

# Vineyard Spray Application and Safety – Resources for Vineyard Managers and Workers

Tom Smith  
Executive Director  
NPSEC

# Today's Outline

1. Pesticide  
Resistance

2. All about  
Sprayers

3. Worker  
Protection  
Standards  
(WPS)

4. Pesticide  
Certification  
& Training  
(C&T)

Access this presentation at:

<https://npsec.us/picktn>



# 1. Managing for Resistance

Pesticide Mode of Action (MoA)

Herbicide Resistance Action Committee  
(HRAC)

Insecticide Resistance Action Committee  
(IRAC)

Fungicide Resistance Action Committee  
(FRAC) How pests develop resistance

How Pests Develop Resistances

# HRAC Mode of Action Classification 2021



## Light Activation of ROS<sup>a</sup>

**Inhibition of Photosynthesis at PS II**

**5** D1 Serine 264 binders (and other non-histidine 215 binders)

**6** D, Histidine 215 binders

## Cellular Metabolism

**2** Inhibition of Acetolactate Synthase

**1** Inhibition of Acetyl CoA Carboxylase

**15** Inhibition of Very Long-Chain Fatty Acid Synthase

**30** Inhibition of Fatty Acid Thioesterase

**29** Inhibition of Cellulose Synthase

**31** Inhibition of Serine Threonine Protein Phosphatase

**28** Inhibition of Dihydroorotate Dehydrogenase

**9** Inhibition of Enolpyruvyl Shikimate Phosphate Synthase

**18** Inhibition of Dihydroterate Synthase

## Cell Division and Growth

**3** Inhibition of Microtubule Assembly

**23** Inhibition of Microtubule Organization

**4** Auxin Mimics

**24** Uncouplers

**19** Auxin Transport Inhibitors

**0** Unknown Mode of Action

HRAC	LD50 (HRAC)	HRAC	LD50 (HRAC)
1	A	19	F
2	B	22	D
3	K1	23	K2
4	O	24	M
5	C1,2	27	F2
6	C3	28	none
8	G	29	L
9	G	30	G
10	H	31	B
12	F1	32	I
13	F4	33	J
14	E	34	F3
15	K3	35	unknown mode of action
16	I	36	Z

HRAC: <https://www.hracglobal.com/>

Herbicide Mode of Action: <https://hracglobal.com/files/FactSheet.pdf>

<sup>a</sup> Based on oxygen species  
<sup>b</sup> Includes pro herbicide  
<sup>c</sup> HRAC1 representative herbicides include phenols, butyltin compounds, and other active in the family. Active without chemical family names are indicated with a white background

A free copy of this poster can be downloaded at [www.hracglobal.com](http://www.hracglobal.com)

## 7.2. The Classification Table

IRAC MoA Classification Version 10.1, December 2021		
See section 7.4 for further information on sub-groups. See section 7.3 for criteria for descriptors of the quality of MoA information.		
Main Group and Primary Site of Action	Sub-group, class or exemplifying Active Ingredient	Active Ingredients
<b>1</b> <b>Acetylcholinesterase (AChE) inhibitors</b>  Nerve action  {Strong evidence that action at this protein is responsible for insecticidal effects}	<b>1A</b> Carbamates	Alanycarb, Aldicarb, Bendiocarb, Benfuracarb, Butocarboxim, Butoxycarboxim, Carbaryl, Carbofuran, Carbosulfan, Ethiofencarb, Fenobucarb, Formetanate, Furathiocarb, Isoprocarb, Methiocarb, Methomyl, Metolcarb, Oxamyl, Pirimicarb, Propoxur, Thiodicarb, Thiofanox, Triazamate, Trimethacarb, XMC, Xyllycarb
	<b>1B</b> Organophosphates	Acophate, Azamethiphos, Azinphos-ethyl, Azinphos-methyl, Cadusafos, Chlorethoxyfos, Chlorfenvinphos, Chlormephos, Chlorpyrifos, Chlorpyrifos-methyl, Coumaphos, Cyanophos, Demeton-S-methyl, Diazinon, Dichlorvos/ DDVP, Dicrotophos, Dimethoate, Dimethylvinphos, Disulfoton, EPN, Ethion, Ethoprophos, Famphur, Fenamiphos, Fenitrothion, Fenthion, Fosthiazate, Heptenophos, Imicyafos, Isafenphos, Isopropyl O-(methoxyaminothio-phosphoryl) salicylate, Isoxathion, Malathion, Mecarbam, Methamidophos, Methidathion, Mevinphos, Monocrotophos, Naled, Omethoate, Oxydemeton-methyl, Parathion, Parathion-methyl, Phenthoate, Phorate, Phosalone, Phosmet, Phosphamidon, Phoxim, Pirimiphos-methyl, Profenofos, Propetamphos, Prothiofos, Pyraclofos, Pyridaphenthion, Quinalphos, Sulfotep, Tebupirifos, Temephos, Terbufos, Tetrachlorvinphos, Thiometon, Triazophos, Trichlorfon, Vamidothion
<b>2</b> <b>GABA-gated chloride channel blockers</b>  Nerve action  {Strong evidence that action at this protein is responsible for insecticidal effects}	<b>2A</b> Cycloidiene Organochlorines	Chlordane, Endosulfan
	<b>2B</b> Phenylpyrazoles (Fiproles)	Ethiprole, Fipronil

