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Effects of Pesticides on Environment

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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 environment. 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. This paper intends to discuss about pesticides, their types, usefulness and the environmental concerns related to them. Pollution as a result to overuse of pesticides and the long term impact of pesticides on the environmental are also discussed in this paper. In end discuss the methods to eradicate the use of pesticides and finally it looks forward towards the future impacts of the pesticide use the future impacts of the pesticide use the future of the world after eradicating pesticides.
Keywords: Pesticides, Environment, Chronic effects of pesticides, Environmental hazards.

Introduction - A pesticide is a toxic chemical substance or a mixture of substances or biological agents that are intentionally released into the environment in order to avert, deter, control and kill, destroy populations of insects, weeds, rodents, fungi or other harmful pests. They include insecticides, herbicides, nematicides, fungicides, molluscicides, rodenticides, plant growth regulators and other compounds.(1) Pesticides work by attracting, seducing and then destroying or mitigating the pests. Pests can be broadly defined as " the plants or animals that jeopardize our food, health and comfort."

The use of pesticides has increased many folds over the past few decades. According to an estimate, about 5.2 billion pounds of pesticides are used worldwide per year. The use of pesticides for pest mitigation has become a common practice all around the world. Their use is not only restricted to agricultural fields, but they are also employed in homes in form of sprays, poisons and powders for controlling cockroaches, mosquitoes, rats, fleas, ticks and other harms bugs. Due to this reason, pesticides are frequently found in our food commodities in addition to their presence in the air. Pesticides can be natural compounds or they can be synthetically produced. They may belong to any one of the several pesticide classes. Major classes include organochlorines, carbamates, organophosphates, pyrethroids and neonicitinoids to which most of the current and widely used pesticides belong. Pesticides formulations contain active ingredients along with inert substances, pesticides break down into substances known as metabolites that are more toxic to active ingredients in some situations. At the end merits of pesticide usage and the harmful impact of pesticides on human health and the environment.

Classification of Pesticides: Pesticides are known to be one of the extremely useful and beneficial agents for preventing losses of crops as well as diseases in humans. Based on the action, pesticides can be classified as destroying, repelling and mitigating agents. Insects and pests are getting immune to the commercial pesticides due to over usage. Recently pesticides have been developed which target multiple species.(2) Now a days, chemical pesticides and insecticides are becoming a dominant agent for eliminating pests. When these chemical pesticides are used in a combination of effective natural enemy than that result in enhanced integrated pest management and act as a comprehensive prophylactic and remedial treatment .(3)

On the level of population, the effects of pesticides depend on exposure and toxicity, as well as on different factors like life history, characteristics, timing of application, population structure and landscape structure .(4) Nerve targets of insects which are known for development of neuroactive insecticides include acetylcholinesterase for oganophosphates and methycarbamates, nicotinic acetylcholine receptors for neonicotinoids, gamma-aminobutyric acid receptor channel for polychorocyclohexanes and fiproles .(5)These pesticides are associated with different types of toxicities .(6)

Worldwide pesticides are divided into different categories depending upon their target. Some of these categories include herbicides, insectIcides, fungicides,

rodenticides, molluscicides, nematicides and plant growth regulators. Non- regulated use of pesticides has led the environment into disastrous consequences. Serious concerns about human health and biodiversity are raising due to overuse of pesticides. (7) Pesticides are not only toxic to people related to agriculture, but they also cause toxicity in industries and public health work places. Depending upon the target species, pesticides can cause toxicities in natural flora, natural fauna and aquatic life . (8)

Merits of Pesticide Use: Pesticides provide primary as well as secondary benefits. The former ones are obvious after direct usage of pesticides such as the killing of insects that feed on crops. Later are the result of the primary benefits and they are for longer periods. Worldwide, 40% of the agricultural produce is lost due to plant diseases, weeds and pests collectively. If there would have been no pesticides, crop losses would have been many folds greater. Moreover, these crop saving substances not only protect the crops from damage rendered by pests, but they also increase the yields of crops considerably. (9)

Protection of farm and agricultural lands means protection of all forms of life. Pesticides protect forests and other wildlife habitat from invasive species of plants and non–native insects and other pests. Improved agricultural yields help the farmers to produce more food without expanding their agricultural land which consequently protects biodiversity. (10) Insecticides also improve home sanitary conditions by keeping the population of bugs in control. (11) Moreover, pesticides also preserve the beauty of recreational spots by controlling weeds and also prevent structural damage associated with termite infestations .(12)

Risks Associated with Pesticide Use: Risks associated with pesticide use have surpassed their beneficial effects. Pesticides have drastic effects on non- target species and affect animal and plant biodiversity, aquatic as well as terrestrial food webs and ecosystems.

