Soil and Pollution

Waste: Waste may be defined as useless, unwanted or discarded material.

Introduction of waste into soil may result soil contamination or pollution. Pollution, thus, refers to the addition of substances resulting in the degradation of soils and the environment. Major types of wastes reaching the soil can be classified as under:

1. Agricultural wastes
2. Industrial wastes
3. Municipal wastes
4. Nuclear wastes

1. Agricultural Wastes

Agricultural wastes include many forms of fertilizers, pesticides, plant residues, animal waste, compost and forest residues. Many of them are beneficial when added to the soil e.g. plant residues and FYM. Some of them such as plant and forest residues are important sources for the production of methane and ethanol previously called biofertilizer. However, improper handling and disposal of many types of agricultural wastes may cause contamination and pollution.

a. Fertilizers: Use of inorganic fertilizers is essential to increase crop production but it may prove hazardous to the environment. Nitrogenous fertilizers that can be converted into nitrates may cause environmental problem. Nitrates are taken up by plants but high nitrate contents in plants are considered unhealthy especially when crops are used for the manufacture of baby food. When nitrates are not taken up by the plants, then contamination of ground water with nitrates may occur. Nitrate ions are negatively charged and hence, are not adsorbed by negatively charged soil colloids and in this way are subjected to leaching in ground water. Nitrates present in drinking water are harmful for animals.

Another fertilizer element considered a hazard in soils and the environment is phosphorus. Phosphorus is a plant nutrient and is required for plant growth. However, with the excessive use of phosphate fertilizers, large amounts of the phosphate may leach into streams and lakes. An over enrichment of lake water with phosphate and nitrate ions causes excessive growth of unwanted aquatic plants and this process is called as **eutrophication**.

Environmental concerns, therefore caution against the indiscriminate use of fertilizers. An overuse, causing contamination and pollution, may impose restrictions by the government that may prove very costly to agricultural operations.

b. Pesticides: Pesticides are used for the control of pests and diseases in crops. They include insecticides, fungicides and herbicides. An environmentally friendly pesticides must have at least the following attributes:

- Must be safe to handle
- Must be effective but short lived
- Must not be harmful to human health

Their potential as a pollutant depends on their biodegradability and toxicity to animals and people. Pesticides that can persist in soils for long time affect the food chain by process called biological magnification which means accumulation and subsequent concentration in the food chain. DDT may persist in soils for years and such persistent insecticides can cause problems to non-target organisms. They may cause severe damage to animals. Safety levels of these pesticides for human health are set today on the basis of the effect of long term exposure to these chemicals.

An additional environmental problem is the development of resistance by many organisms over time caused by the frequent use of pesticides. Generally, this forces even greater use of the chemicals leading to more contamination and pollution of the environment.

c. Crop Residues: Crop residues are generally very beneficial for soils and will cause no serious pollution when disposed of in a proper manner. They are main source of food and energy for microorganisms and control loss of water by evaporation from soils when used as mulch and may protect the soil against erosion. They contain plant nutrients which are released upon decomposition.

d. Animal wastes from agricultural operations include manure from cattle, chickens, sheep and other types of animals. They vary considerably in chemical composition due to the type and amount of feed used and also the methods of collection, storage and handling. Most of the nutrients in manure are not easily available to plants. Their release depends on the rate of decomposition or mineralization. Biologically, animal manures contain a large number of saprophytic disease carrying and parasitic microorganisms which need to be taken into consideration in the disposal of manure.