



Effects of Chemical Pesticides on Human Health and Environment

Pavan M. Kadam

Department of Chemistry, Shri Vyankatesh Arts, Commerce & Science College, Deulgaon Raja Dist. Buldna, Maharashtra.

Abstract : Pesticides are chemicals used to control pests and increase crop production, but they can have negative effects on human health and the environment. Pesticide exposure can lead to acute poisoning, chronic health effects, birth defects, respiratory problems, and skin irritation in humans. Pesticides can also contaminate soil and water, harm non-target organisms, reduce biodiversity, and contribute to the development of pest resistance and outbreaks. It is crucial to use pesticides responsibly and follow safety precautions to minimize their adverse effects on human health and the environment. So we studied about the commonly used pesticides by farmers and their harmful effects on human body and biodiversity.

Index Terms – Pesticides, environment, health hazards.

I. INTRODUCTION

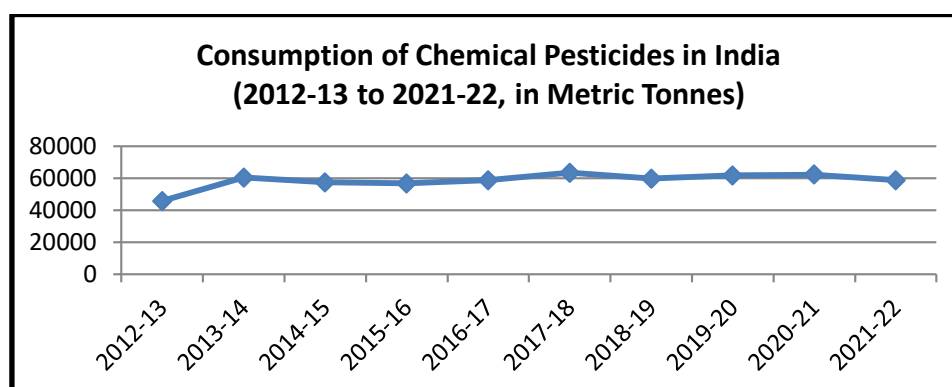
To meet the growing demand for food, pesticides are extensively used in agriculture to protect crops from pests. While the availability of safe and effective pesticides and their responsible use by farmers are crucial for the long-term sustainability of agriculture, pesticides pose a significant threat to the Sustainable development goals due to their potential adverse effects on non-target species and the environment. Exposure to pesticides has been linked to various health impacts on humans, such as cancers, neurological, immunological, and reproductive effects. Pesticides can also contaminate soil and water, reduce biodiversity, and contribute to pest resistance and outbreaks. The future of Indian farming is hazardous. Hazardous chemicals have begun getting into underground water supplies as a result of overuse of pesticides. Therefore, it is most important to understand the quantity of pesticide use and precautions to be taken to minimize their harmful effects on human health and environment.

In India, a lot of people work in agriculture because it's an important part of the country's economy. India is one of the top countries in the world when it comes to making and using pesticides. Many years ago, there was something called the Green Revolution that helped India use a lot more pesticides. But now, the country is using less pesticide because some of them are banned and farmers are using better ways to control pests. Even though the use of pesticides has gone down, the country still uses a lot of them. Some states in

India use more pesticides than others, like Maharashtra and Uttar Pradesh. These two states use about 40% of all the pesticides used in the country each year. Punjab is another state that uses a lot of pesticides. Using so many pesticides is not good for the environment and people's health. To address these issues, the Indian government has implemented various policies and programs to reduce the use of harmful pesticides and promote safer and sustainable pest management practices. For instance, the government has banned the use of certain types of pesticides, such as endosulfan and monocrotophos, which have been linked to severe health impacts. The government has also introduced the Integrated Pest Management (IPM) program, which aims to reduce the reliance on pesticides and promote the use of alternative pest control methods, such as biological control and crop rotation.

Many pesticides have been linked to health and environmental problems (1, 2, 3–8), and several pesticides are no longer used in agriculture (2). Pesticide exposure can occur through ingestion, inhalation, or skin contact with the substance. The type of pesticide, the length of exposure, the method of exposure, and the individual health status (such as dietary deficits and the condition of one's skin, for example) all affect the potential health outcome. The agricultural workers and the family members of pesticide applicators are most at danger.

