



IMPACT OF PESTICIDE ON SOIL, PLANTS AND HUMAN HEALTH

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ABSTRACT

Pesticides are used to kill the pests and insects which attack on crops and harm them. Different kinds of pesticides have been used for crop protection for centuries. Pesticides benefit the crops; however, they also impose a serious negative impact on the soil. Excessive use of pesticides may lead to the destruction of biodiversity. Many birds, aquatic organisms and animals are under the threat of harmful pesticides for their survival. Pesticides are a concern for sustainability of environment and global stability. Pollution as a result to overuse of pesticides and the long term impact of pesticides on the environment are also discussed in the paper.

I INTRODUCTION

Pesticides constitute any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest. They can also serve as plant regulators, defoliants, or desiccants. Chemicals have long been used to control pests. Sumerians already employed sulfur compounds to control insects and mites 4500 years ago. Pyrethrum, a compound derived from the dried flowers of *Chrysanthemum cinerariaefolium*, has been applied as an insecticide for over 2000 years. Salt or sea water has been used to control weeds. Inorganic substances, such as sodium chlorate and sulfuric acid, or organic chemicals derived from natural sources were widely employed in pest control until the 1940s. During World War II (1939-1945), the development of pesticides increased, because it was urgent to enhance food production and to find potential chemical warfare agents [3]. Consequently, the 1940s witnessed a marked growth in synthetic pesticides like DDT, aldrin, dieldrin, endrin, parathion, and 2,4-D. In the 1950s, the application of pesticides in agriculture was considered advantageous, and no concern about the potential risks of these chemicals to the environment and the human health existed.

The best pesticide policies need to reconcile environmental concerns with economic realities – pest management is mandatory, and farmers must survive economically. A number of studies have described the problems that not using pesticides would cause. Without pesticides, food production would be lower, and larger cultivated farm areas would be necessary to produce the same amount of food, which would impact the wildlife habitat. More frequent cultivation of the fields would increase soil loss due to erosion, too. Knutson et al. have pictured the U.S. society without pesticides: agricultural production would decrease, food prices would rise, farmers would be less competitive in global markets, and U.S. exports would drop, leading to many job losses.



Despite their benefits, pesticides can be hazardous to both humans and the environment. Countless chemicals are environmentally stable, prone to bioaccumulation, and toxic. Because some pesticides can persist in the environment, they can remain there for years. Environmental contamination or occupational use can expose the general population to pesticides residues, including physical and biological degradation products present in the air, water, and food.

There are various ways to group pesticides, including classification based on the pests they control. Some example, insecticides combat insect growth or survival, herbicides act against plants, weeds, and grasses, rodenticides tight against rats and other rodents, avicides act against bird populations, fungicides attack fungi, and nematicides combat nematodes. The global pesticide market divided according to the type of pesticide is as follows: 42.48% herbicides, 25.57% insecticides, 24.19% fungicides, and 7.76% other types of pesticides. Pesticides grouping can also rely on their chemical structure. Organophosphorus (chlorpyrifos and diazinon), carbamates (carbaryl and aldicarb), organochlorine (DDT and aldrin), pyrethrins and pyrethroids (cyfluthrin and cypermethrin), benzoic acids (dicamba), triazines (atrazine and simazine), phenoxyacetic derivatives (2,4-D), dipyrindyl derivatives (diquat and paraquat), glycine derivatives (glyphosate), and dithiocarbamates (maneb and ziram).

Pesticides and human health

Many workers and residents, especially in the rural sector, are in contact with pesticides on a daily basis, so they are at high risk of poisoning by these compounds. This exposure can cause neuropsychiatric sequelae (mood disorders, depression, and anxiety), because many pesticides underlie changes in the function (e.g., cholinergic crisis) of the central, peripheral, and autonomic nervous system, which are often followed by suicide attempts. In addition to being causative agents of neuropsychiatric disorders that might culminate in suicide, these effects may lead to the use of pesticides as a weapon. According to data released by the World Health Organization (WHO) [89], suicide by pesticides is common in many Asian and Latin American countries. Pesticides are often poorly controlled and widely available, particularly in countries of low and middle income [42]. The first epidemiological reports of suicides involving pesticides appeared in the beginning of the 1990s. Currently, homicides and suicides involving pesticides have raised the concern of many organizations and governments as, depression and suicide clearly correlate with high exposure to pesticides. This concern has motivated and still motivates many studies into how and why exposure to pesticide occurs; researchers have also caught methods to solve this serious social problem.

