

PESTICIDE: ITS CURRENT IMPACT AND USE IN THE INDIAN PERSPECTIVE

¹Ms Vandana Arya ,²Ms Stuti Sharma,²Ms Sayani Nag

¹Assistant Professor, ²Student

¹Department of Food Technology

¹Shaheed Rajguru College of Applied Sciences for Women, University of Delhi, India

ABSTRACT:

The introduction of pesticides in Indian agriculture back in the 20th century was seen as a remarkable feat with a manifold increase in productivity. However, unchecked overuse of pesticides has now posed a serious threat to the agricultural sector and health of our country. Overuse of pesticides have led to the contamination of both surface and groundwater resources. Pesticides leach into the soil and get mixed with the groundwater while excess pesticides wash off of the crops and run into water resources. These not only contaminate the water resources but are extremely harmful to the aquatic and human life. Pesticides are not target specific-while they may kill the pests, they are intended for they may also kill other non-target organisms. Pesticides residue exhibit bioaccumulation and build up to harmful levels for humans and other animals. Many solutions have been proposed to battle the adverse effects of pesticides. Practices like crop rotation, intercropping, crop diversity, organic pesticides, etc. are being practiced and encouraged throughout the country. The government has also passed several bills and acts time and

time again to take actions against the overuse of pesticides and to control the level of these to be used in crop fields to ensure minimal health hazard to the country.

INTRODUCTION

The Indian subcontinent ranks second worldwide in farm outputs. It's the seventh largest agricultural exporter and the sixth largest net exporter. But the advent of our country through these ranks can be attributed to the green revolution that took place 1965 onwards. With the introduction of HYV seeds, tractors, irrigation facilities, pesticides, herbicides, etc. the agricultural productivity increased by a tremendous amount but the aftermath of the revolution has changed dramatically. Pesticides introduced in Indian farms early on were DDT and BHC circulated by the manufacturing plants of Calcutta (Bharadwaj and sons) in 1952, moving to the era of 1960s use of pesticides in India increased immeasurably. The plausible reason for this may be the introduction of HYV seeds that were more receptive to pesticides and fertilizers.

The definition of a pesticide as given by the EPA (Environmental Protection

Agency). Any substance or mixture of substances intended for firstly, Preventing, destroying, repelling or mitigating any pest, secondly, use as a plant regulator, defoliant, or desiccant, or thirdly, Use as a nitrogen stabilizer. According to Mr. M.S. Swaminathan – “Green Revolution has some repercussion like overuse of pesticide and now focus should be given on continuous improvement of productivity without harming ecology that can be done through organic farming or green agriculture.”⁽¹⁾ Having considered the brief history and the standard definition of pesticides the factors that contribute to the increased use of pesticides in our agricultural sector can be attributed as follows- The recent increase in pesticide use is because of higher use of herbicides as cost of manual weed control has risen due to increase in agricultural wages, The need to safeguard adequate food availability and sufficiency for the growing global population, In India, more than 40,000 different types of insects have been recorded and 1000 of these have been listed as potential pests for economic plants. Thus, pesticides have been considered as an effective tool to minimize the crop damage and loss due to pests, insects, etc.

So, it is pretty much clear from the above facts that as soon as farmers plant seeds in the ground, these growing plants become vulnerable to weeds, insects and therefore threaten the crops potential. Thus, ideal pest management takes in account the individual growing conditions and ecology of the field or the farm to prevent the pests from decreasing the rate of productivity. Although advances in agricultural sciences have kept the total use of pesticides unchanged since the 1980s, novel methods are being devised to decrease the use of pesticides by the Indian farmers particularly the Indian farmers because the amount of pesticide in our food is way more than an average American or a European diet. . Thus, it becomes essential to regulate the use of cost effective and environmentally safe pesticides among Indian farmers. The central insecticide board and registration has taken its measures to ensure the safe and regulated use of pesticides among farmers as well the companies involved in the production of pesticides. The board scrutinizes and periodically reviews all pesticides and their usage. Some of them can even be banned afterwards if they cause serious environmental or public health concerns.