Pesticides may be metabolized, expelled, stored, or bioaccumulated in body fat within a human or animal body (1, 2, 9) A wide range of common foods and drinks, such as cooked meals, water, wine, fruit juices, snacks, and animal feeds, might include pesticide residues (10-17). Only 0.1% of pesticides are estimated to affect the target entity, with the remainder contaminating the environment (18). Most farmers are unaware of the types of pesticides, their levels of poisoning, safety precautions, and the risks they pose to human health and the environment. A significant issue in society is the impact of agricultural pesticides on organisms that are not their intended targets. Several studies have looked at how pesticide exposure affects a variety of health issues, particularly the risk of cancer. This objective of this work is to examine the effects of commonly used pesticides in agricultural and their effect on human health and environment.



Source- Directorate of Plant Protection Quarantine Storage

In addition to direct effect on human health and environment accidents are another threat caused by improper handling of these chemical pesticides. According to NCRB report, around 8000 cases of unintentional ingestion of insecticides/pesticides occurred in 2021 alone, which led to the deaths of 7800 people in India (19). Pesticides are also related to other problems, such as farmer suicides and corporate monopolies. Many research commonly link pesticide exposure to negative health outcomes. Children are the most sensitive category due to their small body mass and age-related potential pesticide exposure risk. Cancer risk has been linked favorably to children's direct contact with pesticides (20). Several epidemiological studies

also demonstrate a link between parental pesticide exposure and the relative risks of childhood cancer (21-22). According to a study that compared pesticide data with medical records, pregnant women who live nine miles from farms where pesticides are sprayed have a higher risk of losing an unborn child to birth abnormalities (23). Parallel to these findings, we discovered a strong correlation between the mortality rate for children under the age of five and pesticides, especially insecticides and other pesticides. According to reports, there is a direct correlation between the use of insecticides and herbicides and asthma diagnoses made before the age of five (24).

Material & Method

Information regarding most common pesticides used by farmer was collected from fertilizers and pesticide stores. We have found 28 pesticides are more commonly used by farmers out of which some are insecticides and fungicides which are Acetamiprid (20%), Azoxystrobin (11%) + Tebuconazole (18.3%), Biphenthrin, Carbendazin (50%), Chlorantraniliprole (18.5%), Clothianidin (50%), Cyantroniliprole 10.26%, Diafenthiuron (50%), Dimethoate, Emamectin Benzoate(95%), Emiamectin benzoate (5%), Ethion technical (54.5%) Fenoxoprop (9.3%), Fipronil (18.87%), Fipronil (5%), Fluopyram (17.7%) + Tebuconazole (17.7%) Hexaconazole, Imazethopyr (35%) + Imazomox (35%), Imidacloprid (17.80%), Lambdacyhalothrin (5%) Monocrotophos (36%), Potassium Phosphate, Profenofos (40%) + Cypermethrin (4%), Propiconazole (25%), Propineb, Spirotetramat (11.01%), Imidacloprid (11.01%), Tebuconazole(50%) + trifloxystrobin (25%), Thiamethoxam (25%), Thiamethoxam(12.6%) + Lambdacyhalothrin (9.5%), Triazophos (60%). We studied the effects of these pesticides and fungicides on human health and environment.

Result & Discussion

Some of the common effects of pesticides on human health:

1. Acute Poisoning: Pesticides can cause acute poisoning, which can lead to symptoms such as nausea, vomiting, diarrhea, headaches, dizziness, and even death.
2. Chronic Health Effects: Long-term exposure to pesticides can lead to chronic health effects such as cancer, reproductive and developmental disorders, neurological disorders, and endocrine disruption.
3. Birth Defects: Pesticide exposure during pregnancy can increase the risk of birth defects in newborns.
4. Respiratory Problems: Pesticide exposure can cause respiratory problems such as asthma, chronic bronchitis, and chronic obstructive pulmonary disease (COPD).
5. Skin Irritation: Pesticides can cause skin irritation and allergic reactions in some people.

Some of the effects of pesticides on the environment:

1. Soil Contamination: Pesticides can contaminate soil, which can affect the health of plants and animals.
2. Water Pollution: Pesticides can enter the water supply through runoff and can contaminate rivers, lakes, and groundwater, which can affect the health of aquatic life and wildlife.
3. Loss of Biodiversity: Pesticides can harm non-target organisms, including beneficial insects, birds, and mammals, which can lead to a loss of biodiversity.

4. Resistance: Repeated use of pesticides can lead to the development of resistance in pests, which can make the pesticides less effective over time.
5. Pest Outbreaks: Pesticides can kill off beneficial insects and predators that naturally control pests, which can lead to pest outbreaks and the need for more pesticides.