Detoxification measures after poisoning are crucial, no matter whether exposure was intentional, accidental, or occupational. Recognition of poisoning is easy when the patient knows which pesticide he/she was exposed to or when symptoms are typical. However, poisoning may be unclear if the patient has generalized symptoms. Therefore, along with the procedures to terminate contamination, an investigation with family members and the people present at the time of contamination, and information on patient care should exist. These individual will be questioned, about the way in which the patient was exposed to the contaminant and about the possibility of simultaneous

intoxication with other poisons. Along with these recognition steps the analytical detection of pesticides is mandatory.

Decontamination methods must be combined with care and maintenance of vital signs and administration of antidotes. It is important to bear in mind that new cases of contamination may appear. Furthermore, professionals as well as other patients staying in the same ward as the contaminated individuals must wear protective equipment until decontamination and treatment are complete. Methods exist to decontaminate patients poisoned via gastrointestinal tract. Gastric lavage is extremely invasive and aggressive to the body, so it is indicated only in potentially fatal cases. The cathartic method, which elicits bowel movement to force excretion of the pesticide, is not suitable when poisoning induces diarrhea. Administration of adsorbents is an alternative – adsorbents can bind to the toxic agent, to form a stable compound. This compound is not absorbed by the gastrointestinal tract and is subsequently excreted with the feces. This method is commonly performed in conjunction with the cathartic method. The most usual adsorbent is activated charcoal, but it does not adsorb all pesticides. Finally, the syrup ipecac, a medicinal plant, can help to induce vomit. However, this procedure is contraindicated in the case of ingestion of hydrocarbons or corrosive substances. In the case of dermal exposure, it is necessary to start the decontamination process by placing the patient under a shower and using soap and water to remove the chemicals from the skin, hair, nails, ear canals, and other possibly contaminated body parts. If contact occurs by the ocular route, it is essential to rinse the eyes with plenty of clean water. All the materials and clothes used by the patient at the time of intoxication, like clothes and shoes, should be removed. In cases of large contamination, it is crucial to consider the need to decontaminate all the people who work in the emergency system. Because hundreds of pesticides compositions exist, we will focus on the clinical profile and treatment of pesticides that cause major poisoning, in terms of quantity and severity of cases. In general, treatment aims to override the mechanism of action of the toxic pesticides, and many possibilities exist.

Pesticides and environmental health

Pesticides reach the environment primarily during preparation and application. Application can take place via different techniques, depending on factors such as the formulation type, the controlled pest and, the application timing. In agriculture, it is possible to apply pesticides to the crop or to the soil. Liquids sprays are commonly used in crops; for example, boom sprayers, tunnel sprayers, or aerial application. Systemic pesticides can also be employed. As for soils, pesticides can be applied as granules, injected as a fumigant, or sprayed onto the soil surface, which is possibly followed by pesticide incorporation into the soil top layer. Seeds are sometimes treated with pesticides prior to planting. After application, pesticides can be taken up by target organisms, degraded, or transported to the groundwater; they can also enter the surface water bodies, volatilize to atmosphere, or reach non-target organisms by ingestion, for example. The physical and chemical properties of the pesticide, soil, site conditions, and management practices influence the behavior and fate of pesticides. Concerning the physical and chemical properties of pesticides, their solubility determines their transport in surface runoff and their leaching to

groundwater. The higher the solubility, the greater the carrying and leaching. The partition coefficient also affects the behavior of pesticides, and many chemicals do not leach because soil particles adsorb them.

Adsorption depends on the chemical and also on the soil type. The volatility of pesticides indicates their tendency to become a gas; the higher the volatility (high vapor pressure), the larger their loss to the atmosphere. Environmental conditions such as temperature and humidity impact volatility, which can occur from soil, plants, or surface water, and may continue for several days or weeks after pesticide application. In the atmosphere, the chemicals can be transported over long distances. Subsequent atmospheric deposition can contribute to surface water pollution. Finally, the degradation of pesticides that also determines the behavior and fate of these compounds in the environment. Degradation (their break down into other chemical forms) can occur by photodecomposition, microorganisms, and a variety of chemical and physical reactions. Pesticides with low biodegradation are called persistent, they can remain in the environment for a long time.

