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Richard X. Latin

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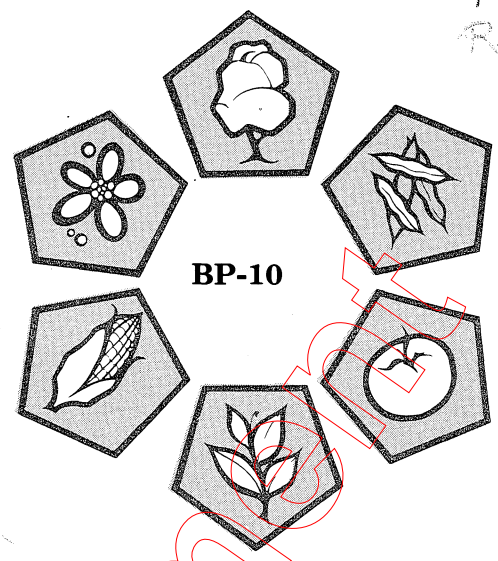
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Department of Botany and Plant Pathology
Lilly Hall of Life Sciences

Plant Disease Control



Directory of Fungicides for Indiana Vegetable Diseases

Richard X. Latin, Extension Plant Pathologist

This directory can be used to cross-reference selected vegetable diseases and registered fungicides (or bactericides in the case of copper compounds) for their control. Emphasis is given to stem, leaf, and fruit diseases of vegetable crops grown in Indiana. *Fungicide product labels should be consulted for application rates and intervals, harvest restrictions, and safe-handling information.* The product label is the definitive source of information about the fungicide in question.

For satisfactory disease control, diagnose problems accurately prior to selection and application of fungicides. A good reference for diagnosing vegetable diseases is *Identifying Diseases of Vegetables*.^{*} It includes color prints and accurate descriptions of disease symptoms. Copies of this and various plant disease control bulletins are available from the Department of Botany and Plant Pathology at Purdue University.

How to Use the Directory

Selected vegetable crops and diseases are cross-checked with fungicides listed by their common names at the top of Table 1. (Common names are names coined for active ingredients of fungicides. Several different commercial

products may contain the same active ingredient and have the same common name.) Table 2 lists common names, product trade names, product producers, and product formulations. An alphabetized list of fungicide trade names and corresponding common names is provided in Table 3. Below are two examples of how this directory can be used:

Example 1. Suppose rust has been diagnosed as a problem in snap beans and you wish to know which fungicides can be used against rust. According to Table 1, chlorothalonil, maneb, and zineb will protect beans from rust. Names of commercial products with these common names are listed in Table 2. The commercial products include Bravo 500 (chlorothalonil); Dithane M22, Dithane FZ, Manzate, and Manex (maneb); Dithane Z78 and Zineb 75WP (zineb).

Example 2. Suppose Dithane M45 is recommended for tomato disease control and you wish to know the specific diseases it will protect against. According to Table 3, the common name of Dithane M45 is mancozeb. Refer to the mancozeb column and tomato disease section in Table 1. The tomato diseases which Dithane M45 (mancozeb) will protect against are indicated by "●" and include anthracnose, early blight, gray leafspot, late blight, and Septoria leafspot.

^{*}MacNab, A. A., et al., Dept. of Plant Pathology, The Pennsylvania State University.

Table 1. Selected vegetable crop diseases and registered fungicides. Fungicides registered for control of specific diseases are indicated by '●'.

Crop	Disease(s)	Fungicide (Common Name)																					
		anilazine	benomyl	captafol	captan	chlorothalonil	DCNA	dinocap	mancozeb	maneb	metalaxyl	metiram	thiophanate M	TPTH	triadimefon	vinclozolin	zineb	basic copper sulfate	copper ammonium carbonate	copper hydroxide	copper oxychloride sulfate	copper resinate	
Asparagus	rust							●	●		●												
Beans	anthracnose				●					●						●	●						
	bacterial blight																●	●	●			●	
	halo blight																	●	●				●
	rust					●				●						●							●
	white mold	●					●						●										
Cabbage Broccoli	Alternaria leaf blight				●					●								●			●		
	black rot																				●		
Cauliflower	downy mildew				●					●						●	●			●			●
Carrot	Alternaria leafspot				●			●	●				●			●	●					●	
	Cercospora leafspot				●			●	●				●			●	●				●	●	
Celery	Septoria blight	●	●		●	●			●	●		●	●			●	●					●	
	Cercospora blight	●	●		●				●	●		●	●			●	●					●	●
Cucumber Muskmelon Watermelon	Alternaria leaf blight	●		●		●			●			●					●	●			●	●	
	angular leafspot																●	●	●	●	●	●	●
	anthracnose	●	●	●	●	●			●	●						●	●			●	●	●	●
	downy mildew	●		●	●	●			●	●	●	●				●	●	●	●	●	●	●	●
	gummy stem blight	●	●	●		●			●	●		●					●						
	powdery mildew		●					●							●								
Lettuce	downy mildew									●						●	●				●		●
	leaf drop					●										●							