List of banned pesticides in India				
Pesticides Banned for Manufacture, Import and use				
Aldrin				
Benzene Hexachloride				
Calcium Cyanide				
Chlordane				
Copper Acetoarsenite				
Cibromochloropropane				
Endrin				
Ethyl Mercury Chloride				
Ethyl Parathon				
Heptachlor				
Menazone				
Nitrofen				
Paraquat Dimethyl Sulphate				
Pentachlorophenol				
Phenyl Mercury Acetate				
Sodium Methane Arsonate				
Tetradifon				
Toxafen				
Aldicarb				
Chlorobenzilate				
Deildrine				
Maleic Hydrazide				
Ethylene Dibromide				
TCA(Tri Chloro Acetic)				
Metaxuron				
Chlorofenvinphos				

Fig 1. List of banned pesticides in India ⁽²⁾

The importance of pesticides, insecticides, herbicides is immense and their presence is salient in the production growth of the country. The fact that can't be ignored is that they have quite a number of harmful effects as well not only physiologically on humans but their excessive use significantly contributes to lithospheric as well as in hydrosphere pollution. These harmful effects have been well recognized by the government of India as well, therefore there have been subsequent legal measures that have

been taken by the government to regulate the import, registration process, manufacture, sale, transport, distribution and use of pesticides with a view to prevent risk to human beings or animals and for all connected matters, throughout the country.

Problems Associated with the Increased use of Pesticides

The kinds of pesticides being used and the amount in which they are being used is of significant importance to the farmers as well as the consumers that

purchase the crops. Significant effect is also observed on the fertility of the soil and the water bodies surrounding the agricultural land.

The problems caused by the industry can be classified in 4 major groups:

INFLUENCE ON WATER: -

Ground water contamination

The ability of pesticides to cause pollution is due to their ability to leach into the soil and pesticides with poor absorption capacity are likely to get absorbed into the soil. In regions of West Bengal, the groundwater was found to contain high levels of pesticides and the degree of contamination was so high it was declared unfit for drinking. A four-member research team collected river water samples from 32 locations and groundwater samples from at least 235 locations between 2014 and 2016 from various districts including Murshidabad, Nadia, North 24 Parganas, South 24 Parganas and Kolkata located across the lower Gangetic river basin that spreads over 21,000 sq. km in south Bengal. ⁽³⁾Another example comes from Kanpur where the collected groundwater samples were reported to contain high concentrations of organochlorine and organophosphorus pesticides. The ground water of rural areas is subject to a more intense contamination since a major density of the population there is involved in agricultural practices. The ground water levels of Farrukhabad were observed and analyzed that the results were quite alarming. It was

reported that almost all the samples were contaminated with residues of HCH and DDT. Pesticides are composed of chemicals like nitrates, fluorides and arsenic. These chemicals do play their part by imparting pest resistance but when used excessively could penetrate into the deep layers of the soil contaminating the groundwater. Ground water is one of the most valuable resources of nature but it is now being desecrated. Water pollution through pesticides might not look a bigger problem today but it slowly piles up leading to devastating consequences.

Surface water contamination

Surface water pollution is caused due to runoff of pesticides from treated plants and soil which happens majorly during or after rainfall. Some pesticides have greater ecotoxicological effect than others and these are the pesticides that increase the bioaccumulation and transference process. Bioaccumulation often refers to the process wherein certain substances like pesticides enter lakes, rivers and the ocean and then move up the food chain in increasingly greater concentrations as they get consumed by zooplanktons and aquatic animals which in turn are eaten by animals or humans.

In a recent survey, it has been observed that 58% of drinking water samples drawn from various hand pumps and wells around **Bhopal** were contaminated with organochlorine pesticides above the EPA standards. The majorities of the organochlorine pesticides are very persistent in

environmental media and generate severe adverse health impacts.

Vidarbha region in Maharashtra comprises 11 districts. Livelihood of around 65% rural population of this region is dependent on agriculture and allied activities. Groundwater from dug well, handpump, tube wells and water from rivers like Wainganga, Wardha, Purna and Kanhan which are all tributaries of Godavari River, are the major source of drinking water for Vidarbha region. ⁽¹⁾

IMPACT ON SOIL AND ESTABLISHING TOLERANCES FOR CROPS AND COMMODITIES-

The uncontrolled use of pesticides may have an effect on the micronutrients as well as the microflora present in the soil. They do put an end to the pests present in the vicinity of the crop but also end up killing the non-target organisms. Pesticides sprayed on crops sometimes tend to remain on them passing further into the food chain. Now, as the country is looking forward to its second green revolution the government has come up with alternatives for these pesticides, one being integrated pest management.

