SABUJEEMA

An International Multidisciplinary e-Magazine

Volume 1| Issue 3 | June, 2021

www.sabujeema.com

WELLNESS

PESTICIDE POLLUTION IS A THREAT TO ENVIRONMENT

-R. Jayashree, R. Murugaragavan, S. S. Rakesh, R. Shanmugasundaram & P. T. Ramesh

"Read More, Grow More"

editorsabujeema@gmail.com

Sabujeema Sabujeema

sabujeema-international-multidisciplinary-e-magazine

Volume 1 - Issue 3 - June 2021

SABUJEEMA

An International Multidisciplinary e-Magazine

PESTICIDE POLLUTION IS A THREAT TO ENVIRONMENT

[Article ID: SIMM0062]

R. Jayashree
Department of Soils and Environment, Agricultural College and Research Institute, Tamil Nadu Agricultural University, Madurai-625104, Tamil Nadu, India

R. Murugaragavan
Department of Soils and Environment, Agricultural College and Research Institute, Tamil Nadu Agricultural University, Madurai-625104, Tamil Nadu, India

S. S. Rakesh
Department of Environmental Sciences, AC&RI, Tamil Nadu Agricultural University, Coimbatore-641003, Tamil Nadu, India

R. Shanmugasundaram
Department of Soils and Environment, Agricultural College and Research Institute, Tamil Nadu Agricultural University, Madurai-625104, Tamil Nadu, India

P. T. Ramesh
Department of Soil Science and Agricultural Chemistry, AC&RI, TNAU, Killikulam-628252, Tamil Nadu, India

ABSTRACT

In 1939, Dichloro-Diphenyl-Trichloroethane (DDT) was discovered, which has become extremely effective and rapidly used as the insecticide in the world. However, twenty years later, due to biological effects and human safety, DDT has been banned in almost 86 countries. Since the use of pesticides in agriculture inevitably leads to exposure of non-target organisms (including humans), undesirable side-effects may occur on some species, communities or on ecosystems as a whole. The pesticides which reach the soil or plant material in the target area begin to disappear by degradation or dispersion. Pesticides may volatilise into the air, runoff or leach into surface water and groundwater, be taken up by plants or soil organisms or stay in the soil. The total seasonal losses in runoff for soil-surface applied pesticides average about 2% of the application and rarely exceed 5-10% of the total applied. Pesticides can cause major damage to aquatic life, with fish kills as the most visible exponent. Aquatic toxicity of pesticides often is assessed by determining toxicity to algae, crustaceans and fish, representing three major trophic levels.

Keywords: DDT, Pesticides, toxicity, biomagnifications, immunodisfunction

INTRODUCTION

Pesticides are chemical substances that are meant to kill pests. In general, a pesticide is a chemical or a biological agent such as a virus, bacterium, antimicrobial, or disinfectant that deters, incapacitates, kills, pests. Pesticides are commonly used to eliminate or control a variety of agricultural pests that can damage crops and livestock and reduce farm productivity. Many ancient civilizations used pesticides to protect their

crops from insects and pests. Ancient Sumerians used elemental sulfur to protect their crops from insects. Whereas, Medieval farmers experimented with chemicals using arsenic, lead on common crops. The Chinese used arsenic and mercury compounds to control body lice and other pests. While, the Greeks and Romans used oil, ash, sulfur, and other materials to protect themselves, their livestock, and their crops from various pests. Meanwhile, in the nineteenth century, researchers focused more on natural techniques involving compounds made with the roots of tropical vegetables and chrysanthemums. In 1939, Dichloro-Diphenyl-Trichloroethane (DDT) was discovered, which has become extremely effective and rapidly used as the insecticide in the world. However, twenty years later, due to biological effects and human safety, DDT has been banned in almost 86 countries. Since the use of pesticides in agriculture inevitably leads to exposure of non-target organisms (including humans), undesirable side-effects may occur on some species, communities or on ecosystems as a whole.

PESTICIDE TYPES

Biodegradable:

The biodegradable kind is those which can be broken down by microbes and other living beings into harmless compounds.

Persistent:

While the persistent ones are those which may take months or years to break down. Another way to classify these is to consider those that are chemical forms or are derived from a common source or production method.

Chemically-related pesticides:

1. Organophosphate: Most organophosphates are insecticides; they affect the nervous system by disrupting the enzyme that regulates a neurotransmitter.

