



G- Journal of Environmental Science and Technology

(An International Peer Reviewed Research Journal)

Available online at <http://www.gjestenv.com>

Consequences of Pesticides on Environment: A Review

Sahar Mobin* and Mohd. Kamil Usmani

Department of Zoology, Aligarh Muslim University, Aligarh, Uttar Pradesh, INDIA

ARTICLE INFO

Received: 24 July 2017

Revised : 10 Oct 2017

Accepted: 28 Oct 2017

Key words:

Agriculture, Crops, India, Pest

ABSTRACT

Outrageous use of pesticides has raised major issue of environmental concern. Pesticides cover broad range of insecticides, fungicides, weedicides, herbicides, rodenticides, nematocides, molluscicides, growth regulators etc. Although the purpose of pesticides is to harm only the target pests but if it is not used correctly, they can also harm people or the environment. Agricultural development perpetuates to remain the most paramount objective of Indian orchestrating and policy. In the process of development of agriculture, pesticides have become a consequential implement as a plant protection agent for boosting aliment engenderment. Further, pesticides play a consequential role by keeping many dreadful diseases. However, exposure to pesticides both occupationally and environmentally causes a range of human health quandaries. The objective of this paper is to review effects of pesticides on various biotic and abiotic factors of the environment and to mitigate proper solutions for it.

1) INTRODUCTION

Agriculture is demographically the broadest economic sector and plays a consequential role in the overall socio-economic fabric of India. Indian agriculture is diverse, ranging from impoverished farm villages to developed farms utilising modern agricultural technologies [1]. But in consecutive time, convention of pesticides has immensely increased and lead to hazardous effects on environment by deteriorating air, water and soil quality and ill effects on flora and fauna.

At present, in India proximately 150 pesticides are registered with licit application. Currently, India is the most sizably voluminous engendered of pesticides in Asia and ranks 12th in the world for application of pesticides [2].

Yield of crops gets negatively affected when infested with pests. Pesticides are used in order to make field devoid of pests and to get optimum yield. But to accomplish this, improper usage of pesticides is being done. Enormous usage of pesticides without knowing the actual dosage has raised concernment about environment and human health.

Rashid et al., [3] discussed herbicides and pesticides as potential pollutants leading to global problem. Yang et al., [4] has shown abnormal foraging behaviour in the honey bee by sublethal dosage of imidacloprid. Relya [5] and Rohr et al., [6] shows the effects of agrochemicals on amphibians. Kelly and South [7], Frankenberger et al., [8], Fletcher et al., [9], Locke et al., [10], Hayo and Werf [11], Decourtye et al., [12], Forson and Storfer [13], Relyea and Hoverman [14], Akhtar et al., [15], Agarwal et al., [16], Damalas and Eleftherohorinos, [17], Macneale et al., [18], Casida and Durkin [19], have studied use and effects of pesticides.

2) EFFECTS OF PESTICIDES ON OZONE

Pesticides sprayed on the soil evaporate and damages the protective ozone layer whicheventually results in deleterious

rays from the sun that reaches the earth. Widespread utilization of MtBr, Methyl Bromide as a fumigant has been found to cause Stratospheric Ozone Layer Depletion and results in serious health issues [20].

3) EFFECTS OF PESTICIDES ON SOIL

Beneficial soil microorganism population declines by excessive use of pesticides [21].

According to soil scientist Dr. Elaine Ingham, "If we lose both bacteria and fungi, then the soil degrades. Overuse of chemical fertilizers and pesticides have effects on the soil organism that are similar to human overuse of antibiotics. Indiscriminate use of chemicals might work for a few years, but after a while, there aren't enough beneficial soil organisms to hold onto the nutrients [22]. Pell et al., [23] has discussed potential denitrification and nitrification tests for the evaluation of pesticide's effect on soil. Moorman [24] has thrown light on effects of pesticides on microbes and their processes related to soil fertility. Lang and Cai [25] has reported the effects of chlorothalonil and carbendazim on nitrification and denitrification in soils.

