

## **1.0 ENVIRONMENTAL EFFECTS OF ORGANIC, INORGANIC AMENDMENTS AND AGROCHEMICALS**

### **8.1 INTRODUCTION**

Over the past century humans have introduced a large number of chemical substances into the environment. Some are the waste from industrial and agricultural processes. Some have been designed as structural materials and others have been designed to perform various functions such as improving crop growth or killing pests and weeds. Obviously some chemicals are useful but many are toxic and their harm to the environment and our health far outweighs their benefit to society. We need to manage the risks better by only using chemicals, which are safe.

#### **Agrochemical**

—Any substance used in the management of an agricultural ecosystem, including fertilizers, pH-adjusting agents, soil conditioners, pesticides, and crop-growth regulators.

#### **Fertilizer**

—An agrochemical that is added to soil to reduce or eliminate nutrient-caused constraints to crop productivity. Fertilizers are substances that are added to farmlands to encourage plant growth and to increase crop yields.

#### **Soil conditioners**

—Substances added to soil to improve its aeration and water-holding capacity, with great benefits in terms of crop growth. Various organic compounds can be used as soil conditioners, but compost is the best. Materials used as soil conditioners include peat, livestock manure, sewage sludge, and even shredded newspapers

## **Pesticide**

- Any substance or mixture of substances intended for preventing, destroying, repelling or mitigating any pest. A pesticide may be a chemical substance, biological agent (such as a virus or bacterium), antimicrobial, disinfectant or device used against any pest.

## **Detrimental Effects of Agrochemicals on the Environment**

The use of certain agrochemicals has also been associated with some important environmental ecological damages as outlined below:

### **1) Fertilizers:**

**i) Groundwater contamination:** Excessive use of fertilizers can lead to the contamination of groundwater with nitrate, rendering it unfit for consumption by humans or livestock. Water containing large concentrations of nitrate can poison animals by immobilizing some of the hemoglobin in blood, reducing the ability to transport oxygen.

**ii) Eutrophication:** In addition, the run-off of agricultural fertilizer into streams, lakes, and other surface waters can cause an increased productivity of those aquatic ecosystems, a problem known as eutrophication. It starts by increasing the amount of phytoplankton in the water, this then blocks out the sunlight, which leads to plants being unable to photosynthesise, which in turn

means that the fish and other creatures don't have anything to eat, which means they die and then in turn so do other animals that depend on them such as birds.

**2) Pesticides:** The use of pesticides raises a number of environmental concerns. Over 98% of sprayed insecticides and 95% of herbicides reach a destination other than their target species, including non-target species, air, water and soil.

### **i) Air pollution by pesticides**

Pesticides can contribute to air pollution. Pesticide drift occurs when pesticides suspended in the air as particles are carried by wind to other areas, potentially contaminating them. Pesticides that are applied to crops can volatilize and may be blown by winds into nearby areas, potentially posing a threat to wildlife.

### **ii) Water pollution by pesticides**

There are four major routes through which pesticides reach the water:

- a) it may drift outside of the intended area when it is sprayed,
- b) it may percolate, or leach, through the soil,
- c) it may be carried to the water as runoff or it may be spilled, for example accidentally or through neglect. d) it may also be carried to water by eroding soil.

There are some factors that also affect pesticide's ability to contaminate water and these include:

- a) its water solubility,
- b) the distance from an application site to a body of water,

- c) weather,
- d) soil type,
- e) presence of a growing crop, and
- f) the method used to apply the chemical.

### **iii) Soil pollution by pesticides**

Many of the chemicals used in pesticides are persistent soil contaminants, whose impact may endure for decades and adversely affect soil conservation. The use of pesticides decreases the general biodiversity in the soil. Not using the chemicals results in higher soil quality with the additional effect that more organic matter in the soil allows for higher water retention. This helps increase yields for farms in drought years, when organic farms have had yields 20-40% higher than their conventional counterparts. A smaller content of organic matter in the soil increases the amount of pesticide that will leave the area of application, because organic matter binds to and helps break down pesticides.

### **Effect of pesticides on plants**

- i) It hinders nitrogen fixation in legumes. The insecticides DDT, methyl parathion, and especially pentachlorophenol have been shown to interfere with legume-rhizobium chemical signaling. Reduction of this symbiotic chemical signaling results in reduced nitrogen fixation and thus reduced crop yields.
- ii) Pesticides can kill bees and they are strongly implicated in pollinator decline and the loss of species that pollinate plants.

iii) On the other side, pesticides have some direct harmful effect on plant including poor root hair development, shoot yellowing and reduced plant growth.

### **Effect on animals**

Pesticides inflict extremely widespread damage to biota, and many countries have acted to discourage pesticide usage through their Biodiversity Action Plans.

i) Animals may be poisoned by pesticide residues that remain on food after spraying, for example when wild animals enter sprayed fields or nearby areas shortly after spraying.

ii) Widespread application of pesticides can eliminate food sources that certain types of animals need, causing the animals to relocate, change their diet, or starve.

iii) Poisoning from pesticides can travel up the food chain; for example, birds can be harmed when they eat insects and worms that have consumed pesticides.

iv) Some pesticides can bioaccumulate, or build up to toxic levels in the bodies of organisms that consume them over time, a phenomenon that impacts species high on the food chain especially hard.

v) Some pesticides come in granular form, and birds and other wildlife may eat the granules, mistaking them for grains of food. A few granules of a pesticide is enough to kill a small bird.

vi) The herbicide paraquat, when sprayed onto bird eggs, causes growth abnormalities in embryos and reduces the number of chicks that hatch successfully, but most herbicides do not directly cause much harm to birds. Herbicides may endanger bird populations by reducing their habitat.

vii) Fish and other aquatic biota may be harmed by pesticide-contaminated water. Pesticide surface runoff into rivers and streams can be highly lethal to aquatic life, sometimes killing all the fish in a particular stream.

### **Effect on Humans**

Pesticides are implicated in a range of impacts on human health due to pollution

i) Pesticides can enter the human body through inhalation of aerosols, dust and vapor that contain pesticides; through oral exposure by consuming food and water; and through dermal exposure by direct contact of pesticides with skin.

ii) Pesticides are sprayed onto food, especially fruits and vegetables, they secrete into soils and groundwater which can end up in drinking water, and pesticide spray can drift and pollute the air.

iii) Exposure to pesticides can range from mild skin irritation to birth defects, tumors, genetic changes, blood and nerve disorders, endocrine disruption, and even coma or death.

### **Pest resistance**

Pests may evolve to become resistant to pesticides. Many pests will initially be very susceptible to pesticides, but some with slight variations in their genetic makeup are resistant and therefore survive to reproduce. Through natural selection, the pests may eventually become very resistant to the pesticide.

### **3) Persistent organic pollutants**

Persistent organic pollutants (POPs) are compounds that resist degradation and thus remain in the environment for years. Some pesticides, including aldrin, chlordane, DDT, dieldrin, endrin,

heptachlor, hexachlorobenzene, mirex, and toxaphene, are considered POPs. POPs have the ability to volatilize and travel great distances through the atmosphere to become deposited in remote regions.