It was found that most of pesticides and fungicides do not have any chronic effect in short term but may cause skin irritation, allergic reactions, eye irritation, and if inhaled may cause respiratory problems. Some pesticides like Carbendazin (50%) Cyantraniliprole (10.26%), Ethion technical (54.5%), Fipronil (18.87%), Lambdacyhalothrin (5%), Monocrotophos (36%), Profenofos (40%) + Cypermethrin(4%), Propiconazole (25%), Propineb may cause serious damage to health by prolonged exposure through inhalation and if swallowed and may cause damage to organs through prolonged or repeated exposure. Spirotetramat (11.01%) + Imidacloprid (11.01%) insecticide and Tebuconazole(50%) + trifloxystrobin (25%) fungicide Suspected of damaging fertility or the unborn child, may cause harm to breast-feed children. Monocrotophos (36%) is banned for use on vegetables due to its harmful effects on health. Triazophos (60%) is banned from August 2018. The use of Triazophos is completely banned with effect from the 31st December, 2020 but it was commonly used by farmers before it was banned. Thus like the harmful effects of pesticides and fungicides on human health they also have adverse effect on environment and biodiversity. Most of insecticides and fungicides are very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment like Carbendazin (50%), Chlorantraniliprole (18.5%), Clothianidin (50%), Cyantraniliprole (10.26%), Diafenthiuron (50%), Emamectin Benzoate(95%), Fenoxoprop(9.3%), Fipronil (18.87%), Fluopyram (17.7%) + Tebuconazole (17.7%), Hexaconazole, Lambdacyhalothrin (5%), Monocrotophos(36%), Profenofos (40%) + Cypermethrin(4%), Propiconazole (25%), Propineb, Spirotetramat (11.01%) imidacloprid (11.01%), Tebuconazole (50%) + trifloxystrobin (25%), Thiamethoxam (25%), Thiamethoxam(12.6%) + Lambdacyhalothrin (9.5%), Triazophos (60%). Some pesticides are harmful to bees like Dimethoate, Emamectin Benzoate(95%), Fipronil (18.87%) , Imidacloprid (17.80%), Thiamethoxam (25%), Triazophos (60%).

Conclusion

The use of chemical pesticides is increasing over the years, the usage of pesticides should be reduced by the implementation of measures like biological pest management and good farming practices. Despite the fact that pesticides are designed to avoid, get rid of, or control hazardous pests, numerous studies have raised questions about the dangers that pesticides pose to the environment and human health. From this it was observed that many pesticides on long term exposure may cause chronic diseases to farmers and their family members and the peoples who are in regular contact with these pesticides. So through educational programmes, farmers should be made aware of misuse, negligent use of non-purpose thread or application errors, such as the wearing of protective clothing during application, adherence to personal hygiene rules, excessive use and unnecessary duplication, exposure to chemicals, and contact with them. Most of the pesticides were harmful to aquatic plants and animals hence should not be used near water bodies, aquaculture

or pisciculture. Some pesticides were harmful to bees so avoid using them in flowering season. Additionally, policymakers can promote policies that incentivize sustainable agriculture and reduce the use of harmful pesticides. By doing so, we can ensure that agriculture remains a sustainable and healthy sector in India for years to come. Overall, it is important to use pesticides responsibly and follow all safety precautions to minimize their negative effects on human health and the environment.