2. Carbamate: Similar to the organophosphorus pesticides, the carbamate pesticides also affect the nervous system by disrupting an enzyme that regulates the neurotransmitter. However, the enzyme effects are usually reversible.

3. Organochlorine insecticides:They were commonly used earlier, but now many countries have been removed Organochlorine insecticides from their market due to their health and environmental effects and their persistence (e.g., DDT, chlordane, and toxaphene).

4. Pyrethroid: These are a synthetic version of pyrethrin, a naturally occurring pesticide, found in chrysanthemums(Flower). They were developed in such a way as to maximise their stability in the environment.

5. Sulfonylurea herbicides: The sulfonylureas herbicides have been commercialized for weed control such as pyrithiobac-sodium, cyclosulfamuron, bispyribac-sodium, terbacil, sulfometuron-methyl Sulfosulfuron, rimsulfuron, pyrazosulfuron-ethyl, imazosulfuron, nicosulfuron, oxasulfuron, nicosulfuron, flazasulfuron, primisulfuron-methyl, halosulfuron-methyl, flupyrsulfuron-methyl-sodium, ethoxysulfuron, chlorimuron-ethyl, bensulfuron-methyl, azimsulfuron, and amidosulfuron.

6. Biopesticides: The biopesticides are certain types of pesticides derived from such natural materials as animals, plants, bacteria, and certain minerals.

Examples of pesticides:

Examples of pesticides are fungicides, herbicides, and insecticides. Examples of specific synthetic chemical pesticides are glyphosate, Acephate, Deet, Propoxur, Metaldehyde, Boric Acid, Diazinon, Dursban, DDT, Malathion, etc.

BENEFITS OF PESTICIDES

The major advantage of pesticides is that they can save farmers. By protecting crops from insects and other pests. However, below are some other primary benefits of it.

1. Controlling pests and plant disease vectors.
2. Controlling human/livestock disease vectors and nuisance organisms.
3. Controlling organisms that harm other human activities and structures.

IMPACT OF PESTICIDES IN ECOSYSTEM:

- The toxic chemicals in these are designed to deliberately released into the environment. Though each pesticide is meant to kill a certain pest, a very large percentage of pesticides reach a destination other than their target. Instead, they enter the air, water, sediments, and even end up in our food.
- Pesticides have been linked with human health hazards, from short-term impacts such as headaches and nausea to chronic impacts like cancer, reproductive harm.
- The use of these also decreases the general biodiversity in the soil. If there are no chemicals in the soil there is higher soil quality, and this allows for higher water retention, which is necessary for plants to grow.

An application of pesticide, depending on crop stage, formulation, intended target, application technique, and weather conditions is distributed between soil, plant foliage or crop residues, and losses due to drift. When pesticides are applied from an aircraft, up to 50% may drift out of the target area . When a spray boom is used, losses due to drift are smaller but still significant: 1-10% and 10-30% . Adjuvants used in the formulation of the pesticide can change the agronomic effects (effectiveness, phytotoxicity) of the formulated product. Adjuvants may also affect the environmental impact, as dispersion patterns may be altered and the functional activity period of the active ingredient may be lengthened or its degradation delayed.

The pesticides which reach the soil or plant material in the target area begin to disappear by degradation or dispersion. Pesticides may volatilise into the air, runoff or leach into surface water and groundwater, be taken up by plants or soil organisms or stay in the soil. The total seasonal losses in runoff for soil-surface applied pesticides average about 2% of the application and rarely exceed 5-10% of the total applied.

The fraction removed by leaching is generally less. In contrast, volatilisation losses of 80-90% have sometimes been measured within a few days after application. Concern about the presence of pesticides in surface water dates from the 1960s, when residues of chlorinated hydrocarbon

insecticides getting into bodies of water were shown to be directly toxic to aquatic organisms. During the 1970s and 1980s, increasing numbers of pesticides were found in groundwater., causing great concern, as groundwater is a major source for drinking water in many countries.

PESTICIDE BEHAVIOUR IN SOIL:

The following processes determine pesticide behaviour in soils: 1. degradation by soil microorganisms; 2. chemical degradation (e.g. hydrolysis); 3. sorption and binding by organic and mineral soil components; 4. uptake by plant roots; 5. volatilisation; 6. the diluting effects of water flow processes.

