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AN ANALYSIS OF EFFECTS OF PESTICIDES ON ENVIRONMENT

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ABSTRACT

Pesticides are poisonous chemical compounds, mixtures of chemicals, or biological agents that are introduced into the environment with the aim of preventing, deterring, controlling, or killing and destroying populations of insects, weeds, rodents, fungus, or other hazardous pests. Pesticides are used to eliminate pests and insects that wreak havoc on crops. Pesticides of various types have been used to protect crops for millennia. Pesticides benefit crops, yet they have a significant detrimental effect on the environment. Excessive pesticide usage has the potential to destroy biodiversity. The existence of many birds, aquatic creatures, and animals is threatened by toxic chemicals. Pesticides pose a threat to the environment's long-term viability and global stability. The purpose of this chapter is to examine pesticides, their kinds, applications, and environmental issues. The chapter also discusses pollution caused by pesticide misuse, as well as the long-term effects of pesticides on the ecosystem. Finally, the chapter addresses strategies for eliminating pesticide usage, as well as potential effects of pesticide use and the world's future once pesticides are eliminated.

KEYWORDS: *Agent, Chemical, Environment, Farmer, Pesticide.*

1. INTRODUCTION

Pesticides operate by luring pests in, enticing them, and then killing or controlling them. Pests are described as plants or animals that pose a threat to our food, health, or comfort. Pesticide usage has risen dramatically during the last several decades. Pesticides are utilized throughout the globe at a rate of approximately 5.2 billion pounds each year, according to estimates. Pesticides are now widely used to prevent insect infestations all over the globe. Their usage is not limited to agricultural areas; they are also used in houses to control cockroaches, mosquitoes, rats, fleas, ticks, and other pests in the form of sprays, poisons, and powders.

Pesticides are often discovered in our food as a result of this, in addition to their presence in the air. Pesticides may be made from natural chemicals or from synthetic compounds. They may be classified as one of many pesticide classes. Organochlorines, carbamates, organophosphates, pyrethroids, and neonicitinoids are the major groups to which most contemporary and extensively used pesticides belong. Active chemicals, as well as inert components, pollutants, and impurities, are found in pesticide formulations. Pesticides break down into compounds known as metabolites once released into the environment, and in certain cases, these metabolites are more hazardous than the active components[1].

Pesticides promise to effectively eliminate dangerous pests, but the dangers connected with their usage have regrettably outweighed their benefits. Nonselective insecticides harm both target and non-target plants and animals. Furthermore, certain pests acquire genetic resistance to insecticides as time passes. This chapter examines the history of pesticide use, the benefits of pesticide use,

and, most significantly, pesticides' negative effects on human health and the environment[2].

1.1 Pesticide Use: From Past to Present:

Pesticides have been employed since the time of the Ancient Romans, when they used sulphur to kill bugs and salts, ashes, and bitters to control weeds. Arsenic as a pesticide was advocated by a Roman naturalist. A combination of honey and arsenic was employed to control ants in the 1600s. Farmers in the United States began utilizing chemicals like as nicotine sulphate, calcium arsenate, and sulphur for field-related purposes in the late 1800s, but their efforts were ineffective due to the rudimentary means of administration. Arsenic, an impure version of copper, was employed to suppress the Colorado potato beetle epidemic in the United States in 1867. Several effective and cheap pesticides were synthesized and manufactured during and after World War II, which marked a significant advance in pesticide production[3].

Between 1950 and 1955, fungicides such as captan and glyodin, as well as the organophosphate insecticide Malathion, were launched, followed by the discovery of triazine herbicides between 1955 and 1960. Monsanto produced Agent Orange, an experimental military pesticide that was employed during the Vietnam War from 1961 to 1971. In addition, the usage of insecticides hit an all-time high in 1961. After 1962, however, there was a significant drop in the production of new pesticides as public awareness of the environmental risks connected with indiscriminate pesticide usage grew. In her book Silent Spring, published in 1962, American scientist Rachel Carson said that spraying DDT in the field causes the death of non-target species via direct or indirect poisoning. The publication of Silent Spring led in a period of quiet in the area of pesticide research and development. However, in the late 1960s, it ushered in a new era with the introduction of "integrated pest management" (IPM). IPM is a pest management technique that employs biological predators or parasites to control pests.

