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Review Paper

Use Abuse and Environmental Impacts of Pesticides: A Preliminary Review

Shweta Singh[a]; Shekhar Anand Pandey[b] and K.K. Singh[b]
[a-] *Dr. S.P.M. Government Degree College, Bhadohi, U.P. India.*
[b-] *T.D.Post Graduate College, Jaunpur, 222202, U.P, India.*

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Corresponding Author:
Shweta Singh
Dr. S.P.M. Government Degree College, Bhadohi, U.P. India.

Abstract
Pesticides are an important management tool in agricultural production. They increase yields and reduce the presence of foreign materials in some commodities. Pesticides are used widely to control insects, weeds and fungi that might otherwise destroy a large part of the world's food crops. They are also used in many countries to control insect vectors of human diseases such as malaria.
The other side of the pesticide is there are huge bad impacts on environment and human health. Many of the chemicals used in pesticides are persistent soil contaminants, whose impact may endure for decades and adversely affect soil conservation. Despite the magnitude of the problem of pesticide poisoning, there have been very few analytical studies in developing countries to identify the risk factors. The dangers of pesticide use to human health and environment (Air, water and soil) comprise of acute poisoning caused by intentional, occupational or accidental exposure and adverse health effects caused by long-term (mainly occupational) exposure. Each pesticide comes with a specific set of environmental concerns. Undesirable effects have led many pesticides to be banned. Over time, pesticides have generally become less persistent and more species-specific, reducing their environment footprints.

Keywords: *Pesticides, commodities, risk factors, etc.*

Introduction

The term pesticide covers a wide range of compounds including insecticides (DDT, endrin, heptachlor etc) [1] fungicides (zineb, captan, and maneb) [2], herbicides (paraquat), rodenticides (warfarin, bromodiolone), molluscicides (quaternary and polyquaternary ammonium compounds), nematicides (carbofuran, fenamiphos) plant growth regulators (auxins, ethylene releasers, gibberellins) and others. Since the 1900s, people have been using different types of pesticides and the environment is filled with various levels of these chemicals. However, consumers have to be aware of the positive and negative impact of these chemicals on the environment. The Improvement of the quality of human life is one of the benefits of pesticides and the environment can be protected at the same time. However, it cannot be denied that these chemicals also have harmful effects on humans and their environment. Pesticides can kill bees and are strongly implicated in pollinator decline, the loss of species that pollinate plants, including through the mechanism of Colony Collapse disorder, [3-6]. Application of pesticides to crops that are in bloom can kill honeybees, [7] which act as pollinators. Pesticides can enter the body through inhalation of aerosols, dust and vapor that contain pesticides; through oral exposure by consuming food/water; and through skin exposure by direct contact [8]. Soil health is also adversely affected by the use of pesticides and the environment groups in the United States have conducted studies to prove this. One study revealed that in 1940 to 1991, fruits and vegetables showed a decline in trace mineral content by as much as 76%. This is because the soil that is polluted with harmful chemical substances affected the nutritional value off the crops. The chemical protection of plants is based on the use of various organic and inorganic compounds toxic to harmful organisms. They persist in the soil for a long time and harm the next crop also. The main aim of this review is to formulate new biodegradable chemical agents and which are more specific in action and less persistent in the open environment.

Benefits of Pesticides

Only some benefits of pesticides are listed here.

Quality of food

In countries of the first world, it has been observed that a diet containing fresh fruit and vegetables far prevail over potential risks from eating very low residues of pesticides in crops [9]. Increasing evidence [10] shows that eating fruit and vegetables regularly reduces the risk of many cancers, high blood pressure, heart disease, diabetes, stroke, and other chronic diseases. Lewis discussed the nutritional properties of apples and blueberries in the US diet and concluded that their high concentrations of antioxidants act as

protectants against cancer and heart disease [11]. Lewis attributed doubling in wild blueberry production and subsequent increases in consumption chiefly to herbicide use that improved weed control.

Other areas – transport, sport complex, building
The transport sector makes extensive use of pesticides, particularly herbicides. Herbicides and insecticides are used to maintain the turf on sports pitches, cricket grounds and golf courses. Insecticides protect buildings and other wooden structures from damage by termites and wood boring insects.

Perils of Pesticides
It includes following subheadings:
Humans and their life
If the credits of pesticides include enhanced economic potential in terms of increased production of food and fibre, and amelioration of vector-borne diseases, then their debits have resulted in serious health implications to man and his environment. There is now overwhelming evidence that some of these chemicals do pose a potential risk to humans and other life forms and unwanted side effects to the environment [12; 13]. No segment of the population is completely protected against exposure to pesticides and the potentially serious health effects, though a disproportionate burden is shouldered by the people of developing countries and by high risk groups in each country [14]. The world-wide deaths and chronic diseases due to pesticide poisoning number about 1 million per year [15].

