**Control of Weeds and Pests**

The small-sized unwanted plants, which grow along with a cultivated crop in a field, are called weeds. Like other pests, they also adversely affect crops by suppressing growth. The growth of weeds in the crop fields is harmful because they consume a great amount of nutrients, water, sunlight and space, which are meant for the crop plants. Growth of weeds tends to reduce the crop yield and lower the quality of food grains. The weeds sometimes are a crop plant or plant of another variety of same crop.

**Methods of weed control**

Weeds can be controlled by following methods:

1. **Mechanical control**

These include the following methods: uprooting, weeding with trowel or ‘khurpi’ or harrow (a comb-like implement), hand hoeing (scrapping), interculture, ploughing, burning and flooding.

 The process of removing the weeds from crop field is called weeding. Weeding can be done by the following methods: (1) Weeds may be pulled out with hand. Ploughing helps in removing large number of the weeds because it uproots majority of them. (2) Before sowing or transplantation, weeds are removed by using a big comb-like harrow. Harrow cannot be used in standing crops because it will also uproot the crop plants. The weeds appear during the growth of crop plants are removed manually by using a trowel (khurpa).

1. **Cultural control**

They include the following methods: Proper bed preparation, timely sowing of crops, intercropping and crop rotation.

1. **Chemical control**

Chemical weed killer, called herbicides or weedicides, are sprayed on weeds to destroy (kill) them. This is called chemical control of weeds. Some common examples of weedicides are the following:

1. 2,4-D (2,4-Dichlorophenoxy acetic acid
2. Atrazine
3. Fluchloralin
4. Isoproturon
5. **Biological control**

Biological control of weeds involves the deliberate use of insects or some other organisms, which consume and specifically destroy the weed plants. The best Indian example of biological control is eradication of prickly-pear cactus (opuntia) by using the cochineal insects in Maharashtra and Tamil Nadu. Generally, a combination of one or more of these weed control methods is employed to get good results. The fish grass carp control aquatic weeds.

**Control of Pests**

 Pest control is the strategy applies for killing, repelling, or interfering with the feeding, reproduction, life cycle and distribution of pest populations. It does not aim at the total elimination of pests from an area; it aims at maintaining the pest population much below the damage threshold level.

The basic principles of pest control are exclusion, eradication, protection and resistance.

1. **Exclusion**

It involves the activities that prevent the pathogens from getting introduced to a given area

1. **Eradication**

It is the elimination of established and successful pests and pathogens from an area.

1. **Protection**

It is the isolation of host plant from pests or pathogens

1. **Resistance**

Resistance is the countering or defending of the attack of pests and pathogens. Plant breeders accomplish it by incorporating new genes into cultivars.

**Methods of pest control**

The major methods of pest control include:

1. **Biological method**
2. **Cultural method**
3. **Physical method**
4. **Mechanical method**
5. **Chemical method**
6. **Biological control**

Biological control is the eradication or suppression of pest species using their natural enemies, such as predators, parasites, or pathogens. The natural enemies are introduced, encouraged and multiplied by artificial means to fight the pests.

* **Inoculation**

This is the selection and introduction of the enemies of pests to areas where they are absent

* **Augmentation**

This is the mass rearing and release of the enemies of the pest species at an appropriate time to areas where they either are absent or are present in small numbers. It is better to rear them in laboratories and to increase their number before releasing them to the field.

* **Conservation of natural enemies**

Conservation is the protection of natural enemies from their own predators and pathogens, and also from harmful chemicals.

* **Encouragement**

It is the promotion of the growth and multiplication of the natural enemies of pests by providing them optimum ecological requirements.

1. **Cultural control**

This is the deliberate modification of the agricultural practices to the disadvantage of pest populations; pests are either locally eliminated or reduced to below the damage threshold level. This method is the cheapest of all control measures. Some of the common cultural methods are the following:

* **Crop rotation**

It is the strategy whereby the same species is not perpetually planted on the same plot of land. Additionally, its relative does not follow a species. Instead, a species with different soil requirements are rotated in a definite cycle. Rotation of crops is effective in reducing the populations of certain soil born diseases, such as tomato wilts. The causal organisms of such diseases need the host plant in order to thrive. They cannot persist in the soil, if the host is absent for about two to three years.

* **Trap cropping or companion cropping**

In this method small ‘trap plots’ are maintained near the major crop. Trap crop acts as a ‘trap’ and attracts the pest. After the pest has established on the host in the trap plot, the plot is either ploughed or treated with pesticides. For e.g. castor plants are often planted near chilly cultivation, and tomatoes in the citrus orchards.

* **Mixed cropping**

In this method, two or more crops are grown simultaneously in the same plot. So, even if one crop suffers from pest attack, the others came up well.

* **Tillage operation**

Thorough ploughing helps to bury and kill soil-inhabiting insects and their eggs, larvae and pupae and to expose the hiding and hibernating stages of some others to hot sun, desiccation and bird predation. Plastering the field bunds with mud will eliminate some insects, which breed in grasses.

* **Sanitation**

Disease-causing organisms and insect perpetuate in the infected plant remains have to be incinerated to kill the pathogens.

