses contribute of about 4 %, vegetable 9 % and the other plantation crops 7 %<sup>6</sup>. State wise Andhra Pradesh is the highest pesticides consuming state (23%) followed by Punjab & Maharashtra.

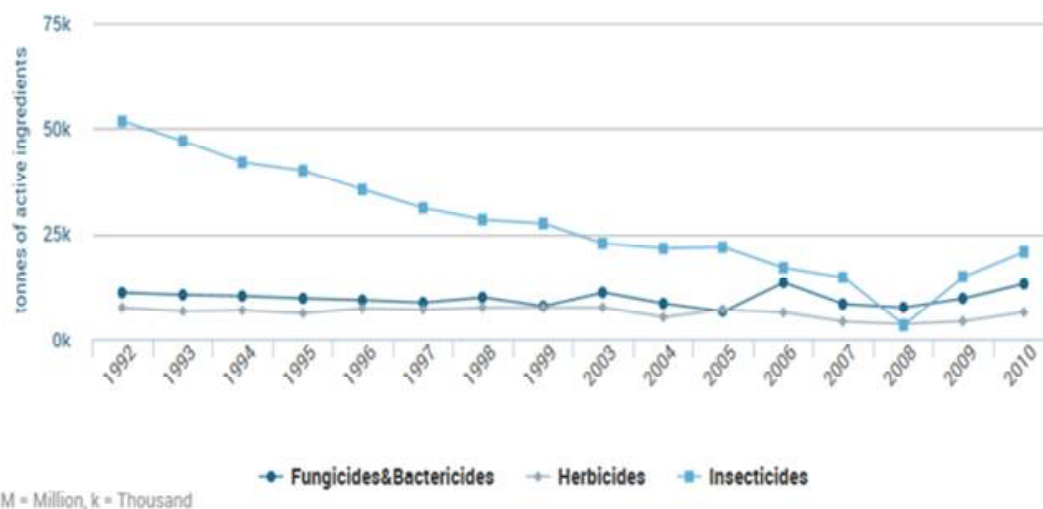


Fig. 1. Pesticide Use in India (1992-2010)

Source: FAOSTAT (<http://faostat3.fao.org/browse/R/RP/E>)

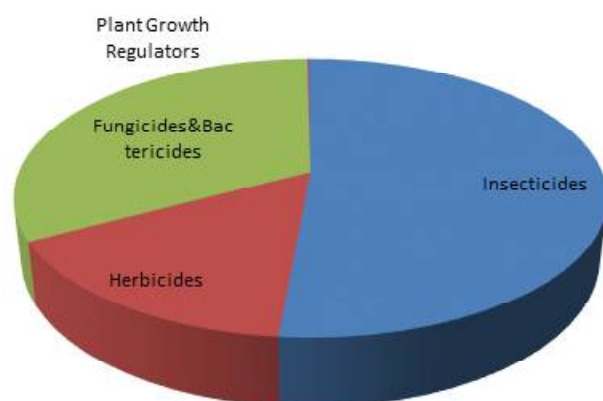


Fig. 2. Share of different components of pesticide in total pesticide use

Source: Author's calculation from data available at faostat.org

## ENVIRONMENTAL IMPACT OF PESTICIDES

The environmental impact of pesticides consists of the effects of pesticides on non-target species. Over 98% of sprayed insecticides and 95% of herbicides reach a destination other than their target species, because they are sprayed or spread across entire agricultural fields<sup>7</sup>. Over time, repeated application increases pest resistance, while its effects on other species can facilitate the pest's resurgence.<sup>8</sup> Pesticides can contribute to air pollution. Pesticide drift occurs when pesticides suspended in the air as particles are carried by wind to other areas; potentially contaminating them.<sup>9</sup> Pesticides that are applied to crops can volatilize and may be blown by winds into nearby areas, potentially posing a threat to wildlife<sup>10</sup>.

## PESTICIDES AND ITS EFFECT

Pesticides are found as common contaminants in soil, air, water and on non-target organisms in our urban landscapes. Once there, they can harm plants and animals ranging from beneficial soil microorganisms and insects, non-target plants, fish, birds, and other wildlife (USGS, 1995).

It is estimated that nearly 10,000 deaths annually to use of chemical pesticide worldwide, with about three-fourths of these occurring in developing countries<sup>11</sup>

There are two types of the pesticide effects on human health:

### Chronic effects of pesticide exposure

Chronic health problems linked to pesticides include adverse neurological effects such as a fourfold increased risk of early-onset Parkinson's disease, shortened attention span, memory disorders, and reduced coordination, reproductive problems including miscarriages, reduced infant development, birth defects, depression and cancer.

### Acute effects of pesticide exposure

Acute health problems which are sometimes misdiagnosed or not recognized as being associated with pesticide toxicity, include blurred vision, headaches, salivation, diarrhoea, nausea, vomiting, wheezing, eye problems, skin conditions, seizure, coma, and even death. Mild to moderate pesticide poisoning mimics intrinsic asthma, bronchitis, and gastroenteritis. Pesticides are especially harmful to children because of their developing physiology. And, relative to their size, they are exposed to higher amounts of pesticides.<sup>12</sup>

## INDIAN SCENARIO

A vast majority of the population in India (56.7%) is engaged in agriculture and is therefore exposed to the pesticides used in agriculture<sup>13, 14</sup>. High use of pesticides results in pesticides poisoning in humans.