Table 1. Selected vegetable crop diseases and registered fungicides. Fungicides registered for control of specific diseases are indicated by '●'. (Continued)

Crop	Disease(s)	Fungicide (Common Name)																					
		anilazine	benomyl	captafol	captan	chlorothalonil	DCNA	dinocap	mancozeb	maneb	metalaxyl	metiram	thiophanate M	TPTH	triadimefon	vinclozolin	zinëb	basic copper sulfate	copper ammonium carbonate	copper hydroxide	copper oxychloride sulfate	copper resinate	
Onion	Botrytis (blast)	●				●			●	●													
	downy mildew				●	●			●	●	●												
	purple leaf blotch	●		●	●	●			●	●													
Pepper	anthracnose								●							●	●						
	bacterial spot																●			●	●	●	
	Cercospora leafspot								●							●	●				●		
Potato	early blight	●		●		●			●	●		●					●	●	●	●	●		
	late blight	●		●		●			●	●	●	●		●			●	●	●	●	●	●	
Spinach	downy mildew								●							●	●						
Squash Pumpkin	anthracnose	●	●		●	●										●	●				●		
	black rot	●	●		●																		
	powdery mildew		●					●							●								
Tomato	anthracnose	●		●	●	●			●	●		●				●	●						
	bacterial speck																●			●		●	
	bacterial spot																●	●	●	●	●	●	
	early blight	●		●	●	●			●	●		●				●	●	●	●	●	●	●	
	gray leafspot	●		●	●	●			●	●		●				●	●						
	late blight	●		●	●	●			●	●	●	●				●	●	●		●			
	Septoria leafspot	●		●	●	●			●	●						●	●				●	●	

Table 2. Common names, trade names, producers, and formulations of selected fungicides registered for vegetable disease control

Common Name	Trade Name	Producer	Formulation
anilazine	Dyrene	Mobay	50WP
benomyl	Benlate	DuPont	50WP
captafol	Difolatan	Chevron	80DG
captan	Captan	Stauffer	4F,50WP,80WP
	Captan	FMC	80WP
	Captec	Griffin	3F
	Orthocide	Chevron	50WP,80WP
chlorothalonil	Bravo 500	SDS Biotech	4.17F,75WP
DCNA	Botran	TUCO	75WP
dinocap	Karathane	Rohm & Haas	25WP,4LC
mancozeb	Dithane M45	Rohm & Haas	80WP
	Manzate 200	DuPont	80WP,4F
maneb	Dithane M22	Rohm & Haas	80WP
	Dithane FZ	Rohm & Haas	4F
	Manzate	DuPont	80WP
	Manex	Griffin	3F
metalaxyl	Ridomil MZ58	Ciba-Geigy	58WP
metiram	Polyram	FMC	80WP
thiophanate M (thiophanate methyl)	Topsin M	Pennwalt	70WP, 4.5F
TPTH (triphenyltin hydroxide)	Du-Ter	Uniroyal	25WP,3F
	Super-tin	Griffin	4F
triadimefon	Bayleton	Mobay	50WP
vinclozolin	Ronilan	BASF	50WP
zineb	Dithane Z78	Rohm & Haas	78WP
	Zineb 75WP	FMC	75WP
*basic copper sulfate	Super-Cu	Griffin	3F
	Triangle	Phelps-Dodge	53WP
	Tribasic Cop- per Sulfate	Citco	53WP
*copper ammonium carbonate	Copper Count N	MRC	**8EC
*copper hydroxide	Kocide 101	Kocide Chem.	50WP
	Kocide 606	Kocide Chem.	3F
*copper oxychloride sulfate	C-O-C-S	FMC	50WP
*copper resinate	Citcop 5E	Tennessee Chemical	**5EC

Formulation Abbreviations

WP = wettable powder; DG = dispersible granules; F = flowable suspension; LC = liquid concentrate; EC = emulsifiable concentrate.