Examples of intense soil pollution comes of regions outside of the country as well one of them is in the Indonesian

shallot farms where the farmers applied pesticides excessively to the fields majorly due to the lack of awareness this resulted in the hardening of the top soil making irrigation difficult and does decreasing the fertility of the soil. ⁽⁴⁾

Pesticides thus applied to the fields to protect the crops from pests can harm the non-target organisms that is the important microorganisms that carry out their basic metabolism and enhance the fertility of the soil.

IMPACT ON FOOD-

As pesticide residue, Pesticide residue means the pesticides or products of the pesticides that may remain in food grains, vegetables and fruits after they are applied to crops. Many of these chemical residues for example derivatives of chlorinated pesticides, exhibit bioaccumulation which could build up to harmful levels in the body as well as in the environment. Persistent chemicals can be magnified through the food chain and have been detected in a wide range of products.

MRL (Maximum Residue Limit) is the highest level of a pesticide residue that is legally tolerated in or on food or feed when pesticides are applied correctly. This range is usually authorized cooperation's like the EPA, FSSAI etc.

Name of the Pesticide	MRL(Maximum Residual Limit)		
	Apple	Grape	Orange
Aldrin			
Parathion	50	100	50
Propanil	500	500	500
Phosdrin	100	100	100
Bromophos Ethyl	10	10	10
Captan	50	50	50
Chlorpyrifos	15000	25000	15000
Chlorpyrifos Methyl	1000	500	1000
Heptachlor	500	200	500
DDT	10	10	10
Alpha Endosulfan	1000	1000	1000

Figure 3: -Table representing the MRL Residues of insecticides in organic foods ⁽⁵⁾

Health hazards caused due to ingestion of these pesticides -

The health hazards caused due to the consumption of pesticides can be classified into two parts –

- 1). **The short-term effects-** this includes headaches and nausea.
- 2). **The long-term effects** –this consists of effects with serious consequences like cancer, neural damage, reproductive harm and endocrine disruption.

Exposure to organophosphates causes accumulation of acetylcholine at synapses results in swift and weighty excitotoxicity and dysfunction of cholinergic neurons. The studies on cancer analyze the risks related with the ingestion of products which have some pesticide residues. These consumption products include fish, water and seafood. These studies find a small but statistically noteworthy association between cancer risks and some specific pesticide residues, for example

dichlorodiphenyltrichloroethane.

Consumption of high pesticide residue percent fruits and vegetables was associated with lower total sperm count, ejaculate volume and percentage of morphologically normal sperm among men attending a fertility clinic. Pesticides exposure may lead to reduced fertility, early and late pregnancy loss, prolonged time-to-pregnancy, spontaneous abortion, and premature birth in female and genetic alterations in sperm. ⁽⁶⁾

SOLUTIONS AND RECOMMENDATIONS TO COMBAT THE ARISING PROBLEM-

The increased use of pesticides has definitely caused a starching revolution in the agricultural industry but their increased use is now starting to pose a threat on various elements of nature like water, soil, humans and animals. The following list consists of some measures and alternatives that can be

considered to reduce the use of pesticides.

Crops rotation, Intercropping and Crop Diversity-

This an effective technique to prevent the pests getting to attack the same kind of crop. Also, it helps in increasing the fertility of the fields. Specially planting legumes that help to increase the level of nitrogen the soil that is an essential micronutrient will ensure a healthy soil. Intercropping is a unique method of planting two kind of crops in the field so the pests can be attracted away from the commercially important host plant. Example, the farmers in Kenya have devised a technique known as the push and pull technique where the plant two kind of crops one that attracts the pests and one that repels it. A field with a rich diversity of crops, vegetables and fruits is said to less susceptible to pests because it is seen that pests usually attack fields that contain one kind of crop.

Using pest against pest –

This is a modern method that had been devised in Israel where a company known as Bio Bee produces *Phytoseiulus persimilis*. This is the most effective natural predator of red spider mites. In 2014, Bio Bee 380 million of the engineered flies to Croatia to help fight fruit fly infestation in orchards. These predators work on the pests that attack tomatoes, potatoes and particularly strawberries.