Soil properties can also affect the movement of pesticides. In relation to the soil texture, coarse-textured sands and gravels have high infiltration capacities, and water tends to percolate through the soil and reach groundwater. Fine-textured soils such as clays generally have low infiltration capacities, so water tends to run off, reaching streams and lakes. Moreover, soil containing more clay in its composition bears larger surface area to adsorb pesticides. Regarding permeability, highly permeable soils allow water to move more easily. This water may contain dissolved pesticides, which will reach groundwater. Texture influences soil permeability. Ultimately, soils with high organic matter content can adsorb pesticides and retain water with dissolved chemicals. Moreover, these soils possess a larger population of microorganisms that can degrade the pesticides.

The site conditions that can determine pesticide behavior in the environment are depth until the groundwater, geological conditions, topography, and climate. In the case of shallow groundwater, the soil filters smaller amount of water with chemicals and adsorbs and degrades lower quantities of pesticides, so contamination is a major concern. Regarding the geological conditions, the presence of wells, sinkholes, and highly permeable materials, such as gravel deposits, facilitates groundwater contamination. On the other hand, the existence of drainage ditches, streams, ponds, and lakes increases the probability that rainfall or irrigation runoff will contaminate surface water. In relation to topography, flat landscapes, areas with closed drainage systems where water drains toward the center of a basin, and especially sinkhole areas, are more susceptible to groundwater contamination. As for climate, large rainfall or irrigation may culminate in large amounts of water percolating through the soil, to reach groundwater. Rainfall can also carry pesticides to surface waters, contaminating rivers, lakes, and seas, and taking these chemicals to distant places. The fact that a contaminant is present in the environment does not necessarily mean that it will reach an organism. The contaminant and the organism must overlap in time and space for exposure to occur. Contact can be dermal or oral or even via inhalation, gills, and, more rarely, injection.

Once pesticides reach non-target organisms, they may undergo biotransformation via reactions like hydrolysis, oxidation, reduction, or conjugation catalyzed by liver enzymes. Biotransformation is an effort of the organism to

detoxify and eliminate xenobiotics, but this process can also produce metabolites that are more toxic than their parent compound, a phenomenon called bio-activation. An example of bio-activation is the biotransformation of DDT, which is not highly toxic to birds, into DDE, which causes thinning of eggshells because it disrupts calcium metabolism.

Pyrethrins and Pyrethroids are non-persistent pesticides used worldwide as insecticides in agriculture, forestry, households, public health and stored products. Therefore, urban and peri-urban populations are potentially chronically exposed to these compounds.

Pyrethrins and Pyrethroids act on sodium channels in the nervous system of numerous phyla, such as arthropods and chordates. Pyrethrins and Pyrethroids present low acute toxicity to mammals and birds and constitute one of the safest insecticides to man. However, at low concentrations these chemicals are acutely toxic to a wide range of aquatic organisms and insects. Pyrethrins are natural compounds extracted from chrysanthemum flowers; pyrethroids are synthetic compounds whose structure resembles the structure of pyrethrins. Light degrades these chemicals. Modification of pyrethroids over the years has enhanced their insecticidal activity and persistence in the environment. Compared with pyrethrins, pyrethroids are more stable under light, which incurs increased environmental risks associated with their use. Pyrethrins and Pyrethroids display high selectivity and easy degradability in the environment as compared with other pesticides, been a favored replacement for organophosphorus compounds.

II CONCLUSION

The data on environmental-cum-health risk assessment studies may be regarded as an aid towards a better understanding of the problem. Data on the occurrence of pesticide-related illnesses among defined populations in developing countries are scanty. Generation of base-line descriptive epidemiological data based on area profiles, development of intervention strategies designed to lower the incidence of acute poisoning and periodic surveillance studies on high risk groups are needed. Our efforts should include investigations of outbreaks and accidental exposure to pesticides, correlation studies, cohort analyses, prospective studies and randomised trials of intervention procedures. Valuable information can be collected by monitoring the end product of human exposure in the form of residue levels in body fluids and tissues of the general population. The importance of education and training of workers as a major vehicle to ensure a safe use of pesticides is being increasingly recognised. There is a need to convey the message that prevention of adverse health effects and promotion of health are profitable investments for employers and employees as a support to a sustainable development of economics. To sum up, based on our limited knowledge of direct and/or inferential information, the domain of pesticides illustrates a certain ambiguity in situations in which people are undergoing life-long exposure. There is thus every reason to develop health education packages based on knowledge, aptitude and practices and to disseminate them within the community in order to minimise human exposure to pesticides.



