PESTICIDES ON AGRICULTURAL FIELDS: THEIR BENEFITS

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Abstract

Protecting crops against pests, weeds and illnesses that may wreak havoc is the primary goal of pesticides. It is estimated that up to 40% of the world's annual potential agricultural yields are lost to these dangers. This proportion would swiftly rise if pesticides were not used. Because of this, all farmers use some type of pesticide to safeguard their crops. Because natural pesticides are more popular than synthetic pesticides, even organic farms employ them. How vital are pesticides, and what precautions should you take if using them? This is what you should know about pesticides.

Keywords: Pesticides, crops, pests, agriculture

INTRODUCTION

Nematicides are a kind of plant growth regulator that may be used as a pesticide to control pests such as ants. Most developed nations prohibited or restricted the use of organochlorine (OC) pesticides, which had been used successfully to combat illnesses like malaria and typhus up until the 1960s.[1]Organophosphate (OP) insecticides, carbamate insecticides, and pyrethroid insecticides were all introduced in the 1960s, 1970s, and 1980s, respectively, to help control pests and increase agricultural productivity. Nontarget species, including humans, must not be harmed in any way by a pesticide. Pesticide usage and abuse have become a hot-button issue because of this. Toxicology has wreaked havoc on human and non-human living forms because of the widespread usage of toxic substances.

The first factory to produce pesticides in India was built in 1952 to produce BHC in Calcutta. Today, India is Asia's second-largest pesticide manufacturer after China, and it ranks 12th globally. Technical grade pesticide manufacturing in India has grown steadily since 1958, from 5,000 metric tons to 102,240 metric tons. About 2% of the world's total pesticide consumption was estimated in 1996–97 in terms of value, which was roughly Rs. 22 billion at the time.

The use of pesticides in India is distinct from the global average. According to Figure 1, 76% of pesticide used in India is insecticide, compared to 44% worldwide. The usage of herbicides and fungicides has decreased as a result of this trend. For cotton crops, pesticides are used 45 percent of the time, followed by paddy and wheat, respectively.

ADVANTAGES OF PESTICIDES

In addition to boosting food output, pesticides can also help farmers make more money and avoid sickness. Pests eat or injure a significant share of agricultural crops, but without pesticides, that number is likely to be far higher.

Pests can be controlled and more food can be produced thanks to the widespread use of pesticides. Farmers are able to enhance their revenues by selling more product when they grow more crops. Pesticides also help farmers save money on labor, which boosts their bottom line. Pesticides minimize the time it takes to eliminate weeds and pests from fields.

Pesticides, in addition to protecting crops and livestock, have also had a positive impact on

human health. Pesticides have been credited with saving the lives of seven million people since 1945 by eradicating disease-carrying or disease-transmitting pests. Pesticides have helped to reduce the incidence of malaria, a disease spread by infected mosquitoes and one of the world's most lethal. Bug-borne illnesses like bubonic plague and typhus were also reduced owing to pesticide usage, which is conveyed by fleas and body lice.

The major advantages of pesticide use are the immediate results of their actions – the anticipated benefits. As an example, the principal advantage of eradicating caterpillars from the cabbage crop is increased yields and a better quality product. There are 26 key advantages resulting from the three main impacts, ranging from recreation grass protection to human lifesaving. As a result of the core advantages, secondary benefits may be less apparent or visible. They might be more subdued, less immediately apparent, or long-term in nature. As a result, it is more difficult to link secondary advantages to pesticide usage, yet they can still be effective arguments for their use. Increasing the output of cabbage, for example, may result in more money for things like schooling and health care for the next generation. Several more advantages have been discovered, ranging from healthier individuals to energy savings.

POTENTIAL SIDE EFFECTS OF COMMON INSECTICIDES

Pesticides have both positive and negative impacts on human health and the environment if its benefits include greater food and fiber production and reduced vector-borne illness. In the face of overwhelming evidence, several of these substances may constitute a threat to human health and the environment. Pesticides affect everyone, and the people of underdeveloped nations and high-risk groups in each country bear a disproportionate share of the burden of the potentially harmful health impacts (WHO, 1990). The annual mortality toll and illness burden caused by pesticide poisoning amounts to around 1 million people worldwide.