Organic Pesticides-

Neem leaves, Timur, garlic, livestock urine are some of the prominent examples of organic pesticides. Organic pesticides not only are healthy for the environment but also help the farmers make the most of their product. It's a pest control method that compliments nature and is ecofriendly as well.

Law, Registration and FDI in India on Pesticides-

The Insecticides Act-

The Insecticides Act, 1968 and Insecticides Rules,1971 regulate the import, registration process manufacture, sale, transport and distribution of pesticides. According the section 3(e) of Insecticides Act, 1968 the word “insecticides” means any substance specified in the schedule or other substances (including fungicides and weedicides) as the central government may, after consultation with the board, by notification in the official Gazette, include in the schedule from time to time.⁽⁷⁾

Pesticides Management Bill,2008-

The Pesticides Management Bill, 2008 was introduced in the Rajya Sabha on October 21, 2008. The Bill seeks to regulate the manufacture quality, import, export and sale of pesticides to control the pests ensure availability of quality pesticide and minimize contamination of agricultural commodities with pesticides residue. Any person who wants to manufacture or sell pesticides or undertake commercial pest control operation with

the use of pesticides may apply for a license. The Bill prohibits the manufacture, import and export of misbranded, spurious or substandard pesticides and any pesticides that contravenes the law. A pesticide cannot be sold, stocked or used if it is not registered.⁽⁷⁾

The FDI Policy-

In the chemical sector 100% FDI is permissible. Manufacture of most chemical products covering organic or inorganic, dyestuff and pesticides is delicensed.

The items that are covered in compulsory licensing list because of hazardous nature are Hydrocyanic Acid and its derivatives, Phosgene and its derivatives and Isocyanates and Di-isocyanates of hydrocarbon. If a foreign entity wishes to undertake/carry out business activity in India then it would require prior approval from foreign Investment promotion board in addition to the compliance of laws relating to pesticides⁽⁷⁾

IPM (Integrated Pest Management)

This refers to the careful consideration of all the available pest control techniques and subsequent integration of appropriate measures that discourage the development of pest population and keep pesticides and the interventions to levels that are economically justified and reduce or minimize risks to human health and the environment.⁽⁷⁾

CONCLUSION:

Pesticides were once considered a blessing in the field agriculture specially for developing countries like India that would like to boost their economy by selling off season vegetables. But the threat that these chemicals are posing to the environment cannot be blindly ignored. We think it is high time that we should start considering the alternatives to these toxic chemicals that are being incorporated into the elements of nature and slowly into our diets. Time and again, the government has constructed and imposed as many laws and restrictions on these pesticides and the research scientists are contributing in the labs by devising new alternatives for these pesticides but what lacks is the awareness among the farmers that actually use these on the fields. The challenge today is now to try find plausible and effective alternatives to reduce the use and to slowly remove these pesticides from the food chain. This challenge may seem more intense but the rewards are promising for the future generations.

REFERENCES: -

- (1) **Kumar Priya Ranjan**, Pesticide Use in Question: An Indian Perspective. 15, No. 3, July-September, 2017 ISSN 0973 – 8444
- (2) List of banned pesticides in India retrieved from
<https://www.scribd.com/document/380786781/List-of-Banned-Pesticides>

(3) Millions in Bengal exposed to pesticide-laden river water and groundwater: Report. The Hindustan times.

<https://www.hindustantimes.com/india-news/millions-in-bengal-exposed-to-pesticide-laden-river-water-and-groundwater-report/story-hTrEEQDKn7i2fs9n093E7N.html>

(4) Tri Joko, Sutrisno Anggoro, Henna Rya Sunoko and Savitri Rachmawati (2017) Pesticides Usage in the Soil Quality Degradation Potential in Wanasari Subdistrict, Brebes, Indonesia.

(5) Maximum Residue Limit retrieved from

https://www.researchgate.net/figure/Maximum-residue-limits-MRLs-of-targeted-pesticides_tbl1_236021381

(6) William R Reeves, Michelle k McGuire, Milton Stokes, John L Vicini (2019) Assessing the Safety of Pesticides in Food: How Current Regulations Protect Human Health

(7) Laws and regulations regarding pesticides usage. Retrieved from www.indiajury.com