Formulation Notes

Fungicides are sold commercially as a mixture of active ingredient (that which kills the fungus) and other substances, i.e., carriers, diluents, solvents, wetting agents, or emulsifiers. The formulation indicates the portion of the product which is active ingredient and the physical form of the product. For WP and DG formulations, the number before the abbreviation indicates the percentage of the product that is active ingredient. For F, LC, and EC formulations, the number before the abbreviation usually** indicates the amount of the product that is active ingredient. For example, 50WP describes a wettable powder that is 50% active ingredient, and 4F describes a flowable product that contains 4 pounds of active ingredient per gallon of product.

*The number preceding the type of formulation for copper products indicates the percentage or amount of metallic copper in the product. For example, 53WP describes a wettable powder product that is 53 percent metallic copper, and 3F describes a flowable product containing 3 pounds of metallic copper per gallon.

**In the case of copper ammonium carbonate, the 8EC formulation indicates that the product is an emulsifiable concentrate that contains 8 percent metallic copper. For copper resinate, the 5EC formulation indicates that the product contains 5 percent metallic copper.

Table 3. Alphabetized list of selected fungicides by their trade names and corresponding common names.

Trade name	Common name
Bayleton	triadimefon
Benlate	benomyl
Bravo 500	chlorothalonil
Botran	DCNA
Captan	captan
Captec	captan
Citcop 5E	copper resinate
C-O-C-S	copper oxychloride sulfate
Copper Count N	copper ammonium chloride
Difolatan	captafol
Dithane FZ	maneb
Dithane M22	maneb
Dithane M45	mancozeb
Dithane Z78	zineb
Du-Ter	triphenyltin hydroxide (TPTH)
Dyrene	anilazine
Karathane	dinocap
Kocide	copper hydroxide
Manex	maneb
Manzate	maneb
Manzate 200	mancozeb
Orthocide	captan
Polyram	metiram
Ridomil MZ58	metalaxyl
Ronilan	vinclozolin
Super-Cu	basic copper sulfate
Super-tin	triphenyltin hydroxide (TPTH)
Topsin-M	thiophanate methyl
Triangle	basic copper sulfate
Tribasic Copper Sulfate	basic copper sulfate
Zineb 75WP	zineb

Table 4. Fungicide active ingredients, toxicities, and toxicity categories.

Fungicide active ingredient	LD ₅₀ mg/kg*		Toxicity category
	Oral	Dermal	
anilazine	> 5000	> 9480	IV
benomyl	> 10000	**	IV
capatafol	6200	**	IV
captan	10000	**	IV
chlorothalonil	> 10000	> 10000	IV
DCNA	> 5000	**	IV
dinocap	980	**	III
mancozeb	> 7500	**	IV
maneb	> 6750	**	IV
metalaxyl	669	> 3100	III
metiram	> 10000	**	IV
thiophanate methyl	7500	**	IV
TPTH	108	**	II
triadimefon	400-1000	> 1000	II
vinclozolin	10000	**	IV
zineb	> 5200	**	IV
copper products	1000	> 8000	III

*LD₅₀ values are given for commercially available formulated products with the active ingredients indicated. Not all products have established dermal LD₅₀ values.

**LD₅₀ values for these fungicides have not been determined.

Fungicide Restrictions

The Environmental Protection Agency has certain restrictions on the use of pesticides, including fungicides. Such restrictions might prohibit the use of a fungicide or allow residue tolerances on harvested vegetables. Growers must know which fungicides are labeled for use on vegetables they raise, how to apply them, and when to apply them with regard to harvest dates.

Federal law states that any use of pesticides in a manner inconsistent with the labeling is illegal. (Labeling refers to all written, printed, or graphic information on, or attached to the fungicide container or package wrapper).

Fungicide Toxicity and Safety

Information regarding toxicity of fungicides mentioned in this publication is provided in Tables 4 and 5. Users should be aware that the danger in handling fungicides depends not only on toxicity values (expressed as LD₅₀ in Table 4), but the amount and type of exposure (oral or dermal) also are factors that decide the danger of a particular pesticide. Safe handling and

disposal instructions are provided on the product label. In case of an accident, note the poison information phone numbers listed below:

**Statewide Poison Control Information
toll free 1-800-382-9097**

**Poison Control Coordinator for Indiana
1-317-633-0332**

Table 5. Interpretation of toxicity categories.

Toxicity category	Signal word*	Relative toxicity
I	Danger-Poison	High
II	Warning	Moderate
III	Caution	Low
IV	Caution	Very low

*Signal words are assigned by levels of acute oral toxicity and are required on the label.