

IMPACT OF AGROCHEMICAL USE IN AGRICULTURE: THEIR BENEFITS AND HAZARDS

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INDRODUCTION

Agriculture is essential for human survival, in order to meet the demand of food created by exponential growth of population. But the food production via conventional agricultural method was insufficient. The absence of modern techniques, different plant diseases and the pest infections, climate events and natural disasters further prevented the agricultural productivity. These lack of sufficiency and efficiency created different famines around the world. The great Chinese famine (1959-61) is one of the most severe and saddest example, which caused the death of 15 to 43 million people. So in order to defeat the far reaching severity of the food scarcity, new techniques were introduced in agriculture, which then known as "Green Revolution"

Green Revolution is a movement which refers to a series of research, development, and technology transfer initiatives. This happened between the 1960s and 1980s. It started with use of new high-yielding varieties of food crop, and the widespread use of machineries, irrigation techniques and agrochemicals such as fertilizers sufficient rapid supply of nutrients and pesticides and herbicides to control the pests and weeds respectively to maximize the productivity. The outcome was the unprecedented gains in the production of grains and other food products particularly in developing countries. In India the Green Revolution started in the late 1960s and with its success India attained food self-sufficiency within a decade.

AGROCHEMICALS

An agrochemicals are general name for the chemicals used in agriculture and are consist of pesticides including insecticides, herbicides, fungicides and nematicides. It also include synthetic fertilizers, various plant hormones and other chemical growth agents. Over the past few decades, the heavy reliance on agrochemicals have been witnessed in order to enhance the crop production. In India, these agrochemicals acted a very crucial role in the success of the green revolution.

Agrochemicals have various beneficial effects. These include supplementation of plant nutrients, crop protection, growth promoters, and growth retardants, preservation of food and materials, and prevention of vectorborne diseases as a primary effect. The most important benefits include the protection of human, animal, and crop health as secondary benefits.

HARMFUL EFFECTS OF AGROCHEMICALS

Agrochemical use raises numerous environmental concerns, including human health and animal health hazards. Pesticides are ubiquitous in the environment and most are synthetic. Food toxicity due to pesticides is associated with severe effects on human health. Actually, the mode of action of pesticides involves targeting the systems or enzymes in pests which may be identical or similar to the systems or enzymes in human beings and they, therefore, pose risks to human and livestock health as well as to the environment.

Pesticide toxicity can result from a high level of exposure, mishandling, ingestion, inhalation, or dermal absorption. Sustained exposure to such agrochemicals for a long period of time may result in various dangerous diseases, such as:

- Hormonal imbalances, leading to infertility and breast pain;
- neurological, psychological, and behavioral dysfunctions;
- reproductive system defects;
- immune system dysfunction;
- blood disorders;
- genotoxicity;
- cancers.

Pesticides can pollute soil, water, grasslands, and other vegetation. In addition to killing insect-pests, pathogens, or weeds, pesticides can be toxic to nontargeted organisms, like birds, fish, beneficial insects, and other plants. A number of toxicological studies in animals demonstrate that pesticides, to which the general population may be chronically exposed, are potential carcinogens, neurotoxins, reproductive toxins, and immunotoxins, besides the involvement of pesticides in the development of neurodegenerative diseases. Several articles and reports evaluated toxicological and epidemiological evidences for various health effects associated with pesticides. Pesticide contamination can affect aquatic fauna and flora, as well as human health when water is used for public consumption. Aquatic organisms are directly exposed to chemicals resulting from agricultural production via surface runoff or indirectly through trophic chains.

Impact on environment

Pesticides can contaminate soil, water, turf, and other vegetation. In addition to killing insects or weeds, pesticides can be toxic to a host of other organisms including birds, fish, beneficial insects, and non-target plants. Insecticides are generally the most acutely toxic class of pesticides, but herbicides can also pose risks to non-target organisms.

Surface water contamination

Surface waters are the main receptors of pesticides contamination from agricultural use. Pesticides can contaminate surface water through runoff from treated plants and soil. Contamination of water by pesticides is widespread. The studies done by the U.S. Geological Survey (USGS) on major river basins across the country reveals that, More than 90 percent of water and fish samples from all streams contained one, or more often, several pesticides. Pesticides were found in all samples from major rivers with mixed agricultural and urban land use influences and 99 percent of samples of urban streams. The USGS also found that concentrations of insecticides in urban streams commonly exceeded guidelines for protection of aquatic life.

Ground water contamination

Groundwater pollution due to pesticides is a worldwide problem. According to the USGS, at least 143 different pesticides have been found in ground water, including pesticides from every major chemical class. During one survey in India, 58% of drinking water samples drawn from various hand pumps and wells around Bhopal were contaminated with Organochlorine pesticides above the EPA standards. Once ground water is polluted with toxic chemicals, it may take many years for the contamination to dissipate or be cleaned up.

Soil contamination

Soil, a natural environment for the growth and development of plants, consists of a mixture of organic and mineral components occurring in gaseous, aqueous and solid states. Genetically and environmentally, soils differ significantly, yet, they tend to perform the function of reservoirs of water and nutrients necessary for a suitable development of the plant root system and microorganism. Soil has the capacity of retaining various pollutants, such as heavy metals, pesticides hence they impart to the contamination of the food chain, which can also potentially threaten human health

The active substances of pesticides produce pollution in soil environment, affecting microorganisms living there. Thus, they may also interfere with the correct sequence of biochemical pathways in soil biogeochemical cycles.

Heavy treatment of soil with pesticides can cause populations of beneficial soil microorganisms to decline. According to the 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 organisms that are similar to human overuse of antibiotics. Indiscriminate use of chemicals might work for a few years, but after awhile, there aren't enough beneficial soil organisms to hold onto the nutrients" (Savonen, 1997). For example, plants depend on a variety of soil microorganisms to transform atmospheric nitrogen into nitrates, which plants can use.

CONCLUSION

Although pesticides are applied to the soil, these substances can be transported over long distances through evaporation and precipitation. In addition, pesticides also reach water bodies by surface runoff and by percolation through the soil and into the groundwater. In this way, many compounds have been detected in high concentrations in surface waters worldwide. The occurrence of these contaminants in the aquatic environment, especially in high concentrations, can cause adverse effects on non-target organisms, including humans. Some of the compounds identified can induce endocrine dysfunction, oxidative stress, immune and neurological system problems, and chromosomal changes among other effects that may be more severe in pregnant women and children. In addition, pesticides generally occur in surface waters as complex mixtures that are difficult to evaluate, and may have additive and synergistic effects. It is noteworthy that some revised toxicological studies observed effects on organisms after exposure to herbicides, fungicides, and insecticides at concentrations found in surface waters .

For these reasons, it is very important that drinking water is treated in order to remove contaminants before distribution to the population. Many examples of pesticides resistant to conventional water treatment methods were observed. These compounds remained stable throughout all of the steps in the process with few exceptions. Among several advance treatment techniques for pesticide removal, the adsorption process presents high efficiency and high adsorption capacity for a wide range of pesticides and may be a process with great potential.

Also more sustainable and environmental friendly system of cultivation needs to be practiced and it should have been called Organic Farming. For that the should be another wave of green Revolution has to occur with focus on to feed a growing world population and to do so sustainably without compromising the environment.

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