Although pest populations may be reduced to dangerously low levels, particularly in pest outbreaks, IPM was not a viable alternative to conventional pesticides. Pyrethroids, sulfonylureas, and the synthetic fungicides triadimefron and metaxyl were launched in the 1970s and 1980s. DDT was outright prohibited in the United States in 1972, followed by restrictions on the use of Endosulfan, Dieldrin, and Lindane. Since then, the number of pesticides that have been prohibited has grown. In 2001, 179 countries joined the Stockholm Convention, which aimed to fully eliminate twelve persistent organic pollutants (POPs), including DDT. Later that year, the European Union (EU) backed a ban on neonicotinoid insecticides[4].

1.2 Pesticide Registration and Safety:

The registration of a pesticide is a time-consuming, legal, and administrative procedure that requires the knowledge and abilities of both the registration authorities and pesticide producers. Potential impacts of pesticide usage on human health and the environment are evaluated throughout this procedure in order to guarantee the safety of active and inert chemicals used in pesticide production. Pesticide registration is an essential element of pesticide management because it guarantees that the pesticide product that is put on the market is approved and used for the intended purpose. It also allows regulators to monitor pesticide quality, pricing, packaging, labeling, safety, and advertising to ensure that users' interests are protected.

Before submitting the application or data report, the registrant or manufacturer is obliged to perform research and analyze several tests relevant to product chemistry. These studies determine the pesticide's potential hazards to people, animals, and non-target species, as well as the pesticide's destiny if discharged into the environment. Physical and chemical properties of active ingredient as well as formulated product, analytical methods, proposed environmental toxicity and human health hazards, recommended uses and labels, safety data, effectiveness for the intended use, container management, and waste product disposal are all included in the data report or

registration application. The application is reviewed and analyzed by scientists in the registration authority, and after assessing the pesticide's environmental, human, and biodiversity risks, the authority either approves the pesticide for use or rejects it if it does not meet the regulatory and registration authority's standards. In addition, the registration authority guarantees that any pesticide that has been registered continues to satisfy the highest safety requirements. As a result, previously approved pesticides are being scrutinized to verify that they satisfy current scientific, safety, and regulatory requirements. Reregistration is the term for this procedure[5].

1.3 Classification of Pesticides:

Pesticides are well-known for being one of the most effective and helpful agents for avoiding agricultural losses and human illnesses. Pesticides are classified as destroying, repelling, or mitigating agents depending on how they work. Due to overuse, insects and pests are becoming resistant to commercial insecticides. Pesticides that target several species have recently been created. Chemical pesticides and insecticides are now the most widely used methods of pest control. When these chemical pesticides are combined with an effective natural enemy, they provide improved integrated pest control and serve as a complete preventive and corrective therapy. Pesticide impacts on populations are influenced by exposure and toxicity, as well as other variables like as life history, application features, and timing, population structure, and landscape structure.

Acetylcholinesterase for organophosphates and methylcarbamates, nicotinic acetylcholine receptors for neonicotinoids, gamma-aminobutyric acid receptor channel for polychlorocyclohexanes and fi proles, and voltage gated sodium channels for pyrethroids and dichlorodiphenyltrichloroethane are among the nerve targets of insects known for the development of The usage of neonicotinoid insecticides is on the rise, according to reports. These insecticides are linked to various kinds of toxicity. Pesticides are classified into various categories throughout the world based on their intended use. Herbicides, insecticides, fungicides, rodenticides, molluscicides, nematicides, and plant growth regulators are some of these categories. Pesticide usage that is not controlled has had catastrophic effects for the environment. Pesticide usage is generating serious concerns about human health and biodiversity. Pesticides are more water soluble, heat stable, and polar than other chemicals, making it harder to decrease their lethality. Pesticides are harmful not just to individuals who work in agriculture, but also to people who work in industries and public health. Pesticides may be harmful to natural flora, wildlife, and aquatic life, depending on the target species[6].