According to Majewski and Capel (1995) about 80-90 % of the applied pesticides can volatized within a few days of application. (13) It is quite common and likely to take place while using sprayers. The volatized pesticides evaporate into the air and subsequently may cause harm to non–target organism. A very good example of this is the use of herbicides, which volatilise off the treated plants and the vapours the sufficient to cause severe damage to other plants. (14) Uncontrolled use of pesticides has resulted in reduction of several terrestrial and aquatic animal and plant species. They have also threatened the survival of some rare species such as the bald eagle, peregrine falcon and osprey. (15) Additionally, air, water and soil bodies have also being contaminated with these chemicals to toxic levels. Among all the categories of pesticides, insecticides are considered to be most toxic whereas fungicides and herbicides are second and third on the toxicity list.

Threats to Biodiversity: The threats associated with the use of uncontrolled use of these toxins cannot be overlooked. It is the need of the hour to consider the pesticide impact on populations of aquatic and terrestrial plants, animals and birds. Accumulation of pesticides in the food chains is of greatest concern as it directly affects the predators and raptors. But, indirectly, pesticides can also reduce the quantity of weeds, shrubs and insects on which higher orders feed. Spraying of insecticides, herbicides and fungicide have also been linked to declines in the population of rare species of animals and birds.

Threats to Aquatic Biodiversity: Pesticides enter the water via drift, by runoff, leaching through the soil or they may be applied directly into surface water in some cases such as for mosquitoes control. Pesticide – contaminated water poses a great threat to aquatic form of life. It can affect aquatic plants, decrease dissolved oxygen in the water and can cause physiological and behavioural changes in the fish populations. In several studies, lawn care pesticides have been found in surfaces waters and water bodies such as ponds, streams and lakes. Pesticides which are applied to land drift to aquatic ecosystems and there they are toxic to fishes and non target organisms. These pesticides are not only toxic themselves but also interact with stressors which include harmful algal blooms .With the overuse of pesticides, a decline in populations of different fish species is observed.(16) About 80% of the dissolved oxygen is provided by the aquatic plants and it is necessary for the sustenance of aquatic life. Killing of aquatic plants by the herbicides results in drastically low O_2 levels and ultimately leads to suffocation of fish and reduced fish producitivity. Generally, levels of pesticides are much higher in surface waters than groundwater probably because of surface runoff from farmland and contimination by spray drift. (17) However, pesticides reach underground through seepage of contaminated surface water, improper disposal and accidental spills and leakages. Aquatic ecosystems are experiencing considerable damage due to drifting of pesticides into the lakes, ponds and rivers.

Threats to Terrestrial Boidiversity: Pesticide exposure can also cause sub –lethal effects on terrestrial plants in addition to killing non target plants. Drifting or volatilization of phenoxy herbicides can injure nearby trees and shrubs (18) Herbicide glyphosate increases susceptibility of plants to diseases (19) and reduces seed quality(20) Earthworms play a significant role the soil ecosystem by acting as bio-indicators of soil contamination and as models for soil toxicity testing. Earthworms also contribute to soil fertility. Pesticides have not spared earthworms from their toxic effects and the later is exposed to the former mainly via contaminated soil pore water. (21)

Pesticide Impact on Human Health: Pesticides have improved the standard of human health by controlling vector-borne diseases, however, their long term and indiscriminate use has resulted in serious health effects. Human beings especially infants and children are highly vulnerable to deleterious effects of pesticides due to the

non-specific nature and inadequate application of pesticides. As the pesticide use has increased over the past few decades, the likelihood of exposure to these chemicals has also increased considerably. Pesticides enter the human body through ingestion, inhalation or penetration via skin[22] But the majority of people get affected via the intake of pesticide contaminated food. The effects of pesticides on human health are highly variable. They may appear in days and are immediate in nature or they may take months or years to manifest and hence are called chronic or long – terms effects.

Conclusion and future Prospects: Pesticides have proved to be a boon for the farmers as well as people all around the world by increasing agricultural yield and by providing innumerable benefits to society indirectly. But the issue of hazards posed by pesticides to human health and the environment has raised concerns about the safety of pesticides. Although we cannot completely eliminate the hazards associated with pesticides use, but we can circumvent them in one way or the other. Exposure can be minimised by several means such as alternative cropping methods or by using well- maintained spraying equipments. If the pesticides are used in appropriate quantities and used only when required or necessary, then the pesticides risks can be minimised.

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