

## COMMON FUNGICIDES FOR GREENHOUSE USE

*Roy W. Judd, Jr.*

*Extension Agent—Horticulture*

The production of top quality, disease-free plants is the goal of every greenhouse operator. To do this, they start with disease-free cuttings, seeds, corms or bulbs. These are planted in pasteurized soil and grown by applying the proper amounts of water and fertilizer. Heat and ventilation are adjusted according to the crop being grown. However, occasionally, somewhere along the way, the plants may be attacked by fungi. This can only occur when we have the "eternal triangle." That is: the host plant, a favorable environment and the pathogen. When this happens, a fungicide should be used. But, which one?

Fungicides are materials that are toxic to fungi and are placed into four types; protectants, eradicants, dual purpose (protectants and eradicants), and systemic. Protectants are materials that are placed on the plant parts before the fungus arrives. Actually they act as barriers between the plant and the fungus. They are the most common type of fungicides. Examples are ferbam, zineb, thiram and Daconil 2787.

Eradicants are fungicides that can destroy the fungus after it has entered the plant and has become established. These materials are fewer in number. The most common ones are PCNB and cycloheximide.

Dual purpose fungicides have both protectant and eradicant properties. They set up a barrier and also destroy established fungal growth. These include captan and maneb.

Systemic fungicides or chemotherapeutants are fungicides absorbed and distributed throughout the plant. The major fungicides in this category are benomyl and thiabendazole.

The disease and host plant determines which fungicide should be used. Following is a list of common fungicides:

1. Benomyl (Benlate 50 WP)--A systemic fungicide with protectant and eradicant properties compatible with most other fungicides and insecticides. Used as a spray to control Botrytis on geraniums, roses, hydrangeas, bedding plants and others, powdery mildew and black spot on roses and many other leaf spots on ornamentals. Also controls soil fungi such as Rhizoctonia, Fusarium, Thielaviopsis and Verticillium. Only labeled for ornamentals at the present time. Manufacturer's suggested rate is 8 oz./100 gallons (2 tsp./gal.).

2. Captan (Captan 50-W, Captan 7.5 Dust, Captan 75 Seed Treater, Orthocide 50-W & 80-W, Orthocide Seed Treater)--protectant and eradicant. Used as a spray, dust, seed treatment or soil drench. Compatible with most commonly used insecticides and fungicides. Used as a spray to control leaf spots of carnation, azaleas and hydrangeas. For seed treatment to prevent preemergence damping-off and soil drench to protect seedlings from damping-off. Labeled for vegetables and ornamentals. Manufacturer's suggested rate is 2 lbs./100 gals. (1 1/2 Tbsp./gal.).

3. Daconil 2787--75 WP--broad-spectrum protectant compatible with most common insecticides and fungicides. Used as a spray for azalea leaf and petal

blight, Botrytis on most plants, black spot and powdery mildew of roses and ray blight of chrysanthemums. Manufacturer's suggested rate is 1 1/2 lbs./100 gals. (1 1/2 Tbsp./gal.). Also available as a thermal dust (Termil) for Botrytis control. (See label for plant listing.)

4. Dexon 35 WP--seed and seedling protectant. Used as a soil drench to control damping-off caused by Pythium and Phytophthora. Combined with PCNB it is effective against root and stem rots of gardenias, poinsettias, snapdragons and damping-off of many seedlings. Mix and use immediately as inactivation will occur when exposed to light for any period of time. Manufacturer's suggested rate is 8 oz./100 gals. for pots, 1 1/2 lbs./100 square feet for bench crops.

5. Dinocap (Karathane, Mildex) 25 WP--Eradicant action, specific for mildew on most greenhouse crops. Compatible with most insecticides and fungicides. Suggested rate is 8 oz./100 gals. (1 tsp./gal.); 6 oz. or less on roses.

6. Dithane M-45, Fore (combination of zinc ion and manganese ethylene bisdithiocarbamate) 80 WP. A broad-spectrum fungicide with protectant properties. Used to control black spot of roses, leaf spot of carnation and gladiolus and Botrytis on many plants. Manufacturer's suggested rate is 1 1/2 -2 lbs./100 gals. (1-1 1/3 Tbsp./gal.)

7. Ferbam (Carbamate, Fermate, Karbam Black)--76 WP. Protective broad-spectrum fungicide used as a spray, dust or soil fungicide. It is compatible with most materials. Used as a bulb treatment, it will control stem rots, root rots and

bulb scale rots. As a soil drench, it is effective against damping-off. As a foliar spray, it is effective against black spot and rust of roses, Septoria leaf spot on chrysanthemum, leaf spot and rust of snapdragons, and Alternaria of carnation. Manufacturer's suggested rate is 1 1/2-2 lbs./100 gals. (2 Tbsp./gal.).