1.4 Merits of Pesticide Use:

Pesticides have both main and secondary advantages. The former are apparent following direct pesticide use, such as the death of crop-feeding insects. Later benefits come as a consequence of the initial benefit and are for extended periods of time. Plant diseases, weeds, and pests together cause the loss of 40% of agricultural output worldwide. Crop losses would have been several times higher if pesticides had not been used. Furthermore, these crop-saving chemicals not only protect crops from insect harm, but they also significantly enhance agricultural yields. A researcher claimed in their study that pesticide use results in a substantial boost in agricultural output, and that economic losses without pesticide use would be considerably worse. According to one estimate, pesticide use has boosted bread grain output by 10–20 percent, while insect pollinators are responsible for 70 percent of food supply.

Crop output would decrease if crops were not protected from pests' catastrophic consequences, as previously stated. A decrease in food production would result in a food scarcity, which would eventually lead to higher food costs. As a result, pesticides have an indirect role in keeping food costs in check. Many agricultural commodities are susceptible to aflatoxins, and pest management is required to prevent the poisons from being transferred from bug to plant. Aflatoxin is a

carcinogen that may cause liver and other types of cancer in adults, as well as impairing growth and development in children. It also suppresses the body's natural immunological response. Aflatoxin contamination caused by insects is controlled using crop protection agents.

Pesticides can help to enhance human health by preventing disease outbreaks by controlling rodent and insect vectors. Insecticide-mediated death of disease vectors has saved the lives of about seven million individuals all over the globe. The most notable example is malaria control, which resulted in 5000 fatalities every day on average. The efficient use of pesticides has kept many tick, rodent, and insect-borne illnesses such as encephalitis, yellow fever, bubonic plague, typhoid fever, typhus, and Rocky Mountain spotted fever under control. Protecting farmland and agricultural areas entails safeguarding all kinds of life. Invasive plant species, non-native insects, and other pests are all protected by pesticides in forests and other animal areas. Improved agricultural yields allow farmers to produce more food without having to extend their agricultural area, protecting biodiversity in the process. Insecticides also help to maintain hygienic conditions in the house by reducing the number of pests. Pesticides also help to maintain the aesthetics of recreational areas by reducing weeds and preventing structural damage caused by termite infestation. Herbicides and insecticides are also used to keep the grass on grounds, pitches, and golf courses in good condition[7].

1.5 Risks Associated with Pesticide Use:

The risks connected with pesticide usage have outweighed the benefits. Pesticides have far-reaching consequences on non-target species, affecting animal and plant biodiversity, as well as aquatic and terrestrial food webs and ecosystems. According to one study, about 80–90 percent of pesticides sprayed may volatilize after a few days of treatment. It's very frequent, and it's more likely to happen while utilizing sprayers. Volatilized pesticides evaporate into the air and may damage non-target organisms as a result. Herbicides, for example, volatilize off the treated plants, and the resulting vapours are sufficient to inflict serious harm to adjacent plants.

Pesticide usage that is out of control has resulted in the extinction of a number of terrestrial and aquatic animal and plant species. They've also put endangered species like the bald eagle, peregrine falcon, and osprey in jeopardy. Furthermore, hazardous amounts of these compounds have been detected in the air, water, and soil. Insecticides are the most hazardous of all pesticide types, with fungicides and herbicides coming in second and third. Pesticides enter natural ecosystems in two ways, depending on how soluble they are. Pesticides that are water soluble dissolve in water and infiltrate ground water, streams, rivers, and lakes, harming untargeted species. Fat-soluble pesticides, on the other hand, enter the bodies of animals via a process called as bio amplification. They are absorbed by animals' fatty tissues, leading in pesticide persistence in food chains for long periods of time[8].

The process of bio amplification can be described as follows:

- A little amount of pesticide enters the bodies of animals in the food chain at a low level, such as grasshoppers (primary consumer).
- Because shrews (secondary consumers) eat a lot of grasshoppers, the pesticide content in their bodies will rise.
- When a high-level predator, such as an owl, consumes shrews and other food, the pesticide content in its body rises dramatically.

