



## Pesticide Application in Agriculture: Benefits and Challenges

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The human race needs a home with clean air and water, non-toxic food, and an environment that does not endanger our health and safety. We have a duty to safeguard the earth's resources since we share this world with so many other living things. Few individuals will disagree that pollution will increase as the world's population expands. It's critical that people become more sensitive to and aware of these issues. Increased population will need more food, fibre, and construction materials, placing a greater pressure on the earth's scarce resources. A rise in environmental sensitivity and government restrictions to safeguard the environment from pesticide contamination will be another result of the population squeeze. When handled appropriately and judiciously, pesticides benefit public health and the environment. They've been employed to manage pests that may be dangerous to humans, for example. Two good examples are plague-carrying rats and malaria-carrying mosquitoes. These initiatives are required, particularly in congested cities and nations with huge populations. Pesticides, on the other hand, can be harmful to both human health and the environment. Any pesticide that is used in an unintended manner is a pollutant and potentially hazardous. Synthetic organic insecticides/pesticides frequently employed in agriculture/forestry are generic biocides with the inherent capacity to harm all living species as well as the environment's quality. The presence of pesticide residues in food and other environmental components has been shown to be hazardous to people, domestic animals, birds, fish, and non-target wildlife in the agro-forestry ecosystem. In addition to these negative impacts, there are insect pest issues to contend with.

### History of Pesticide

Insecticides, fungicides, herbicides, rodenticides, molluscicides, nematocides, plant growth regulators, and other substances are all classified as pesticides. Organochlorine (OC) insecticides, but these were successful in combating a variety of illnesses such as malaria and typhus, were prohibited or limited in most technologically sophisticated nations after the 1960s. Other synthetic insecticides, such as organophosphate (OP) insecticides introduced in the 1960s, carbamates in the 1970s, and pyrethroids in the 1980s, as well as herbicides and fungicides introduced in the 1970s–1980s, considerably aided pest control and agricultural productivity. A pesticide should, in theory, be harmful to the pests targeted but not to non-target species, such as humans. Unfortunately, this is not the case, and the debate over pesticide usage and misuse has erupted. The widespread usage of these compounds, which follows the maxim "if a little is good, a lot more is better," has wreaked havoc on humans and other living things.

### Pesticides' Benefits

The key benefits are the side effects of pesticides – the predicted direct gains from their use. For example, eradicating caterpillars that feed on the crop has the primary benefit of

increasing cabbage yields and improving quality. The three major impacts produce 26 key advantages, ranging from recreational grass protection to human lives saved. Secondary benefits are those that are less evident or immediate as a result of the principal advantages. They might be subtle, less intuitively evident, or long-term in nature. As a result, establishing cause and effect for secondary advantages is more challenging, but they can still be persuasive reasons for pesticide usage.

- Increasing productivity - The use of pesticides in forestry, public health, and the home sphere— and, of course, in agriculture, a sector on which the Indian economy is heavily reliant— has yielded enormous advantages.
- Control of vector-borne diseases- The most efficient way to combat vector-borne illnesses is to destroy the vectors. Insecticides are sometimes the only realistic means to manage insects that transfer illnesses like malaria. Disease control measures are especially critical for cattle.
- Other concerns include transportation, sports complexes, and construction - Pesticides, particularly herbicides, are widely used in the transportation industry. On sports fields, cricket grounds, and golf courses, herbicides and insecticides are used to preserve the turf. Insecticides keep termites and other wood-boring insects out of houses and other wooden structures.

### **Pesticides Detrimental Effect**

- **Toxicity and health consequences in humans**

Pesticides have the most significant effects on human life and health. Every year, 3 million acute pesticide poisoning cases are recorded globally; 2 million of them are suicide attempts, while the remainder are occupational or accidental poisoning cases. Despite pesticide use restrictions and regulations, India accounts for one-third of all poisoning incidents worldwide. In India, the first significant pesticide-related tragedy occurred in Kerala in 1953, when 108 people died from parathion poisoning. The Bhopal Gas Tragedy at the Union Carbide Industry in Bhopal (MP) in 1984 was the world's worst industrial accident involving a chemical plant. At least 3000 individuals have died as a result of breathing methyl isocyanate vapour.

- **Effect on wildlife**

Fish, birds, and mammals are valuable resources to humans and vital components of the ecosystem. Parks, fields, lawns, golf courses, and other open spaces, as well as neighbouring woodland regions and streams, all offer habitat for animals. As a result, caution should be exercised while using pesticides in these locations. The degradation of habitat, which is frequently the consequence of industrial, agricultural, residential, or recreational development, is a serious issue for most wildlife. If animal habitat is threatened or destroyed as a result of unintentional pesticide exposure, the wildlife is also endangered. Sub-lethal pesticide levels in diets can have an impact on animal reproduction. Because all living things are connected in a complex, finely balanced network, the extinction of one species can trigger a detrimental chain reaction that affects many others, making recovery difficult, if not impossible.

- **Effect on soil fertility**

Millions of small creatures, including fungus, bacteria, and a variety of others, live in a tablespoon of good soil. These bacteria serve an important function in assisting plants in using the nutrients they require to develop and survive in the soil. Microorganisms also aid in the storage of water and nutrients, the regulation of water flow, and the filtering of contaminants in the soil. Misuse of chemical fertilisers and pesticides has comparable effects on soil organisms as overuse of antibiotics in humans. Chemicals used indiscriminately may

work for a few years, but there aren't enough beneficial soil organisms to hang on to the nutrients beyond that.

- **Residues of insecticides**

Only a little portion of a pesticide sprayed to a crop (1.0 percent) reaches the target pests, while the rest (>99.0 percent) contaminates soil, water, air, food, feed, forage, and other commodities. Pesticide residues such as DDT, BHC, and other insecticides have been discovered in nearly 100% of the human population. Pesticide residue has been found in all sorts of food goods, vegetable oils, milk and milk products, spices, and honey in various parts of India, according to a monitoring survey. DDT contamination was found in 37 percent of milk samples, above the MRL of 0.05 mg/kg. In comparison, just 1-2 percent of the worldwide sample of food goods contained residues over the MRL.

- **Non-target organism toxicity**

The majority of common insecticides and pesticides used in forestry and agriculture are non-toxic and have a comparable effect on all living things. Pesticides have an impact on a wide range of living organisms, including natural enemies, pollinators, domestic and wild animals, birds, fish, and other aquatic and terrestrial organisms, as well as soil fauna.

- **Insect resurgence**

Resurgence refers to an abnormal rise in insect population or damage that often exceeds the level of economic injury.

- **Other harmful effect of pesticides**

Pesticides used inadvertently on commonly farmed crops, vegetables, and fruit plants have been proven to impact them from germination through harvest. In buildings and godowns, volatile fumigant insecticides may cause unintentional fires and explosions. Pesticides can have a direct effect on plants by influencing their growth, as well as an indirect effect by imparting an off-flavor to their edible sections.