Effects through food supplies
For determining the extent of pesticide contamination in the food stuffs, programs entitled 'Monitoring of Pesticide Residues in Products of Plant Origin in the European Union' started to be established in the European Union since 1996. In 1996, seven pesticides (acephate, chlopyriphos, chlopyriphos-methyl, methamidophos, iprodione, procymidone and chlorothalonil) and two groups of pesticides (benomyl group and maneb group, i.e. dithiocarbamates) were analysed in apples, tomatoes, lettuce, strawberries and grapes. An average of about 9 700 samples has been analysed for each pesticide or pesticide group. For each pesticide or pesticide group, 5.2% of the samples were found to contain residues and 0.31% had residues higher than the respective MRL for that specific pesticide. Lettuce was the crop with the highest number of positive results, with residue levels exceeding the MRLs more frequently than in any of the other crops investigated. The highest value found in 1996 was for a compound of the maneb group in lettuce which corresponded to a mancozeb residue of 118 mg/kg. In 1997, 13 pesticides (acephate, carbendazin, chlorothalonil, chlopyriphos, DDT, diazinon, endosulfan, methamidophos, iprodione, metalaxyl, methidathion, thiabendazole, triazophos) were assessed in five commodities (mandarins, pears, bananas,beans, and potatoes).

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
Pesticides can reach surface water through runoff from treated plants and soil. Contamination of water by pesticides is widespread. The results of a comprehensive set of studies done by the U.S. Geological Survey (USGS) on major river basins across the country in the early to mid- 90s yielded startling results. More than 90 percent of water and fish samples from all streams contained one, or more often, several pesticides [16].

Ground water contamination
Groundwater pollution due to pesticides is a worldwide problem. According to the USGS, at least 143 different pesticides and 21 transformation products have been found in ground water, including pesticides from every major chemical class. Over the past two decades, detections have been found in the ground water of more than 43 states [17]. During one survey in India, 58% of drinking water samples drawn from various hand pumps and wells around Bhopal were contaminated with Organo Chlorine pesticides above the EPA standards [18].

Soil contamination
A large number of transformation products (TPs) from a wide range of pesticides have been documented [19, 20]. Not many of all possible pesticide TPs have been monitored in soil, showing that there is a pressing need for more studies in this field. Persistency and movement of these pesticides and their TPs are determined by some parameters, such as water solubility, soil-sorption constant (K_{oc}), the octanol/water partition coefficient (K_{ow}), and half-life in soil (DT_{50}). Pesticides and TPs could be grouped into :(a) Hydrophobic, persistent, and bioaccumulable pesticides that are strongly bound to soil. Pesticides that exhibit such behavior include the organochlorine DDT, endosulfan, endrin, heptachlor, lindane and their TPs. Most of them are now banned in agriculture but their residues are still present. (b) Polar pesticides are represented mainly by herbicides but they include also carbamates, fungicides and

some organophosphorus insecticide TPs. They can be moved from soil by runoff and leaching, thereby constituting a problem for the supply of drinking water to the population.

Effect on soil fertility (beneficial soil microorganisms)
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" [21]. For example, plants depend on a variety of soil microorganisms to transform atmospheric nitrogen into nitrates, which plants can use. Common landscape herbicides disrupt this process: triclopyr inhibits soil bacteria that transform ammonia into nitrite [22]; glyph sate reduces the growth and activity of free-living nitrogen-fixing bacteria in soil [23] and 2, 4-D reduces nitrogen fixation by the bacteria that live on the roots of bean plants [24], reduces the growth and activity of nitrogen-fixing blue-green algae [25], and inhibits the transformation of ammonia into nitrates by soil bacteria [26]. Mycorrhizal fungi grow with the roots of many plants and aid in nutrient uptake. These fungi can also be damaged by herbicides in the soil.

Conclusion
Pesticides are often considered a quick, easy, and inexpensive solution for controlling weeds and insect pests in urban landscapes. However, pesticide use comes at a significant cost. Pesticides have contaminated almost every part of our environment. Pesticide residues are found in soil and air, and in surface and ground water across the countries, and urban pesticide uses contribute to the problem. Pesticide contamination poses significant risks to the environment and non-target organisms ranging from beneficial soil microorganisms, to insects, plants, fish, and birds. Contrary to common misconceptions, even herbicides can cause harm to the environment. In fact, weed killers can be especially problematic because they are used in relatively large volumes. The best way to reduce pesticide contamination (and the harm it causes) in our environment is for all of us to do our part to use safer, non-chemical pest control (including weed control) methods. Our efforts should include investigations of outbreaks and accidental exposure to pesticides, correlation studies, cohort analyses, prospective studies and randomized trials of intervention procedures. Valuable information can be collected by monitoring the end product of human exposure in the form of residue levels in body fluids and tissues of the general population. The importance of education and training of workers as a major vehicle to ensure a safe use of pesticides is being increasingly recognized.

Our approach to the use of pesticides should be pragmatic. In other words, all activities concerning pesticides should be based on scientific judgment and not on commercial considerations. There are some inherent difficulties in fully evaluating the risks to human health due to pesticides. For example there is a large number of human variables such as age, sex, race, socio-economic status, diet, state of health, *etc.* – all of which affect human exposure to pesticides. But practically little is known about the effects of these variables. The long-term effects of low level exposure to one pesticide are greatly influenced by concomitant exposure to other pesticides as well as to pollutants present in air, water, food and drugs.

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