

# FUNGICIDES AND THEIR SPECTRA

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Financially successful plant propagation requires a conscientious effort to reduce losses due to pathogenic fungi and bacteria to a low level.

Three basic steps are involved: (1) use of disease-free plant material (2) use of pathogen-free rooting media (3) prevention of infection or contamination.

Fungicides have a place in each of the three steps:

In **Step 1**, to ensure that seeds, cuttings, etc. are free of pathogens up to the time they are placed in the rooting medium, *broad spectrum fungicides* have long been used. Two methods of application are involved here:

## **A. Seed Treatment Chemicals:**

1. *Mercurials*, very effective against a wide range of seed and soil-borne pathogens, can no longer be used because of environmental contamination problems.

2. *Captan 75W (Orthocide)* controls most fungi which happen to be on the outside of seed and prevents early damping off due to organisms in soil.

3. *Thiram 75W (Arasan, Panoram, Tersam 75, Thylate, TMTD)* is similar to captan in its broad spectrum effectiveness.

## **B. Bench & Tool Disinfectants:**

1. *Mercurials*. Various mercurial compounds were widely used because of their broad spectrum effectiveness. However, these uses have been withdrawn and most manufacturers have ceased production.

2. *Phenol disinfectants (Lysol, Amphyl, LF10)*. Effective for surfaces and tools but not for flats or benches where fungus sclerotia or resistant spores may be lodged.

3. *Quaternary ammoniums (Roccal, Hyamine, Bactericide #10)*. Usefulness similar to phenols, less objectionable to use.

4. *Chlorine (Perfex, Javex, Clorox)*. Effective for tools; solutions tend to lose effectiveness rapidly.

5. *Formaldehyde (Formalin)*. Effective for sclerotia and resistant spores but is unpleasant to use due to toxicity of solutions and vapours.

**Step 2**, the preparation of pathogen-free rooting media, also utilizes fungicides of a *broad spectrum* — in this case of the fumigant type.

Whenever soil, manure or similar material is used in a rooting or potting mix it is advisable and often essential to partially sterilize the media either with heat or fumigants. The most commonly used chemicals in this category are:

1. *Methyl bromide* (MC-2, Brom-O-Gas). It has the shortest aeration period following treatment, but is hazardous to the operator and is not recommended for carnations, snapdragons, or to control *Verticillium* wilt.

2. *Chloropicrin* - (Larvacide, Picfume, Terr-O-Gas) broadens spectrum of control, when combined with methyl bromide, but has a two week aeration period.

3. *Formaldehyde*. May be applied in water by watering can method, but requires long aeration period — similar to chloropicrin.

4. *Vapam, Vorlex, Mylone, etc.* These materials all perform in a similar fashion and have similar effectiveness and require a 2 week aeration period.

**Step 3** utilizes both *broad and narrow spectrum fungicides*. In some cases these are mixed or drenched into the rooting or potting soil. In other cases foliar applications are involved.

For convenience we'll consider the soil applications first and divide those into broad and narrow spectrums.

#### **A. Soil Fungicides — Broad Spectrum:**

1. *Captan* - a number of fungicides including mercurials have been used in the past for control of damping off and other disorders of a general nature. The only one of these which is still commonly used is captan. Captan can be added to the rooting or potting medium at the rate of about 500 ppm to prevent recontamination by fungi such as *Pythium* and *Fusarium*. It is weak against *Rhizoctonia*.

#### **B. Soil Fungicides. Narrow Spectrum**

1. *Terraclor* (PCNB, Brassicol). Terraclor was the first fungicide to gain wide use in soil applications. It is useful where damping off or root disorders due to *Rhizoctonia*, *Sclerotium*, or *Sclerotinia* are likely to be a problem. It is not effective against *Fusarium* and water molds such as *Pythium* and *Phytophthora*.

2. *Benlate* (benomyl). Benlate is a fairly new fungicide which has many uses in crop protection. As a soil additive it is effective in preventing diseases caused by *Fusarium*, *Verticillium*, and *Rhizoctonia*. It is totally ineffective against the water molds, *Pythium* and *Phytophthora*.