Pesticides represent a significant risk to employees in the manufacture, formulation, spraying, mixing, and loading of pesticides.[6] A larger risk of hazard occurs during manufacturing and formulation since the procedures involved are not completely risk-free. As a result of their employment with a wide variety of hazardous substances, industrial employees have an elevated risk of exposure to different diseases and illnesses.

Every living thing on our planet, including the air, lakes, and oceans, as well as the fish and birds that eat them, might be affected by OC chemicals. There is evidence that DDE, a metabolite of DDT, can induce eggshell thinning, and that DDT exposure has led to a drop in the bald eagle population in the United States. It has been hypothesized that long-term exposure to low doses of endocrine disruptors, such as pesticides, might cause a variety of health problems, including immune suppression, hormone disruption, diminished intelligence, reproductive abnormalities, and cancer, among other issues.

There was a 21% prevalence of neurological symptoms among the 356 employees of four HCH production plants in India (Nigam et al., 1993). NIOSH evaluated the potential toxicity risks of spraying carbamate insecticides like methomyl under field circumstances (NIOH). An abnormal ECG, elevated serum LDH levels, and decreased ChE activity in the spraymen indicate that methomyl is cardiotoxic. A significant prevalence of generalized symptoms, as well as psychiatric, neurological, cardiorespiratory, and gastrointestinal complaints, was found in male formulators working in the unorganized sector who

produced pesticide dust and liquid formulations. These men had low plasma ChE activity, too.

Chloracne almost 200 instances with a defined exposure dependency was found to be the sole impact of dioxin generation on persons affected by the Sevesodiaster in Italy during the manufacturing of a herbicide. Studies on liver function, immune system function, neurological impairment, and reproductive impacts conducted in the early stages of the epidemic produced conflicting results. Due to the accident's emotional effects, as well as chemical exposure, cardiovascular and respiratory illness death rates were elevated. Diabetic cases were also observed to be on the rise.[1] The incidence and mortality of cancer in the lymphatic and haematopoietic systems, as well as in the gastrointestinal tract, have both grown in recent years. Due to a lack of individual exposure data, a short latency time and a small population size for several cancer types, the results cannot be taken as definitive. Mortality from all causes and cancer was unchanged in a comparable survey conducted in 2001. While this research does not prove dioxin to be carcinogenic to people, it does confirm previous concepts linking it to cardiovascular and endocrine issues. 3.6 million acres of Vietnamese and Laotian land were sprayed with herbicide by US forces during the Vietnam War, removing forest cover, destroying crops, and clearing vegetation from around US outposts. Operation Ranch Hand, which ran from 1962 to 1971, was the name given to this operation. The phenoxy herbicides 2,4-dichlorophenoxyacetic acid and 2,4,5-trichlorophenoxyacetic acid were employed in a variety of formulations. There were over three million Americans who enlisted and deployed to Vietnam as part of Operation Enduring Freedom. As well as Vietnamese soldiers and civilians and personnel of the armed forces of other countries, some were subjected to defoliant combinations, notably the chemical Agent Orange.[7]

A NEGATIVE EFFECT ON THE ENVIRONMENT

Soil, water, grass and other plants can be contaminated by pesticides used in agriculture. Pesticides can harm more than just insects and weeds; they can also harm birds, fish, helpful insects, and even plants that aren't the intended target of the pesticide's application. Herbicides can also represent a risk to non-target creatures, although insecticides are often more harmful.