4) EFFECTS OF PESTICIDES ON WATER

Runoff of field water containing pesticide into aquatic ecosystem leads to eutrophication, biomagnifications, and bioaccumulation thus affecting aquatic flora and fauna in a negative way. Groundwater contamination is a worldwide problem. Through a survey around Bhopal it was revealed that 58% drinking water drawn from wells and numerous pumps were adulterated with Organo Chlorine pesticides which was

* Corresponding Author: M/s. Sahar Mobin

Email address: sahar.mobin05@gmail.com

above EPA standards (Kole and Bagchi, 1955) [26]

5) EFFECTS OF PESTICIDES ON PLANTS

Nitrogen fixation is important phenomenon for the poliferationof higher plants. This process is hindered by excessive pesticides present in soil [27].

According to research done by Cornell University, pesticides can kill honeybees that are vectors in cross pollination [28]. Application of insecticides affects the growth of non-target plants as they are not target specific.

6) EFFECTS OF PESTICIDES ON HUMANS

According to California Department of Pesticide Regulation [29], exposure to pesticides can be through inhalation, oral or dermal routes. Small dust particles, vapours of aerosol etc. can be inhaled causing respiratory problems. Orally pesticides can enter body through contaminated food or water leading to digestive disorders. Dermal route include entry via skin causing burns or irritation. It has been observed that the pesticides exposures are increasingly linked to reproductive abnormalities, hormone disruption, diminished intelligence, immune suppression and cancer. Sharma et al. [30] has reported the effects of pesticides on human health and environment.

7) EFFECTS OF PESTICIDES ON ANIMALS

When pesticide is sprayed upon crops it enters the food chain and cause severe health issues to its consumers. The non-targets have to suffer the consequences later. Earthworm known to be farmer's friend has harmful effects on its growth and reproduction [31] Pesticides are persistent and bio accumulates inside the body of the organism i.e., when an organism consumes it the toxic level increases inside their body over a period of time due to bioaccumulation [28].

Water contaminated with pesticides may harm fish and other aquatic biota [32]. Surface run off of pesticide into streams and rivers can be extremely lethal to aquatic fauna, sometimes results in death of fishes in a particular stream. Regular exposure to sub lethal doses of pesticides can cause behavioural and physiological changes in fish populations, such as decreased immunity to disease, abandonment of nests and broods and reduced predator avoidance [32]. Bioaccumulation of pesticide is very common. Pesticide accumulates in water bodies to such an extent that can kill zooplankton, the major source of food for young fishes [33].

Amphibian's populations have declined across the globe in the past several decades. The reason is unexplained which are thought to be varied but out of which pesticides may be a part [34]. Mixtures of pesticides seem to have a collective toxic effect on frogs. Metamorphosis is adversely affected in tadpoles of ponds containing multiple pesticides and ability to catch prey and avoid predators is also decreased [35]. Ability of reproduction is also decreased by herbicide atrazine, turning male frogs to hermaphrodites [35]. Across the Canada and United States disorders such as feminization, skin lesions, deceased hatching success and many other developmental abnormalities have been reported [36].

Each year around 72 million birds are killed in the United States by pesticides as reported by US Fish and Wildlife Service [37]. Birds are the non-target organisms that are continuously being harmed by the use of pesticides. The

common examples of such non target organisms are Bald eagles that are impacted by pesticide use. Silent Spring, a Rachel Carson's dealt with harm caused to birds due to bioaccumulation of pesticide. European and North American bird populations have been seriously affected by DDE-induced egg shell thinning [36]. Some types of fungicides used in the farming of peanut are less toxic to birds and mammals but may kill earthworms, which on the other hand reduce population of the mammals and birds that feed on them [38]. Some of the pesticides are in the form of granules. Animals consume it, mistaking them for food grains and that few granules are more than enough to cause death of its consumer [38].

8) CONCLUSION

Apart from having direct effect on increasing yield of crops by making them pest free, pesticides deteriorates soil, water and air quality.

According to World Health Organisation nearly 20,000 people die each year in developing countries due to consumption of pesticides via their food-multiply that by 40 years.

Lack of education about pesticide appropriate usage results in it's over usage by farmers. Therefore, educating farmers about proper time and usage of pesticides is essential. One on one discussion through seminars should be there between agricultural scientists and farmers. Farmers should be educated about organic farming and its significance.

Government should ban highly toxic pesticides and take measures to promote organic farming and reduce adoption of harmful chemicals.