When a result, as the trophic level rises, the pesticide concentration rises as well, a phenomenon called as bioamplification. More species at higher trophic levels will perish as a result of increased toxicity in their bodies, causing the whole ecosystem to be disrupted. This will ultimately lead to an increase in secondary consumers (shrews) and a reduction in main consumers[9].

1.6 Pesticide Impact on Human Health:

By reducing vector-borne illnesses, pesticides have benefited human health; nevertheless, their long-term and indiscriminate usage has resulted in severe health consequences. Due to pesticides' non-specific nature and ineffective administration, humans, particularly babies and children, are very susceptible to their harmful effects. As the usage of pesticides has grown over the last several decades, so has the chance of being exposed to these chemicals. Each year, approximately 3,000,000 instances of pesticide poisoning and 220,000 fatalities are recorded in poor nations, according to the World Health Organization. Pesticide exposure is a concern for about 2.2 million individuals, the majority of whom live in poor nations.

Furthermore, certain individuals, such as babies, young children, agricultural field laborers, and pesticide applicators, are more vulnerable to pesticide toxicity than others. Ingestion, inhalation, and skin penetration are all ways pesticides reach the human body. However, the majority of individuals are harmed by pesticide-contaminated food. They eventually reach human tissues or storage compartments after passing through numerous obstacles. Although human bodies contain systems for excreting poisons, they are sometimes retained by the circulatory system via absorption. When the concentration of pesticide in the body exceeds the original concentration in the environment, toxic consequences result. Pesticides have a wide range of impacts on human health. They may emerge in a matter of days and be of urgent nature, or they can take months or years to materialize and are therefore referred to as chronic or long-term effects[10].

2. DISCUSSION

Pesticides are used to eliminate pests and insects that wreak havoc on crops. Pesticides of various types have been used to protect crops for millennia. Pesticides are beneficial to crops, yet they have a significant detrimental effect on the ecosystem. Excessive pesticide usage has the potential to destroy biodiversity. Pesticides containing organochlorines are available. Because these herbicides are the least biodegradable, they are prohibited in many countries. Organochlorines, on the other hand, are widely utilized in a variety of settings. As a consequence, significant health risks arise. Pesticides are causing an increase in water contamination, and even at low concentrations, these pesticides pose a significant danger to the ecosystem. The majority of farmers are ignorant of pesticides' potential toxicity. They have no knowledge of the many kinds of pesticides, their poisoning levels, dangers, or precautions to take before using such pesticides. Toxic and ecologically persistent pesticides are employed to eliminate pests for this reason, which may result in deliberate, unintentional, or occupational exposure. These substances have long-term consequences on human health. These farmers should be educated in order to decrease their usage of hazardous pesticides.

3. CONCLUSION

Pesticides have proven to be a godsend for farmers and people all over the globe, boosting agricultural output and delivering countless societal benefits in the process. However, the dangers that pesticides bring to human health and the environment have prompted questions about their safety. We may not be able to fully remove the risks connected with pesticide usage, but we can mitigate them in some manner. Pesticide exposure, and therefore the negative repercussions and undesired impacts of that exposure, may be reduced via a variety of ways, including alternate cropping systems and the use of well-maintained spraying equipment. Pesticide formulations that are more effective, safe, and environmentally friendly may minimize the negative consequences of pesticide use.

Pesticide hazards may be reduced if pesticides are used in suitable amounts and only when needed or essential. Similarly, the havoc may be reduced if a less hazardous formulation or a low dosage of a toxic formulation is employed. Pesticides containing organochlorines are available. Because

these herbicides are the least biodegradable, they are prohibited in many countries. Organochlorines, on the other hand, are widely utilized in a variety of settings. As a consequence, significant health risks arise. Chemical pesticides may be utilized in the future in conjunction with natural therapies and cures, resulting in better long-term pest and bug control. This combination not only ensures environmental sustainability, but also offers a wide range of uses in urban pest and invasive species management.

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