3. *Thophanate-Methyl* (NF-44), *Topsin M*, *Cercobin M*). Frequently referred to as "Japanese Benlate," it has similar activity and similar spectrum of effectiveness.

4. *Dexon (diazoben)*. Dexon was the first fungicide specific for the water molds. It effectively prevents establishment of *Pythium* and *Phytophthora* in the root medium but is short-lived and must be applied as a drench of 50-100 ppm at regular intervals where contamination is likely to occur. It has lost favor because of its unpleasant and unstable nature.

5. *Truban (ethazol, Terrazole, Koban)*. Truban also controls *Pythium* and *Phytophthora* and has the advantage over Dexon in being more stable so that it can be incorporated in the root medium at the rate of 25-50 ppm during preparation. It also gives some control of *Fusarium* and *Rhizoctonia*.

6. *Mixtures*: Due to their specific nature it has been found beneficial to use 2 or more of the above fungicides in combination to give a broad spectrum of activity. The most commonly used of these are:

- Terraclor + Terrazole (Terraclor Super X)
- Dexon + Terraclor
- Truban + Topsin M (Banrot)
- Benlate + Dexon
- Benlate + Truban

### C. Foliar Fungicides

Fungicides which are normally applied to the tops of growing plants can be grouped in either of two ways: (1) by fungicide, listing the pathogens controlled or (2) by disease, listing the fungicides useful against it.

Either method has its advantages and disadvantages but I have chosen the first and have listed the most useful fungicides in that manner in Table 1.

**Table 1.** Fungicides and their uses and disadvantages

FUNGICIDE	ALTERNATIVE NAMES	USES	DISADVANTAGES
Acti-dione	cycloheximide	Powdery mildews and rusts of various ornamentals; blights and leafspots including <i>Keithia</i> blight of <i>Thuja</i>	highly toxic to mammals
Benlate	benomyl	Scab of apple and flowering crab; brown rot of stone fruits; grey mould ( <i>Botrytis</i> ) and powdery mildew; <i>Fusarium</i> and <i>Verticillium</i> wilts; Juniper twig blight ( <i>Phomopsis</i> )	Some fungi are becoming resistant; not effective against <i>Pythium</i> , <i>Phytophthora</i> , <i>Alternaria</i> , peach leaf curl
Bordeaux	—	Dormant spray for cherries, lilac, forsythia, etc. which are susceptible to bacterial blight or canker	difficult to mix; incompatible with other chemicals, often phytotoxic



**Table 1. continued**

Bravo	Daconil Exotherm Termil	Control of <i>Alternaria</i> and <i>Botrytis</i> in greenhouses	possible allergic reaction
Captan	Orthocide	Scab of apple and flowering crab; brown rot of stone fruits; <i>Botrytis</i> ; many other diseases	—
Difolatan	captafol	Dormant spray for peach leaf curl; several foliar diseases	possible allergic reaction
Dodine	Cyprex	Scab of apple and flowering crab; brown rot of stone fruits	—
Ferbam	Fermate	wide spectrum	unpleasant odor and residue
Fixed Copper	Basicop Tricop Coprantol etc.	For bacterial diseases in place of Bordeaux esp. in growing season	not effective against many fungus diseases
Karathane maneb	Dinocap Dithane M-22 Manzate D	powdery mildews broad spectrum protectant against many foliar diseases including rusts. The fungicide to use when in doubt	— —
mancozeb	Dithane M-45 Manzate 200	Same as maneb - contains zinc as well as manganese	—
Parnon	parinol	powdery mildew	—
Pipron	piperalin	powdery mildew	—
Plantvax	oxycarboxin	systemic control of all common rust diseases in greenhouse and nursery	
streptomycin	Agristrep Agrimycin	alternative to coppers for bacterial diseases	limited registration compared to coppers
sulphur	wettable sulphur, lime sulphur Orthorix	wettable sulphur is useful in growing season for powdery mildew. Lime sulphur is useful as a dormant spray for powdery mildew, pear scab and certain other diseases	phytotoxic under certain conditions
Thiophanate-methyl	Topsin-M Cercobin-M NF-44	same as Benlate	same as Benlate
Zineb	Dithane Z-78	broad spectrum against many foliar fungus diseases; protectant action against rusts. Interchangeable with maneb and mancozeb	