1. **Physical control**

This involves the deliberate modification of some physical factors to slow down the growth of pest population or to minimize or prevent pest infestation. Some of the physical methods are the following:

1. Use of dry-die: it is a material formed of a highly porous silica gel. Its application causes the excessive loss of moisture from the body of insects, ultimately resulting in their death.
2. Use of lethal temperatures, both high and low. High frequency radio waves generate a temperature of about 80◦C and it is employed to kill granary weevil and flour beetles.
3. Use of ionizing radiations to kill insect pests or to reduce sterility; male insects can be made sterile by exposing them to gamma radiation.
4. Blowing of refrigerated air through stored grains to maintain a very low temperature and to kill the pests.
5. Use of light traps to attract, catch and kill nocturnal insects.
6. Use of color traps for attracting, collecting and killing some diurnal insects.
7. **Mechanical control**

 Members of the pest species are trapped or killed by mechanical means, or are preserved from gaining access to the host plants by making barriers in this procedure. The common procedures involved in mechanical pest control are the following:

1. Killing of the eggs, larvae and other inactive stages of the pests after handpicking, net collection, etc.
2. Collection and destruction of the pest using traps and trenches.
3. Destruction of the affected plants and plant parts together with the pests.
4. Spiking of stem-borers in their boreholes.
5. Shaking of trees to dislodge and kill the pests.
6. Banding of fruit trees with grease or other banding materials to stop or entangle and kill crawling pests.
7. Flooding of the infested fields after harvest to drawn the soil inhabiting larvae, pupae, and adults of pests.
8. Pest-proof packing of stored products.
9. Covering of fruits and vegetables.
10. **Chemical control**

Chemicals designed to kill pests are called pesticides. They may kill the pests, alter their behavior, induce sterility in them, or impair their metabolism and development. Pesticides differ not only in chemical composition but also in killing action, toxicity, residual effect, specificity, cost and effectiveness.

Classification of pesticides based on application:-

1. Attractants: substances, which can attract pests without contact.
2. Repellents: substances, which repel the pest from some distance.
3. Deterrents: substances that suppress the behavior of pests.
4. Insecticides: chemicals used to kill insect pests. E.g. Malathion, Dicofol, Diazinon.
5. Auxiliary substances: substances that are mixed with insecticides to boost up the action of the latter.
6. Fungicides: substances designed to control fungal pathogens. There are two kinds, namely, protective and systemic.

**MANURING**

 The organic substances used for increasing crop production are called manures. Manures are natural fertilizers. They release nutrients after their decomposition.

**Manures can be grouped into:**

1. **Bulky Organic Manures**
2. **Concentrated Organic Manures**
3. **Bulky Organic Manures**

Bulky organic manures contain small percentage of nutrients and it is applied in large quantities. Bulky organic manures consist of farmyard manure (FYM), compost and green manure.

* **Farmyard Manure**

Farmyard manure refers to the decomposed mixture of dung and urine of farm animals along with litter and left over material from roughages or fodder fed to the cattle. A well-decomposed farmyard manure contains about 0.5% nitrogen (N), 0.2% phosphorus pentaoxide (P2O5) and 0.5% potassium monoxide (K2O). Generally 10 to 20 t/ha is applied, but more than 20t/ha is applied to fodder grasses and vegetables.

* **Compost**

It is prepared from farm and town refuge such as vegetable and animal refuse (e.g. excreta of domestic animals such as cattle, goat, sheep, horse, donkey, camel, dogs, cats, etc.), fecal matter of human beings, sewage waste, weeds, crop stubble, straw, rice, hulls, forest litter, etc. Compost is formed by the decomposition of organic matter by aerobic and anaerobic microorganisms. Farm compost generally contains about 0.5% N, 0.15% P2O5 and 0.5% K2O, where as compost prepared from town refuse contains about 1.4% N, 1.0%P2O5 and 1.4% K2O.

* **Green manuring**

The practice of green manuring includes growing, turning or ploughing and mixing of green crops with soil to improve physical structure and soil fertility. Green manures may include both leguminous and non-leguminous plants. These plants are used by Indian farmers to add nitrogen and organic matter to the soil for the improvement of crop yield.

The green manure crops are grown in the field for about 6 to 8 weeks and turned into field in the tender stage, i.e., at flowering stage. These crops remain buried for about one to two months. During this period, plants should be completely decomposed before sowing of next crop. Generally, the crops, which require high nutrient input, are raised in the green-manured field. Such crops are rice, maize, sugar cane, cotton, wheat, etc.

1. **Concentrated Organic Manures**

Concentrated organic manure contains higher percentage of NPK than in bulky organic manures. The common C.O.Ms is oil cakes, blood meal, fish manure, meat meal, cotton and wool wastes.

* **Oil-cakes**

Oil cakes are the left over materials after extracting oil from oil seeds. Oil cakes contain N, P2O5 and a large percentage of organic matter. Oil cakes are quick acting organic manures. Their nitrogen becomes available to the plants within a few days after application. They should be well powdered before application, so that that they can be spread evenly and can be easily decomposed by microorganisms. Well-powdered oilcakes can be applied during sowing.

* **Blood meal**

Blood meal, or dried blood, is made from the blood collected from slaughterhouses. It contains 10-12% Nitrogen and 1-2% Phosphoric acid. Blood meal is quick-acting manure and is effective for all crops in all types of soils.

* **Meat meal**

 Meat meal is obtained from dried meat wastes. It contains about 10.5% Nitrogen and 2.5 % Phosphoric acid. It is also quick-acting manure and is applied to many crops.

* **Fish meal**

Fishmeal or fish manure is prepared by drying and crushing the non-edible parts and the carcasses of fishes. It contains 4-9% Nitrogen, 3-9% Phosphoric acid and 0.3-1.5 % Potash. It is quick-acting organic manure, ideal for all crops and soils.

* **Cotton and wool wastes**

It is known as shoddy, supplies about 50-150 kg of Nitrogen per tone and may be applied as organic manure at the rate of 2.5 to 5.0 tons per hectare. They are suitable for all types of crop and soils.