IRAC MoA Classification Version 10.1, December 2021		
See section 7.4 for further information on sub-groups. See section 7.3 for criteria for descriptors of the quality of MoA information.		
Main Group and Primary Site of Action	Sub-group, class or exemplifying Active Ingredient	Active Ingredients
<b>3</b> <b>Sodium channel modulators</b>  Nerve action  {Strong evidence that action at this protein is responsible for insecticidal effects}	<b>3A</b> Pyrethroids Pyrethrins	Acrinathrin, Allethrin, d-cis-trans Allethrin, d-trans Allethrin, Bifenthrin, Bioallethrin, Bioallethrin S-cyclopentenyl isomer, Bioresmethrin, Cycloprothrin, Cyfluthrin, beta-Cyfluthrin, Cyhalothrin, lambda-Cyhalothrin, gamma-Cyhalothrin, Cypermethrin, alpha-Cypermethrin, beta-Cypermethrin, theta-cypermethrin, zeta-Cypermethrin, Cyphenothrin, (1R)-trans- isomers], Deltamethrin, Empenthrin (EZ)- (1R)- isomers], Efenvalerate, Etofenprox, Fenpropathrin, Fenvalerate, Flucythrinate, Flumethrin, tau-Fluvalinate, Halfenprox, Imiprothrin, Kadethrin, Permethrin, Phenothrin [(1R)-trans- isomer], Prallethrin, Pyrethrins (pyrethrum), Resmethrin, Silafluofen, Tefluthrin, Tetramethrin, Tetramethrin [(1R)-isomers], Tralomethrin, Transluthrin,
	<b>3B</b> DDT Methoxychlor	DDT Methoxychlor
<b>4</b> <b>Nicotinic acetylcholine receptor (nAChR) competitive modulators</b>  Nerve action  {Strong evidence that action at one or more of this class of protein is responsible for insecticidal effects}	<b>4A</b> Neonicotinoids	Acetamiprid, Clothianidin, Dinotefuran, Imidacloprid, Nitenpyram, Thiocloprid, Thiamethoxam,
	<b>4B</b> Nicotine	Nicotine
	<b>4C</b> Sulfoximines	Sulfoxaflor
	<b>4D</b> Butenolides	Flupyradifurone
	<b>4E</b> Mesoionics	Triflumezopyrim
<b>4F</b> Pyridylidenes	Flupyrimin	
<b>5</b> <b>Nicotinic acetylcholine receptor (nAChR) allosteric modulators – Site I</b>  Nerve action  {Strong evidence that action at one or more of this class of protein is responsible for insecticidal effects}	Spinosyns	Spinetoram, Spinosad



IRAC: <https://irac-online.org/>

Insecticide Mode of Action:  
<https://irac-online.org/modes-of-action/>

# FRAC Classification of Fungicides

Fungal control agents by cross resistance pattern and mode of action 2021 ([www.frac.info](http://www.frac.info))



