

# CHEMICAL CONTROL

Chemical control means to control the plant disease causing pathogen by chemical, such as fungicides; this chemical substance is used for controlling plant fungi.

## **Fungicide:**

The word fungicide originated from two Latin words, viz., “fungus” and “caedo”. The word “caedo” means to kill. Thus the fungicide is any chemical substance which has the ability to kill the fungus.

## **Fungistat:**

Some chemicals do not kill the fungal pathogens. But they simply arrest the growth of the fungus temporarily. These chemicals are called fungistat and the phenomenon of temporarily inhibiting the fungal growth is termed as fungistatic.

## **Antisporulant**

Some chemicals may inhibit the spore production without affecting the growth of vegetative hyphae are called Antisporulant.

## **Characters of an ideal fungicide**

1. It should have low phytotoxicity
2. It should have long shelf life
3. Stability during dilution
4. It should be less toxic to human being, cattle, earth worms, microorganisms etc.
5. It should be a broad spectrum in its action
6. Fungicide preparation should be ready for use
7. It should have compatibility with other agrochemicals
8. It must be cheaper one
9. It should be available in different formulations
10. It should be easily transportable

## **Classification of Fungicides**

Fungicides can be broadly grouped based on their

- (i) Mode of action
- (ii) General use and
- (iii) Chemical composition.

### **I. Based on mode of action**

#### **Contact fungicide:**

Contact fungicides are substances that are applied directly to infected leaves or stems. They only protect the area where the spray is deposited. Examples: Dithane M-45 (Mancozeb), Captan, Rovral (Iprodione) etc.

### Systemic fungicide:

Systemic fungicides, which are drawn up through the roots and redistributed through the xylem vessels, move to all parts of a plant. Examples: Bavistin (Carbendazim), Provax-200 (Carboxin) etc.

## **II. Based on general uses**

The fungicides can also be classified based on the nature of their use in managing the plant diseases-

- Seed protectants: e.g. Captan, Thiram, Provax-200 etc.
- Soil fungicides (pre plant): e.g. Copper oxychloride, Chloropicrin, Formaldehyde etc.
- Foliage and blossom: e.g. Captan, Ferbam, Zineb, Chlorothalonil etc.
- Fruit protectants: e.g. Captan, Maneb, Carbendazim, Mancozeb etc.
- Eradicants: e.g. Lime sulphur, etc.
- Tree wound dressers: e.g. Bordeaux mixture etc.
- Antibiotics: e.g. Actidione, Griseofulvin, Streptomycin, Streptocycline, etc.

## **III. Based on Chemical Composition**

The fungicides can be broadly grouped as follows.

- Copper Fungicide e.g. Bordeaux mixture, Burgundy mixture etc.
- Sulfur or **Sulphur** Fungicide e.g. Thiram, Zineb etc.
- Mercury Fungicide e.g. Mercury bromide, thiomersal etc.
- Quinone Fungicide e.g. Chloranil, Dichlone etc.
- Benzene Fungicide e.g. Chlorothalonil Biphenyl etc.
- Heterocyclic nitrogen compound e.g. Captan, Iprodione etc.
- Organo tin compound e.g. Du-ter, Brestanol etc.

### **Copper Fungicides**

The fungicidal action of copper was mentioned as early as 1807 by Prevost against wheat bunt disease (*Tilletia caries*), but its large scale use as a fungicide started in 1885 after the discovery of Bordeaux mixture by Millardet in France. The mixture of copper sulphate and lime was effective in controlling downy mildew of grapevine caused by *Plasmopara viticola* and later, late blight of potato (*Phytophthora infestans*).

### **Sulfur or Sulphur fungicides**

Use of sulphur in plant disease control is probably the oldest one and can be classified as inorganic sulphur and organic sulphur. Inorganic sulphur is used in the form of elemental sulphur or as lime sulphur. Elemental sulphur can be either used as dust or wettable sulphur, later being more widely used in plant disease control. Sulphur is best known for its effectiveness against powdery mildew of many plants, but also effective against certain rusts, leaf blights and fruit diseases.

Organic compounds of sulphur are now widely used in these days. All these compounds, called as “carbamate fungicides” are derivatives of Dithiocarbamic acid, Dithiocarbamates are broadly grouped into two, based on the mechanism of action. Monoalkyl Dithiocarbamates such as Zineb, Maneb and Dialkyl Dithiocarbamates such as Thiram, Ziram, Mancozeb, Nabam, Ferbam etc.

## **Mercury Fungicides**

Mercury fungicides can be grouped as inorganic and organic mercury compounds. Both the groups are highly fungitoxic and were extensively used as seed treatment chemicals against seed borne diseases. These compounds show bactericidal property also. However, due to their residual toxicity in soil and plants and their extreme toxicity nature to animal and human beings, the use of mercury fungicides is being discouraged.