Contamination of surface water: Pesticides can enter surface water from treated plants and soil via runoff. Pesticides are a common source of water contamination. There were alarming findings from a comprehensive study of the major river basins across the country by the US Geological Survey (USGS) in the early to mid 1990s. Pesticides were found in more than 90% of the water and fish samples collected from all of the streams. More than 99% of samples from urban streams were confirmed to contain pesticides. It was also discovered by the USGS that pesticide concentrations in urban streams frequently exceeded the requirements for aquatic life protection. A total of 23 chemicals,[5] including 17 herbicides, were found in the Puget Sound Basin's rivers. Pesticides were more prevalent in urban streams than in rural streams, according to the United States Geological Survey (USGS). Pesticides regularly used in metropolitan areas such as 2,4-D, diuron, and prometon, as well as the insecticides chlorpyrifos and diazinon, were among the most often

discovered in surface and ground water across the United States. Studies conducted on water samples from 19 of the 20 river basins confirmed trifluralin and 2,4-D to be present. Pesticide concentrations in urban streams frequently surpassed requirements for aquatic life protection, according to the USGS's findings. In general, more pesticides were found in urban streams than in rural streams, according to the USGS report. The herbicide 2,4-D was discovered in 12 of the 13 streams, making it the most frequent pesticide. Also found in Puget Sound basin streams were the pesticide diazinon, and the weed-killers dichlobenil, diuron, triclopyr, and glyphosate. To safeguard aquatic life, scientists measured levels beyond the National Academy of Science's maximum recommendations for diuron and diazinon.

Pesticide-contaminated groundwater is a global concern, especially in developing countries. A total of 143 distinct pesticides and 21 transformation products have been discovered in ground water, including pesticides from all of the major chemical classes.[8] More than 43 states have had detections in their ground water during the previous two decade. Organo Chlorine pesticides were found in excess of EPA guidelines in 58 percent of the drinking water samples collected from several hand pumps and wells near Bhopal during a survey in India. It may take several years for ground water to be free of harmful substances after they have been contaminated. It's also likely that cleanup will be prohibitively expensive and time-consuming, if not impossible.

Many transformation products (TPs) from various pesticides have been found in the soil, contaminating it. More research is needed in this area because not all probable pesticide TPs have been studied in soil. A number of factors, including water solubility, water-to-octanol partitioning coefficient, and half-life in the soil, influence how long these pesticides and their TPs can remain in the environment. Pesticides and TPs can be divided into two categories: (a) soil-bound hydrophobic, persistent, and bioaccumulable pesticides. These pesticides include organochlorine pesticides like DDT, endrin, heptachlor, and its derivatives, such as lindane and related TPs. Although many of them are no longer used in agriculture, their residues remain. (b) Herbicides, carbamates, fungicides, and a few organophosphorus insecticides TPs make up the majority of polar pesticides. By way of runoff and leaching, they pose a threat to the supply of drinking water to the general population. Herbicide-derived pesticide TPs are by far the most well studied in soil. A variety of hazardous phenolic chemicals can be produced by several metabolic processes, including hydrolysis, methylation, and ring breakage. Soils retain pesticides and their TPs in varying degrees, depending on how soil qualities interact with pesticide properties. The soil's organic matter content is the most important factor. Pesticides and TPs are more easily absorbed by organic matter with a higher organic matter concentration. When using pesticides like paraquat, it's critical that the soil has the ability to store positively charged ions in a form that can be exchanged. In the last several years, there has been no advancement in analytical methods or research into the extraction of these compounds. The pH of the soil is also a factor. For ionizable pesticides, the rate of adsorption rises as soil pH decreases.[1]

FERTILITY OF THE SOIL BACTERIA THAT ARE GOOD FOR THE SOIL

Pesticides can harm beneficial soil microbes if they are used excessively. Dr. Elaine Ingham, a soil scientist, says, "The soil declines if both bacteria and fungus are lost.

Toxicological effects on soil organisms are comparable to those of antibiotic abuse in humans. There aren't enough beneficial soil organisms to hang on to the nutrients after a few years of using pesticides in an indiscriminate manner.[2] Nitrogen in the atmosphere is converted into nitrates by a number of soil microbes, for example. A common landscape herbicide, 2,4-D, inhibits the transformation of ammonia into nitrates by soil bacteria; triclopyr inhibits soil bacteria that transform ammonia into nitrite; and glyphosate reduces the growth and activity of free-living nitrogen-fixing bacteria in the soil. This process is disrupted by common landscape herbicides. Many plants have mycorrhizal fungus attached to their roots, which help them absorb nutrients. Herbicides in the soil can also destroy these fungus. Mycorrhizal fungi were shown to be inhibited by oryzalin and trifluralin in one investigation. At quantities lower than those seen in soil following usual applications, Roundup has been demonstrated to be harmful to mycorrhizal fungi. Mycorrhizal fungi were also shown to be harmful to Triclopyr, and oxadiazon decreased the amount of mycorrhizal fungal spores in the presence of these chemicals.