8. Folpet (Folpet, Phaltan) 50 WP--broad-spectrum material with both protective and eradicant properties. May be used as a dust, foliar spray or soil drench. Effective against cutting, stem, and root rots. As a spray, powdery mildew on roses, zinnias, chrysanthemums and snapdragons; black spot and rust on roses; Alternaria leaf spot and Anthracnose on annuals, chrysanthemums and snapdragons. Suggested rate is 1 1/2 lbs./100 gals. (1 Tbsp./gal.).

9. Maneb (Dithane M-22, Maneb 4.5D, Manzate D) 80 WP--broad-spectrum protectant fungicide formulated as wettable powders and dusts. Compatible with most commonly used fungicides and insecticides. Controls black spot of roses, Botrytis and rust on many plants. Manufacturer's suggested rate is 1 1/2-2 lbs./100 gals. (2-3 tsp./gal.).

10. PCNB (Terraclor, Brassicol, Fungiclor) 75 WP--Soil fungicide with good residual action. Controls soil-borne diseases such as Rhizoctonia, Sclerotinia, root and stem rots of carnations, chrysanthemums, poinsettias and snapdragons. Effective against damping-off of bedding plants. Often combined with Dexon. Manufacturer's suggested rate is 3/4 lb./100 gals. (3/4 Tbsp./gal.).

11. Sulfur--Available in various preparations in the elemental form for use as a dust, spray or tablets (volitization) to control mildew.

12. Thiabendazole (Mertect 160) 60 WP--Broad-spectrum systemic fungicide that also has protective properties. Used as a foliar spray, soil drench or bulb treatment. As a spray it is effective against Botrytis, powdery mildew and leaf spots of many ornamentals. Controls blue mold (Penicillium) in bulbs and corms. As a soil drench, it is effective against Rhizoctonia, Verticillium, Fusarium and Sclerotinia. Manufacturer's suggested rate is 1/2-1 lb./100 gals.

13. Thiram (Thiram 75, Arasan, Thylate) 65 WP--Protectant fungicide formulated as wettable powder and dust for use as foliar spray, seed treatment or soil drench. Used on foliage to prevent many leaf spots, anthracnose and rusts. As a soil drench, it controls damping-off and root and stem rots. Manufacturer's suggested rate is 1 1/2-2 lbs./100 gals. (1-1 1/3 Tbsp./gal.).

14. Truban 30 WP--Soil fungicide especially effective against Pythium and Phytophthora. It has good residual action in the soil. Used on many ornamentals including poinsettias, bedding plants, snapdragons and chrysanthemums. Manufacturer's suggested rate is 3-8 oz./100 gals.

15. Zineb (Dithane Z-78, Parzate C) 75 WP--Protective fungicide available as a dust or wettable powder. Compatible with most commonly used insecticides and fungicides. As a foliar spray, it is effective against Botrytis, many leaf spots, Alternaria on carnations and rust on many ornamentals. Manufacturer's suggested rate is 1 1/2 lbs./100 gals. (1 Tbsp./gal.).

When using any fungicide, read the directions carefully. Check amounts to use, proper handling and plants to be used on.

A table of some of the diseases listed and fungicides for their control.

	Benomyl Captan Daconil 2787	Dexon Dinocap Dithane M-45	Perbam Folpet Maneb	PCNB Sulfur Thiabendazole	Thiram Truban Zineb
GENERAL DISEASES					
Bulb Rots	x		x x		
Damping-off	x	x	x	x	x
Leaf spots	x x	x	x x	x	x x
Root rot			x	x	
Rust		x	x x		x x
Seed treatment	x				x
Stem rot			x	x	
FOLIAR DISEASES					
Alternaria	x		x		x
Anthracnose					x
Azalea leaf blight	x x				
Azalea petal blight	x x				
Black spot of rose	x x	x	x x x		
Botrytis	x x	x	x	x	x x
Powdery mildew				x	
Ray blight of c'mum	x x				
Rust of rose			x		
Rust of snapdragon			x		
SOIL DISEASES					
Fusarium	x			x	
Penicillium (bulbs)				x	
Phytophthora		x			x
Pythium		x			x
Rhizoctonia	x			x x	
Sclerotinia	x			x x	
Thielaviopsis	x				
Verticillium	x			x	

EQUIVALENT QUANTITIES FOR  
FUNGICIDE DILUTIONS IN WATER

100 gal.	50 gal.	15 gal.	5 gal.	2 1/2 gal.	1 gal.
4 oz.	2 oz.	0.6 oz.	0.2 oz.	0.1 oz.	0.04 oz.
1/2 lb.	4 oz.	1.2 oz.	0.4 oz.	0.2 oz.	0.08 oz.
1 lb.	1/2 lb.	2.4 oz.	0.8 oz.	0.4 oz.	0.16 oz.
1 1/2 lb.	3/4 lb.	3.6 oz.	1.2 oz.	0.6 oz.	0.24 oz.
2 lbs.	1 lb.	4.8 oz.	1.6 oz.	0.8 oz.	0.32 oz.