Heterocyclic Nitrogen Compounds, Quinones and Miscellaneous Fungicides

## **Heterocyclic Nitrogen Compounds**

Heterocyclic nitrogen compounds are mostly used as foliage and fruits protectants. Some compounds are very effectively used as seed dressers.

## **Benzene compounds**

Many aromatic compounds have important anti-microbial properties and have been developed as fungicides.

## **Quinone Fungicides**

Quinones are present naturally in plants and animals and they exhibit anti-microbial activity and some compounds are successfully developed and used in the plant disease control.

## **Organo tin compounds**

Several other organic compounds containing tin, lead, etc. have been developed and successfully used in plant disease control. Among them, organo tin compounds are more popular and effective against many fungal diseases.

## **Antibiotics**

Antibiotic is defined as a chemical substance produced by one micro-organism which in low concentration can inhibit or even kill other micro-organism. Because of their specificity of action against plant pathogens, relatively low phytotoxicity, absorption through foliage and systemic translocation and activity in low concentration, the use of antibiotic is becoming very popular and very effectively used in managing several plant diseases. They can be grouped as antibacterial antibiotics and antifungal antibiotics. Most antibiotics are products of several actinomycetes and a few are from fungi.

## **Antibacterial antibiotics**

### **Streptomycin sulphate**

Streptomycin is an antibacterial, antibiotic produced by *Streptomyces griseus*. Streptomycin sulphate is sold as Agrimycin-100, Streptomycin sulphate, Plantomycin, Streptocycline etc. Agrimycin 100 contains 15 per cent streptomycin sulphate + 1.5 percent terramycin (Oxy tetracycline). This group of antibiotics act against a broad range of bacterial pathogens causing blights, wilt, rots etc.

## **Tetracycline**

Antibiotics belonging to this group are produced by many species of *Streptomyces*. This group includes Terramycin or Oxymicin (Oxytetracycline). All these antibiotics are bacteriostatic, bactericidal and mycoplasma-static. These are very effective against seed-borne bacteria. This group of antibiotic is very effective in managing MLOs diseases of a wide range of crops. These are mostly used as combination products with Streptomycin sulphate in controlling a wide range of bacterial diseases. Oxytetracyclines are effectively used as soil drench or as root dip controlling crown gall diseases in rosaceous plants caused by *Agrobacterium tumefaciens*.

## **Antifungal antibiotics**

### **Aureofungin**

It is an antibiotic produced in sub-merged culture of *Streptoverticillium cinnamomeum* var. *terricola*. It is absorbed and translocated to other parts of the plants when applied as spray or given to roots as drench. It is sold as Aurefungin-Sol. Containing 33.3% Aureofungin and normally sprays at 50-100 ppm. The diseases controlled are citrus gummosis caused by several species of *Phytophthora*, powdery mildew of apple caused by *Podosphaera leucotricha* and apple scab (*Venturia inaequalis*), groundnut tikka leaf spot, downy mildew, powdery mildew and anthracnose of grapes, potato early and late blight etc.

### **Griseofulvin**

This antifungal antibiotic was first discovered to be produced by *Penicillium griseofulvum* and now by several species of *Penicillium*, viz., *P. patulum*, *P. nigricans*, *P. urticae*, and *P. raciborskii*. It is commercially available as Griseofulvin, Fulvicin and Grisovin. It is highly toxic to powdery mildew of beans and roses, downy mildew of cucumber. It is also used to control *Alternaria solani* in tomato *Sclerotinia fructigena* in apple and *Botrytis cinerea* in lettuce.

## **Methods of application of fungicides:**

Proper selection of a fungicide and its application at the correct dosage and the proper time are highly essential for the management of plant diseases. The basic requirement of an application method is that it delivers the fungicide to the site where the active compound will prevent the fungus damaging the plant. This is mostly achieved by spray, fog, smoke, aerosol, mist, dust, or granules applied to the growing plant or by seed or soil treatment.

### List of Contact and Systemic Fungicides

S.N.	Chemical Name	Trade Name	Nature
1.	Carbendazim	Fungigourd	Systemic
2.	Tridemofon	Belyton	Systemic
3.	Mycobutanil	Systhane	Systemic
4.	Propiconazole 25% EC	Tilt	Systemic
5.	Tebuconazole 25%EC	Folicure	Systemic
6.	Metalexyl	Ridomil - MZ	Systemic
7.	Difconazole 25% EC	Score	Systemic
8.	Azoxystrobin	Amistar	Contact
9.	Trifloxystrobin 25% EC	Flint/Zato	Contact
10.	Pyraclostrobin	Insignia	Contact
11.	Mancozeb	Dithane – M-45	Contact
12.	Captan	Captara	Contact
13.	Copper Oxy- Chloride	Blitox - 50	Contact
14.	Chlorothalonil	Bravo	Contact
15.	Chloroneb	Terraneb SP	Contact
16.	Probineb	Antracol 70WP	Contact
17.	Iprodione	Rovral	Contact