Despite the fact that pesticides offer numerous advantages, there have also been many drawbacks to their usage. It is not always the case that pesticides remain in the area where they are employed. Because of their mobility, they may be found in all three of these mediums: the water, the air, and the soil. Mobility of pesticides is an issue because pesticides can affect other creatures as they travel.

Studies have revealed that pesticides destabilize ecosystems. When pesticides are employed, they can also harm non-pest creatures, which is a problem in many cases. The ecosystem's natural equilibrium can be severely altered as a result of this. Non-pest organisms can be eliminated in order to alter the environment in a way that benefits the pest. Pesticides that migrate from their initial area are known to cause harm to humans as well as wildlife. Between 20,000 and 40,000 individuals worldwide die each year from pesticide poisoning, cancer, and other diseases linked to pesticide exposure.

Bioaccumulation and biological amplification are two more key issues linked with pesticide usage. Bioaccumulation occurs when a chemical accumulates in the body because the body lacks the ability to eliminate it. Several synthetic insecticides can't be degraded. As soon as they enter an organism's body, they remain there forever.[7]

It is possible for pesticides to accumulate in an organism's body and cause harm to the creature or to be passed on to its prey. Due to the fact that pesticides are incorporated into an organism's tissue, they might be passed to a predator when they eat it. Pesticide concentrations in a predator's body will rise as they eat more and more people who have been exposed.[2]

Pesticide concentrations will be larger in higher food chain species since they ate numerous lower level organisms that had pesticides stored in them. The term "biomagnification," sometimes known as "chemical magnification," is used to explain how pesticide concentrations rise up the food chain. The chemical DDT is a well-known example of biomagnification.

Since the 1950s, this insecticide has been used to kill mosquitoes and spray crops to kill pests. Zooplankton ingested the DDT that had been released into the water supply, which was subsequently eaten by smaller fish before being eaten by bigger ones. In the end, the larger fish were eaten by predatory birds,[4] and the birds were killed by the high

concentration of pesticides that accumulated in their bodies owing to biomagnification of the pesticide. Predators like the peregrine falcon were nearly extinct as a result of this change.

CONCLUSION

Despite widespread opposition, pesticides continue to play a key role in agriculture due to their numerous advantages. Its potential to boost output and raise productivity is one of its many advantages. Using pesticides, farmers in India were able to quadruple the amount of grain they produced in less than 50 years, according to one research. As a result, wheat and corn yields have grown, as well. Plants protected by pesticides are more resistant to diseases, weeds, and insects which can reduce the amount of food that can be harvested. Farmers that don't use pesticides risk losing a lot of money because their crops are ruined. One of the advantages of pesticides is their ability to suppress vector-borne diseases.[8] Among them are illnesses that harm people, such as malaria and typhus, which may wreak havoc on crops and cattle. People's overall health has been proven to improve as a result of the increased availability of high-quality meals. Reducing the risk of high blood pressure, heart disease, diabetes, stroke, cancer, and other chronic illnesses has been demonstrated to exceed the probable hazards posed by ingesting pesticide residue on food. Pesticides have also been shown to have unintended side effects, such as the ability to save money on product yield and use that money for things like education and health care.

Pesticides are sprayed directly onto crops by farmers, but spray drift can also expose people to pesticides in more subtle ways. The WHO is the source of this information.