Figure 3 shows the reported incidents of pesticide poisoning over the years, which has shown a random trend but has shown a growth rate of 4.7% exponentially. Out of all the states the highest number of cases were reported in Maharashtra state (8571 cases), evidently Maharashtra is also the second highest user of pesticide. The states which follow Maharashtra are the states where pesticides consumption is less but cases of pesticide poisoning is high. The states are Kerala with 1614 cases of poisoning

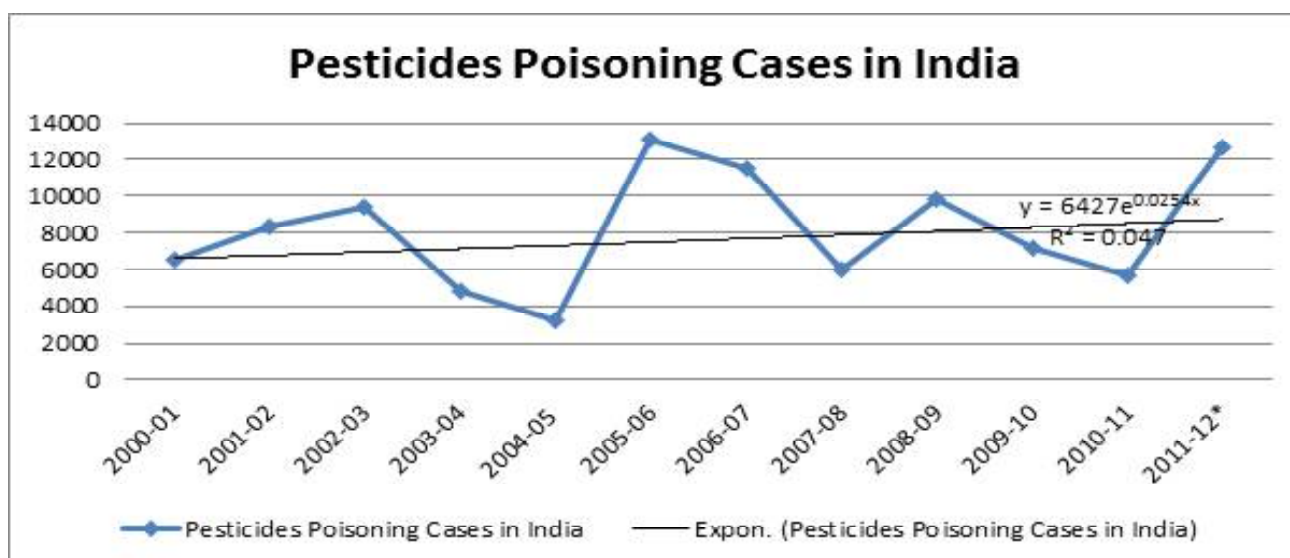


Fig. 3. Pesticide poisoning cases in India

Source: Author's calculation from data available at indiastat.com

and Uttarakhand with 955 cases of poisoning. In Kerala the reason can be the use of Endosulfan, an organochlorine insecticide for aerial spraying over cashew farms for more than 20 Years till 2001 when this insecticide was banned. The first report of pesticide poisoning was also documented from Kerala in 1958, where more than 100 people died after consuming wheat flour contaminated with parathion.

One instance occurred in Bhopal, where more than 5,000 deaths resulted from exposure to accidental emissions of methyl isocyanate from a pesticide factory.

A study on Malwa region of Punjab was carried out. The study showed that the region is facing an unprecedented crisis of environmental health linked to indiscriminate, excessive, and unsafe use of pesticides, fertilizers, and poor groundwater quality. The region has been described as India's "cancer capital" due to abnormally high number of cancer cases, which have increased 3-fold in the last 10 years. Studies of this region have also highlighted a sharp increase in many other pesticide-related diseases, such as mental retardation and reproductive disorders. The most affected individuals are the agricultural workers who are directly exposed to pesticides. The Malwa region of Punjab, India, is less than 15% of the total area of Punjab (only 0.5% of the total geographical area of India), but it consumes nearly 75% of the total pesticides used in Punjab. The high use of pesticides, along with environmental and social factors, is responsible for the high concentration of pesticide residues in the food chain of this region. Moreover, many banned and restricted pesticides are still in use in this region, warranting strict periodical health checkups and other interventions. The present review describes occupational, environmental, and social factors associated with pesticide use in the Malwa region of Punjab, India, and proposes some risk reduction interventions<sup>15</sup>.

## CONCLUSIONS AND POLICY MEASURES

In global context pesticide consumption in India is

low (around 500 g per ha) compared to other countries like Japan (12 kg per ha) and Germany (3 kg per ha) but in India problems resulting from unregulated and uncontrolled usage are quite alarming. It can be attributed to fragmented land holdings, lower level of irrigation, dependence on monsoons, and low awareness among farmers about the hazards of usage of pesticides etc.<sup>16</sup>. Lack of awareness among the farmers, deliberate suppression of facts, resource constraints, unlawful approaches, public policies and poor alternative mechanisms are found responsible for the present state of affairs.<sup>3</sup> The government bodies should acknowledge the alternatives and provide proactive support to farmers so that they may shift to ecological, sustainable and healthy ways of farming. Thus use of biopesticides as a component of Integrated Pest Management (IPM) programs can greatly decrease the use of conventional (chemical) pesticides, while achieving almost the same level of crop yield. However, effective use of biopesticides demands understanding of a great deal about managing pests especially by the end users<sup>16</sup>. Cases of environment friendly pest control and mechanisms, have to be researched, developed and propagated on a large scale. In addition to these, the state intervention in the form of liberal subsidies to pesticides must be economically rationalized for discouraging excessive pesticide use<sup>3</sup>.

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