REFERENCES

1. Altenbach JS, Geluso KN, Wilson DE. Population size of *Tadaria brasiliensis* at Carlsbad Caverns in 1973. In: Grnoways HH, Baker RJ, editors. Biological investigations in Guadalupe Mountains National Park. 1979. p. 341. Texas, Natl Park Service Proc Trans Ser No 4.
2. Ambrosi D, Isensee A, Macchia J. Distribution of oxadiazon and phosalone in an aquatic model ecosystem. American ChemSoci. 1978;26(1):50–53.
3. Andreu V, Pico' Y. Determination of pesticides and their degradation products in soil: critical review and comparison of methods. Trends Anal Chemistry. 2004;23(10–11):772–789.
4. Arias RN, Fabra PA. Effects of 2,4-dichlorophenoxyacetic acid on *Rhizobium* sp. growth and characterization of its transport. ToxicolLett. 1993;68:267–273.
5. Asteraki EJ, Hanks CB, Clements RO. The impact of the chemical removal of the hedge-based flora on the community structure of carabid beetles (Col. Carabidae) and spiders (Araneae) of the field and hedge bottom. J ApplEnt. 1992;113:398–406.
6. Barcelo D, Porte C, Cid J, Albaiges J. Determination of organophosphorus compounds in Mediterranean coastal waters and biota samples using gas chromatography with nitrogen–phosphorus and chemical ionization mass spectrometric detection. Int J Environ A Chem. 1990;38:199–209.
7. Barcelo' D, Hennion MC. Trace Determination of Pesticides and Their Degradation Products in Water. Amsterdam, The Netherlands: Elsevier; 1997. p. 3.
8. Barron MG, Galbraith H, Beltman D. Comparative reproduction and developmental toxicology of birds. Comp. Biochem Physiol. 1995;112c:1–14.
9. Becker PH. Seabirds as monitor organisms of contaminants along the German North Sea coast. Hel Meerr. 1989;43:395–403.
10. Behera B, Singh SG. Studies on Weed Management in Monsoon Season Crop of Tomato. Indian J Weed Sci. 1999;31(1–2):67.
11. Belzer W, Evans C, Poon A. FRAP study report, 1998. Vancouver, BC: Aquatic and Atmospheric Science Division, Environment Canada; 1998. Atmospheric concentrations of agricultural chemicals in the Lower Fraser Valley.
12. Bernardz JC, Klem D, Goodrich LJ, Senner SE. Migration counts of raptors at Hawk Mountain, Pennsylvania, as indicators of population trends, 1934–1986. Auk. 1990;107:96–109.
13. Bevans HE, Lico MS, Lawrence SJ. Water quality in the Las Vegas Valley area and the Carson and Truckee Riverbasins, Nevada and California, 1992–96. Reston, VA: USGS.U.S. Geological Survey Circular; 1998. p. 1170.

14. Bhatia MR, Fox-Rushby J, Mills M. Cost-effectiveness of malaria control interventions when malaria mortality is low: insecticide-treated nets versus in-house residual spraying in India. *Soil Sci Med.* 2004;59:525.
15. Vengatesan K., and S. Selvarajan: Improved T-Cluster based scheme for combination gene scale expression data. *International Conference on Radar, Communication and Computing (ICRCC)*, pp. 131-136. IEEE (2012).
16. Kalaivanan M., and K. Vengatesan.: Recommendation system based on statistical analysis of ranking from user. *International Conference on Information Communication and Embedded Systems (ICICES)*, pp.479-484, IEEE, (2013).
17. K.Vengatesan, S. Selvarajan: The performance Analysis of Microarray Data using Occurrence Clustering. *International Journal of Mathematical Science and Engineering*, Vol.3 (2) ,pp 69-75 (2014).
18. Sayyed same, Sarfaraz khan,K.Vengatesan, S. B , Sanjeevikumar P,Jaspreetkuar, Paper entitled “ Smart City Automatic Garbage Collection for a better Tomorrow” *International Journal of Pure and Applied Mathematics*, Volume 114 No. 9 2017, 455-463.