

B.Sc. III Year (Theory)

Semester –VI

Paper XX (C)

Microbiology and Disease Management

Unit-2

Disease management:

2. Control methods

b. Soil sterilization

Dr. S. S. Patale

Associate Professor

Department of Botany

Smt. S. K. Gandhi Arts, Amolak Science and P.H. Gandhi

Commerce College, Kada Dist. Beed

Email- sspatale@rediffmail.com Ph. 9823937501

SOIL TREATMENT

Soil treatment includes those methods which are used for the possible destruction of pests, harmful fungi, bacteria and nematodes, insects and weed seeds. Methods may be classified as physical and chemical. Certain other methods such as agronomic practices or mechanical or mechanical and biological methods also adopted. Many harmful soil microflora colonise in the soil are responsible for causing diseases in plants are very difficult to be get rid of. Control of them poses a serious problem and in many instances may be a limiting factor in the growth of the crop. Soil contains both harmful and beneficial organisms. The fertility of soil and availability of nutrients to large extent is dependent on the biological activity of the beneficial microorganisms. Hence soil treatment should aim at the destruction of only harmful organisms while the beneficial ones will not be affected.

Various methods of soil treatment may be classified as follows:

- 1) Physical methods: a) Steam sterilisation; b) Hot-air sterilisation; c) Electrical sterilisation.
- 2) Chemical methods: a) Volatile chemicals; and b) Non-volatile chemicals.

1) Physical methods:

Physical methods of soil sterilization involve use of heat in dry or wet form to kill the destructive organisms. In tropical countries, exposure of soil to the heat of the sun in summer gives at least partial control of soil borne organisms. Soil sterilization with heat has its own advantages, as it does not leave any toxic residue and soil can be used immediately as soon as it cools. Amongst some of the disadvantages of physical treatments are the inconvenience, cost of heating installations in many cases and the possibility of accumulation of soluble salts that may be injurious to plant growth.

Steam is considered to be the efficient source of heat. Most of the heat resistant fungi, bacteria and viruses capable of inciting plant diseases are inactivated by a 30 minutes exposure to temperature 60⁰C. Most weed seeds are inactivated at 82⁰C and nematodes at 49⁰C.

The majority of the beneficial micro-organisms can survive the temperature that inactivates the pathogenic ones. To secure the beneficial effects of soil sterilization, the soil should be maintained at a temperature of 80-90°C for one hour. Various methods of soil treatment by heat are available. Sterilization by steam is effected by the passage of the steam, at high or low pressure generated from a boiler into the soil. A mixture of steam and air has also been recommended for the reduction of cost. Small quantities of soil in glasshouses can be sterilized by heating in the flat pan maintaining the correct temperature. Methods of heating the soil with electric heating coils are also available and practiced in some countries.

2) Chemical methods:

Soil treatment by the application of chemicals is a simple phenomenon. The chemicals are cheap; have a power of good penetration; harmless and non-injurious to the plants. But most of the chemicals used for the sterilisation of soil do not possess all the desired properties. The methods of application of pesticides for the soil treatment depend on the characteristics of the chemical and machinery used for the purpose. Gases (methyl bromide), liquids (carbon disulphide, formaldehyde) are introduced by injecting them at set points through injectors. Soil particles in the form of dust are incorporated into the soil through plowing. Most of the pesticides have to be applied before planting or sowing as they act as general sterilants. Some fungicides like Maneb, Zineb, Ziram or Copper compounds are not phytotoxic at lower concentration and they may be applied as drenches in the standing crop.

Volatile soil treating chemicals:

These chemicals are often known as fumigants. They are follows:

a) Chloropicrin: Nitrochloroform or trichloronitromethane (CCl_3NO_2) is a colourless non-inflammable, poisonous liquid. It is effective for the control of a wide range of soil borne pests. It is to be applied as a preplanting treatment, as it is extremely toxic to living plants and care should be taken so that no chemical is split near any living plant. It is marketed as liquid or as an aerosol formulation.

It is injected into the soil with special injection equipment. About 3 ml of the liquid has to be injected at a depth of 13 cm on 26 cm centre grids throughout the bed. After the treatment soil should be wet with water an entire area should be covered with plastic sheet for 24 hours. Treated soil should not be used for planting or sowing at least for 10 to 14 days. Longer periods may be needed in cold rainy weather.

b) Methyl bromide (CH_3Br): Methyl bromide is not injurious to the plants and has a greater penetration rate. It is odourless, but very dangerous to the operators and all precautions need to be taken. Methyl bromide is a gas which is marketed as aerosols or in cylinders. It may also be available in liquid form. Soil treated with methyl bromide should be covered for 24-48 hours and seven days aeration should be allowed before planting. Treatment with methyl bromide may reduce germination of some seeds. Such soil should be planted with garlic, cornation or salvia.

c) Vapam ($\text{C}_2\text{H}_4\text{NS}_2\text{Na}, 2\text{H}_2\text{O}$): It can be applied to the soil mixed with water with the help of a power sprayer at the rate of 500cc/10m². After treatment soil should be watered and kept for two or three weeks before use for planting. It leaves no toxic residue in the soil. It is very effective against pests, weed seeds and nematodes.

d) Mylone: 3,5-dimethyltetra hydro1,3,5,2H-thiadiazine-2-thione ($C_2H_{10}S_2N_2$): It is applied at the rate of 150kg/ha either mixed with sand and applied with fertilizer, spreader or may be applied uniformly with a sprinkling can or power sprayer as suspension in water. A period of two or three weeks should be elapse between treatment and planting. It is effective against weeds and nematodes.

e) Formaldehyde: It is used as 1% solution at the rate of 4 litres per 10 sq. m. After treatment soil should be watered and covered for 24 hours. After removal of cover soil should be raked for two to three days.

f) Allyl alcohol: It is used to control weed seeds and nematodes.

g) Carbon disulphide (CS_2): It is cheap, volatile and has good insecticidal properties. Carbon disulphide enters the soil by a simple process of diffusion.

Non-volatile soil treating chemicals:

Carbmates (Zineb, Ziram, Maneb) have been suggested as promising chemicals for giving protection against soil borne fungi. These chemicals may be used as dust or drench. As dust, 15% dust to be applied at the rate of 1kg/500m² or liquid 0.05% solution at the rate of 4lit/10m².

Nitrobenzenes- pentachloronitrobenzene has been found to be effective against a number of fungi. It may be applied as a mix, surface application, and transplant solution. It is available as dust with active ingredient varying from 10-40% and for spray as 75%WP. Doses for dust vary from 10 to 40kg/ha depending upon strength, crop and disease. Spray concentration vary from 0.1 to 0.5% depending upon the time of application, crop and disease.

Copper compounds- copper fungicides at the rate of 25 per cent dilution of spray strength have been found to be promising in control of phycomycetes fungi when applied as drench. Such applications may be made even with standing crop in the soil, as the fungicides are not phytotoxic. Trenches filled with lime, surrounding the dead stumps have been found to be useful in the prevention of spread of root infecting fungi in tropical plantation crop.

Chlorinated hydrocarbons- Gamma-BHC, DDT, aldrin etc. have been applied successfully for the control of insects in the form of dust at the time of soil preparation prior to planting. While gamma-BHC and DDT do not persist for very long time, cyclodiene insecticides like aldrin or dieldrin decompose very slowly and there may be accumulation in the soil.

Some systemic fungicides like thiabendazole, benomyl have shown promise for soil treatment. Cultural and biological methods may also be adopted for getting rid of pests in the soil.

Thank You