REFERENCES

- [1] World Health Organization. *Public Health Impact of Pesticides Used in Agriculture*. England: World Health Organization (1990).
- [2] Alewu B, Nosiri C. Pesticides and human health. In: Stoytcheva M, editor. *Pesticides in the Modern World – Effects of Pesticides Exposure*. InTech (2011). p. 231–50. Available from: <http://www.intechopen.com/books/pesticides-in-the-modern->
- [3] Hayes TB, Case P, Chui S, Chung D, Haeffele C, Haston K, et al. Pesticide mixtures, endocrine disruption, and amphibian declines: are we underestimating the impact? *Environ Health Perspect* (2006) 114:40–50. doi:10.1289/ehp.8051
- [4] Sanborn M, Kerr KJ, Sanin LH, Cole DC, Bassil KL, Vakil C. Non-cancer health effects of pesticides. Systematic review and implications for family doctors. *Can Fam Physician* (2007) 53:1712–20.
- [5] Pimentel D, Burgess M. Environmental and economic costs of the application of pesticides primarily in the United States. In: Pimentel D, Peshin R, editors. *Integrated Pest Management*. New York, Heidelberg, Dordrecht, London: Springer Science + Business Media Dordrecht (2014). p. 47–71.
- [6] Mnif W, Hassine AIH, Bouaziz A, Bartegi A, Thomas O, Roig B. Effect of endocrine disruptor pesticides: a review. *Int J Environ Res Public Health* (2011) 8:2265–2203. doi:10.3390/ijerph8062265.
- [7] Goulson D. Ecology: pesticides linked to bird declines. *Nature* (2014) 511:295–6. doi:10.1038/nature13642
- [8] Zheng S, Chen B, Qiu X, Chen M, Ma Z, Yu X. Distribution and risk assessment of 82 pesticides in Jiulong River and estuary. *Chemosphere* (2016) 144:1177–92. doi:10.1016/j.chemosphere.2015.09.050.
- [9] Pirsahab M, Limoe M, Namdari F, Khamutian R. Organochlorine pesticides residue in breast milk: a systematic review. *Med J Islam Repub Iran* (2015) 29:228.
- [10] McGill AE, Robinson J. Organochlorine insecticide residues in complete prepared meals: a 12-month survey in S.E. England. *Food Cosmet Toxicol* (1968) 6:45–57. doi:10.1016/0015-6264(68)90080-1
- [11] Cabras P, Angioni A. Pesticide residues in grapes, wine, and their processing products. *J Agric Food Chem* (2000) 48:967–73. doi:10.1021/jf990727a
- [12] Zambonin CG, Quinto M, De Vietro N, Palmisano F. Solid-phase micro-extraction – gas chromatography mass spectrometry: a fast and simple screening method for the assessment of organophosphorus pesticides residues in wine and fruit juices. *Food Chem* (2004) 86:269–74. doi:10.1016/j.foodchem.2003.09.025
- [13] Burnett M, Welford R. Case study: coca-cola and water in India: episode 2. *Corp Soc Responsib Environ Mgmt* (2007) 14:298–304. doi:10.1002/csr.97
- [14] Lorenzin M. Pesticide residues in Italian ready-meals and dietary intake estimation. *J Environ Sci Health B* (2007) 42:823–33. doi:10.1080/03601230701555021

- [15] Nag SK, Raikwar MK. Persistent organochlorine pesticides residues in animal feed. *Environ Monit Assess* (2011) 174:327–35. doi:10.1007/s10661-010-1460-1
- [16] Witczak A, Abdel-Gawad H. Assessment of health risk from organochlorine pesticides residues in high-fat spreadable foods produced in Poland. *J Environ Sci Health B* (2014) 49:917–28. doi:10.1080/03601234.2014.951574
- [17] Chourasiya S, Khillare PS, Jyethi DS. Health risk assessment of organochlorine pesticide exposure through dietary intake of vegetables grown in the periurban sites of Delhi, India. *Environ Sci Pollut Res Int* (2015) 22:5793–806. doi:10.1007/s11356-014-3791-x.
- [17] Carriger JF, Rand GM, Gardinali PR, Perry WB, Tompkins MS, Fernandez AM. Pesticides of potential ecological concern in sediment from South Florida Canals: An ecological risk prioritization for aquatic arthropods. *Soil Sediment Contam* 2006; 15: 21-45
- [18] Carriger JF, Rand GM, Gardinali PR, Perry WB, Tompkins MS, Fernandez AM. Pesticides of potential ecological concern in sediment from South Florida Canals: An ecological risk prioritization for aquatic arthropods. *Soil Sediment Contam* 2006; 15: 21-45.
- [19] https://ncrb.gov.in/sites/default/files/ADSI-2021/ADSI_2021_FULL_REPORT.pdf
- [20] Infante-Rivard C, Weichenthal S. Pesticides and childhood cancer: an update of Zahm and Ward's 1998 review. *J Toxicol Environ Health B Crit Rev* 2007; 10: 81-99.
- [21] Davis JR, Brownson RC, Garcia R, Bentz BJ, Turner A. Family pesticide use and childhood brain cancer. *Arch Environ Contam Toxicol* 1993; 24(1): 87-92.
- [22] van Wijngaarden E, Stewart PA, Olshan AF, Savitz DA, Bunin GR. Parental occupational exposure to pesticides and childhood brain cancer. *Am J Epidemiol* 2003; 157: 989-997.
- [23]. Bell EM, Hertz-Picciotto I, Beaumont JJ. A case-control study of pesticides and fetal death due to congenital anomalies. *Epidemiology* 2001; 12: 148-156.
- [24]. Salam MT, Li YF, Langholz B, Gilliland FD. Children's Health Study. Early-life environmental risk factors for asthma: findings from the Children's Health Study. *Environ Health Perspect* 2004; 112: 760-765.