As a result, many of the pesticides used in agricultural wind up in the human body. Direct and indirect exposure are the two basic ways in which a person is exposed. Pesticides can be applied, used, or created by individuals in an agricultural, occupational, or residential context, while indirect exposure can occur by ingesting polluted water, food, air, or dust. Agriculture employees, pesticide industry staffers as well as exterminators are all at risk of occupational contamination. It is not uncommon for pesticide application workers to be exposed to the greatest levels of pesticides.[6] Accidental chemical spills, leaks, malfunctioning spraying equipment or airborne dust particles, inappropriate use or application of pesticides or not following safety measures can all lead to this form of exposure. Pesticides can reach the general populace in two ways: indirectly through household pesticide use, or directly through direct contact with pesticides. There are several ways in which pollution may enter the water, land, and air. Even if instructions and safety precautions are followed to the letter, at-home insecticides can leave residue on clothing, surfaces, bedding, and other equipment. Human exposure might also be increased under certain meteorological situations. For example, severe winds can induce increased spray spread while high temperatures can cause pesticide applications to evaporate quicker.

The information gathered from environmental and health risk assessment studies can be helpful in figuring out what's going on. There is a paucity of information on the prevalence of pesticide-related disorders among populations identified in underdeveloped nations. Baseline descriptive epidemiological data, intervention measures to reduce acute poisoning rates, and periodic surveillance studies on high-risk populations are essential to ensure the safety of the population. Investigations of pesticide outbreaks and unintentional exposures,[4]correlation studies, cohort analysis and randomised trials of intervention

techniques should be included in our efforts. It is possible to gain valuable information by monitoring the amounts of residues in the general population's bodily fluids and tissues. Workers' education and training are increasingly being recognized as a key mechanism for ensuring safe application of pesticides.

Pesticides offer the best potential for individuals who are adept at balancing risk and reward in the context of risk-benefit analysis. Pesticides have been projected to have an annual economic impact on poor nations of around $8 billion on non-target animals (including humans).[6]To provide the greatest possible margin of safety, it is necessary to consider all of the risks and rewards. Pesticide usage has a very different cost-benefit profile in affluent and underdeveloped nations. To avoid starvation and infectious illnesses like malaria, poor nations must utilize pesticides. As a result, it may be necessary to accept some degree of risk. Pesticides should only be used when absolutely necessary. There should be no commercial motives in any decision-making about pesticide use. In order to thoroughly assess the threats that pesticides pose to human health, several inherent challenges must be overcome. For example, a wide range of human characteristics – such as age, gender, race, socioeconomic level, food, and overall health – influence the likelihood of someone being exposed to pesticides. However, little is known about how these factors interact with one other. Concomitant exposure to various pesticides and contaminants in air, water, food and pharmaceuticals dramatically influences the long-term consequences of low-level exposure to one pesticide.

Many people think pesticides are a quick, easy, and economical way to get rid of weeds and insect pests in urban settings. Pesticide usage, on the other hand, comes at a high price. Almost every area of our ecosystem has been poisoned by pesticides. As a result, pesticide residues may be detected in the soils, air, and groundwater of all countries. Insects, plants, fish, and birds are all at danger due to pesticide contamination, as are soil microbes and other non-target creatures. Even herbicides may affect the environment, contrary to popular belief. Weed killers, on the other hand, pose an issue since they are utilized in big quantities. Pesticide pollution in our environment can be reduced if we all do our part to employ safer, non-chemical methods of pest management (including weed control) rather than using pesticides.

The process of determining the types and extents of pesticide-related benefits has been a combination of investigation, speculation, and distillation. However, there have been some unexpected twists and turns along the way.[2] The basic picture is what we expected: criticizing pesticides garners attention, ideological praise, and research opportunity, but praising them draws charges of self-serving bias. Scientific publications, reports, media stories, and websites in favor of and against pesticides show this disparity. Most of the community's economic advantages may be traced back to its role in promoting social well-being, with some notable exceptions. There are mostly economic, social, and environmental advantages at the national level, with a few exceptions. The environmental advantages only become apparent at the global scale.

Employers and employees need to know that investing in preventative health measures and health promotion programs is a worthwhile endeavor that benefits both parties and contributes to long-term economic growth. We can conclude that pesticides show some uncertainty in instances when humans are subjected to lifelong exposure based on our

limited understanding of direct and/or inferential evidence.[4] As a result, developing and disseminating health education materials based on knowledge, ability, and practice is essential if we are to reduce human exposure to pesticides.

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