Alternative to chemical pesticides are bio-pesticides should be promoted and used [39]. Their harmful residues are not detected, they are more effective than chemical in the remote future, they are biodegradable, they are target specific and do not pollute environment.

Acknowledgement:- I am thankful to UGC for providing Non Net fellowship and Chairman of Department of Zoology, AMU Aligarh for providing necessary facilities to conclude this work.

REFERENCES

- 1) Vijay, H. R., Vishal H. and Dhanalaxmi, S. 2015. Regulation of water in agriculture field using Internet of Things. Technological Innovation in ICT for Agriculture and Rural Development (TIAR), 2015 IEEE.
- 2) Mathur, S. C. 1999. Future of Indian pesticides industry in next millennium. Pesticide Information, 24(4).
- 3) Rashid, B., Husnain T. and Riazuddin, S. 2010. Herbicides and pesticides as potential pollutants: a global problem. Plant adaptation phytoremediation. Springer, Dordrecht, pp 427-447.
- 4) Yang, E. C., Chuang, Y. C., Chen, Y. L. and Chang, L. H. 2008. Abnormal foraging behavior induced by sublethal dosage of imidacloprid in the honey bee (Hymenoptera: Apidae). J Econ Entomol, 101:1743-1748.
- 5) Relyea, R. A. 2005. The lethal impact of roundup on aquatic and terrestrial amphibians. Ecol Appl, 15:1118-1124.