Toxicology of pesticides Pesticides are generally cause unintended environmental effects, since they are not fully selective to the target organism. Organisms may take up pesticides through ingestion of food and water, respiration and through contact with skin or exo-skeleton. The chemical that crosses the various barriers of the body reaches the metabolising tissue or a storage depot. Toxicity of a chemical usually is expressed as the effective concentration or dose of the material that would produce a specified effect in 50% of a large population of a test species. The pesticide compound will accumulate in organisms of the food chain with successive increases at each step. This process is termed biomagnifications. Clearly, a pesticide which bioaccumulates is potentially more harmful to the environment than a substance with similar exposure and toxicity but which does not bioaccumulate. Toxic effects and in particular those of chronic nature can be very diverse. In the assessment of pesticide toxicity to humans phenomena such as carcinogenesis, immunodisfunction, mutagenesis, neurotoxicity and teratogenesis should be considered along with toxicity in the restricted sense. Recent evidence indicates that pesticides may damage the immune system and can mimic hormones and may thus disrupt the endocrine system in both humans and animals, causing a variety of disorders .Human health issues such as increased incidence of breast cancer, prostate cancer, testicular cancer, endometriosis, birth defects in the male reproductive tract, and reductions in sperm count have been associated with the presence of endocrine disrupting chemicals in the environment. Whereas data on acute toxicity to humans (based on tests with other mammals) are available for virtually all pesticides, data on chronic toxicity, in particular regarding the newly discovered hazards outlined above, are insufficient for a many pesticides. The fact that it has taken several decades to discover that some of the most commonly used pesticides or their metabolites are endocrine disruptors is upsetting. It supplies a powerful case to those arguing that as our knowledge of the effects of pesticides on humans and the natural environment by definition is incomplete, the 'precautionary principle' should be applied by rigorously limiting exposure to pesticides.

Although most pesticide use is directed to the control of pests on above-ground plant parts, a large proportion of the pesticide reaches the soil. The biological population of the soil consists among others of bacteria, fungi, algae, earthworms and insects . It is important to consider the potential of pesticides for adverse effects on the soil microflora, which has a critical role in the maintenance of soil fertility. A large number of studies have shown that the effect of properly applied pesticides on the

functioning of the soil microbial process often is limited, as affected soil organisms can be replaced by more resistant ones. However, it is hard to predict the long-term effects of such structural changes in the soil microflora, as they may lead to changes in the occurrence of soil-borne pathogens).

Birds are among the most valued forms of wildlife, because of their conspicuousness and aesthetic appeal. By the early 1950s, it was well established that dead birds were commonplace in fields sprayed with DDT or other insecticides. In these cases mortality generally resulted from secondary poisoning, the birds eating insects disabled by insecticides. The former practice of treating seeds with organochlorine insecticides resulted in extensive mortality of many seed-feeding birds. When insufficient quantity of pesticide is consumed to cause mortality, sublethal effects may occur. DDT contamination may disturb reproductive behaviour and can cause eggshell thinning, which was shown to be a major mechanism of pesticide impact on avian populations . Data on acute bird toxicity are available for most pesticides , but data on more subtle sublethal effects are often lacking. Pesticide related deaths of mammals usually result from feeding on contaminated sources. Predatory mammals accumulate higher residues than herbivores. Widespread mortality of wild mammals in association with major pest control programmes has been reported, in particular when organochlorine pesticides were used. Peri and neonatal exposure of mammals to pesticides such as aldrin, atrazine, chlordane and dieldrin has shown these substances can elicit a variety of perturbations in the sexual differentiation of mammals. Pesticides can cause major damage to aquatic life, with fish kills as the most visible exponent. Aquatic toxicity of pesticides often is assessed by determining toxicity to algae, crustaceans and fish, representing three major trophic levels.

CONCLUSION:

Enormous use of pesticide in agriculture that pose problem in surrounding life forms and its ecosystem by various means and ways to spoil the ecosystem and its structure and functions. The best way to protect the environment by using biopesticides and biocontrol agents to safeguard the ecosystem.

REFERENCES

Hayo M.G. van der Werf. 1996. Assessing the impact of pesticides on the environment. Agriculture, Ecosystems and Environment. 60: 81-96

Penrose, L.J., Thwaite, W.G. and Bower, C.C., 1994. Rating index as a basis for decision making on pesticide use reduction and for accreditation of fruit produced under integrated pest management. Crop Prot., 13: 146-152.

WHO-UNEP, 1989. Public health impact of pesticides used in agriculture. World Health Organization-United Nations Environment Programme, Geneva, Switzerland.