- 6) Rohr, J. R., Schotthoefler, A. M., Raffel, T. R., Carrick, H. J., Halstead, N., Hoverman, J. T., Johnson, C. M., Johnson, L. B., Lieske, C., Piwoni, M. D., Schoff, P. K. and Beasley, V. R. 2008. Agrochemicals increase trematode infections in a declining amphibian species. *Nature*, 455:1235–1239.
- 7) Kelley, W. D. and South, D. B. 1978. In vitro effects of selected herbicides on growth and mycorrhizal fungi. *Weed Sci Soc. America Meeting*. Auburn University, Auburn, Alabama, 38.
- 8) Frankenberger, W. T., Tabatabai, M. A. Jr. and Tabatabai, M. A. 1991. Factors affecting L-asparaginase activity in soils. *Biol Fert Soils*, 11:1–5.
- 9) Fletcher, J. S., Pflieger, T. G. and Ratsch, H. C. 1993. Potential environmental risks associated with the new sulfonylurea herbicides. *Environ Sci Technol*, 27:2250–2252.
- 10) Locke, D., Landivar, J. A. and Moseley, D. 1995. The effects of rate and timing of glyphosate applications of defoliation efficiency, regrowth inhibition, lint yield, fiber quality and seed quality. *Proc Beltwide Cotton Conf*, 2:1088–1090.
- 11) Hayo, M. G. and Werf, V. D. 1996. Assessing the impact of pesticides on the environment. *Agric Ecosyst Environ*, 60:81–96.
- 12) Decourtye, A., Lacassie, E and Pham-Delègue, M. H. 2003. Learning performances of honeybees (*Apis mellifera* L.) are differentially affected by imidacloprid according to the season. *Pest Manag Sci*, 59:269–278.
- 13) Forson, D. D. and Storfer, A. 2006. Atrazine increases Ranavirus susceptibility in the tiger salamander (*Ambystoma tigrinum*). *Ecol Appl*, 16:2325–2332.
- 14) Relyea, R. A. and Hoverman, J. T. 2008. Interactive effects of predators and a pesticide on aquatic communities. *Oikos*, 117:1647–1658.
- 15) Aktar, W., Sengupta, D. and Chowdhury, A. 2009. Impact of pesticides use in agriculture: their benefits and hazards. *Interdiscipl Toxicol*, 2:1–12.
- 16) Agrawal, A., Pandey, R. S. and Sharma, B. 2010. Water pollution with special reference to pesticide contamination in India. *J Water Res Prot*, 2(5):432–448.
- 17) Damalas, C. A. and Eleftherohorinos, I. G. 2011. Pesticide exposure, safety issues, and risk assessment indicators. *Int J Environ Res Public Health*, 8:1402–1419.
- 18) Macneale, K. H., Kiffney, P. M. and Scholz, N. L. 2010. Pesticides, aquatic food webs, and the conservation of Pacific salmon. *Front Ecol Environ*, 8:475–482.
- 19) Casida, J. E. and Durkin, K. A. 2013. Neuroactive insecticides: targets, selectivity, resistance, and secondary effects. *Annu Rev Entomol*, 58:99–117.
- 20) Doris, S., Jeffrey, M., Michael, W. and Jack, H. 2011. Environmental Impacts from Pesticides Use: A Case Study of Soil Fumigation in Florida Tomato Production. *Int J Environ Res Public Health*, 8(12).
- 21) Wasim, A., Dwaipayyan, S. and Ashim, C. 2009. Impact of Pesticides Use in Agriculture: their Benefits and Hazards. *Interdisciplinary Toxicology*, 2(1)
- 22) Savonen, C. 1997. Soil microorganisms object of new OSU service. *Good Fruit Grower*.
- 23) Pell, M., Stenberg, B. and Torstensson, L. 1998. Potential denitrification and nitrification tests for evaluation of pesticide effects in soil. *Ambio*, 27:24–28.
- 24) Moorman, T. B. 1989. A review of pesticide effects on microorganisms and microbial processes related to soil fertility. *J Prod Agric*, 2:14–23.
- 25) Kole, R. K. and Bagchi, M. M. 1995. Pesticide residues in the aquatic environment and their possible ecological hazards. *J Inland Fish Soc India*, 27(2).
- 26) Lang, M. and Cai, Z. 2009. Effects of chlorothalonil and carbendazim on nitrification and denitrification in soils. *J Environ Sci*, 21:458–467.
- 27) Rockets and Rusty. 2007. Down On TheFarmYields, Nutrients And Soil Quality. Scienceagogo.com.
- 28) Cornell University. 2007. Pesticides in the environment. Pesticide fact sheets and tutorial. Pesticide Safety Education Program.
- 29) California Department of Pesticide Regulation. 2008. "What are the Potential Health Effects of Pesticides?" Community Guide to Recognizing and Reporting Pesticide Problems. Sacramento, CA.
- 30) Sharma, D. R., Thapa, R. B., Manandhar, H. K., Shrestha, S. M. and Pradhan, S. B. 2012. Use of pesticides in Nepal and impacts on human health and environment. *J Agric Environ*, 13:67–72.
- 31) Yasmin, S and d'Souza, D. 2010. Effects of Pesticides on the Growth and Reproduction of Earthworm: A Review. *Applied and environmental Soil Science*, 1-9
- 32) Helfrich, L. A., Weigmann, D. L., Hipkins, P. and Stinson, E. R. 1996. Pesticides and aquatic animals: A guide to reducing impacts on aquatic systems. Virginia Cooperative Extension. Retrieved on 2007-10-14
- 33) Pesticide Action Network North America. 1999. Pesticides threaten birds and fish in California. Retrieved on 2007-09-17.
- 34) Cone M. 2000. A wind-borne threat to Sierra frogs: A study finds that pesticides used on farms in the San Joaquin Valley damage the nervous systems of amphibians in Yosemite and elsewhere. *L.A. Times* Retrieved on 17-09-2007.
- 35) Science Daily (February 3, 2006), Pesticide combinations imperil frogs, probably contribute to amphibian decline. Sciencedaily.com. Retrieved on 2007-10-16.
- 36) Vos, J. G., Dybing, E., Greim, H. A., Ladefoged, O., Lambre, C., Tarazona, J. V., Brandt, I. And Vethaak, A. D. 2000. Health effects of endocrine-disrupting chemicals on wildlife, with special reference to the European situation. *Critical Reviews in Toxicology*, 30(1): 71-133.
- 37) Fimrite, P. 2011. Suit says EPA fails to shield species from poisons. *The San Francisco Chronicle*.
- 38) Palmer, W. E., Bromley, P. T. and Brandenburg, R. L. 2007. Wildlife and pesticides – Peanuts. North Carolina Cooperative Extension Service.
- 39) Tulsi, B. and Sharma, J. P. 2013. Impact of Pesticides Application in Agricultural Industry: An Indian Scenario. *International Journal of Agriculture and Food Science Technology*.