**A: Nucleic Acids Metabolism**

A1: RNA polymerase I # 1: fungicides (morpholines)  
 A2: adenosine deaminase # 2: fungicides (pyridazines)  
 A3: DNA / RNA synthesis (prop.) # 3: telomerans  
 A4: DNA topoisomerase type II (gyrase) # 21: catenolig acids

**B: Cytoskeleton and Motor Proteins**

B1:  $\beta$ -tubulin assembly in mitosis # 1: MBC fungicides (benzimidazole carbamates)  
 B2:  $\beta$ -tubulin assembly in mitosis # 10: fungicides (triazolopyrimidines)  
 B3:  $\beta$ -tubulin assembly in mitosis # 22: benzoxazoles and thiazole carbonylcarbamates  
 B4: cell division (antitubulin site) # 23: phenylamides  
 B5: decolocalisation of spectrin-like proteins # 43: benzoxazoles  
 B6: actin/myosin/vibrio function # 47: cytoskeletons  
 B7: actin/myosin/vibrio function # 50: arylpiperazine ketones

**C: Respiration**

C1: complex I NADH:Oxidoreductase # 3: fungicides (succinylated pyridazines)  
 C2: complex II: succinate-dehydrogenase # 7: SDHI fungicides (pyridopyrimidines)  
 C3: complex II cytochrome bct (ubiquinol oxidase) at Qo site (cyt b gene) # 11: QoI fungicides (quinone outside inhibitors)  
 C4: complex II cytochrome bct (ubiquinol oxidase) at Qc site # 21: QcI fungicides (quinone inside inhibitors)  
 C5: uncouplers of oxidative phosphorylation # 29  
 C6: inhibitors of oxidative phosphorylation, ATP synthase # 30: fungicides (pyridazines)  
 C7: ATP transport (proposed) # 31: fungicides (pyridazines)  
 C8: inhibition of complex II cytochrome bc1-complex (inhibitor) # 32: fungicides (pyridazines)  
 C9: inhibition of complex II cytochrome bc1-complex (inhibitor) # 33: fungicides (pyridazines)  
 C10: inhibition of complex II cytochrome bc1-complex (inhibitor) # 34: fungicides (pyridazines)  
 C11: inhibition of complex II cytochrome bc1-complex (inhibitor) # 35: fungicides (pyridazines)  
 C12: inhibition of complex II cytochrome bc1-complex (inhibitor) # 36: fungicides (pyridazines)  
 C13: inhibition of complex II cytochrome bc1-complex (inhibitor) # 37: fungicides (pyridazines)  
 C14: inhibition of complex II cytochrome bc1-complex (inhibitor) # 38: fungicides (pyridazines)  
 C15: inhibition of complex II cytochrome bc1-complex (inhibitor) # 39: fungicides (pyridazines)  
 C16: inhibition of complex II cytochrome bc1-complex (inhibitor) # 40: fungicides (pyridazines)  
 C17: inhibition of complex II cytochrome bc1-complex (inhibitor) # 41: fungicides (pyridazines)  
 C18: inhibition of complex II cytochrome bc1-complex (inhibitor) # 42: fungicides (pyridazines)  
 C19: inhibition of complex II cytochrome bc1-complex (inhibitor) # 43: fungicides (pyridazines)  
 C20: inhibition of complex II cytochrome bc1-complex (inhibitor) # 44: fungicides (pyridazines)  
 C21: inhibition of complex II cytochrome bc1-complex (inhibitor) # 45: fungicides (pyridazines)  
 C22: inhibition of complex II cytochrome bc1-complex (inhibitor) # 46: fungicides (pyridazines)  
 C23: inhibition of complex II cytochrome bc1-complex (inhibitor) # 47: fungicides (pyridazines)  
 C24: inhibition of complex II cytochrome bc1-complex (inhibitor) # 48: fungicides (pyridazines)  
 C25: inhibition of complex II cytochrome bc1-complex (inhibitor) # 49: fungicides (pyridazines)  
 C26: inhibition of complex II cytochrome bc1-complex (inhibitor) # 50: fungicides (pyridazines)

**D: Amino Acid and Protein Synthesis**

D1: methionine biosynthesis (cys gene) (proposed) # 4: fungicides (pyridazines)  
 D2: protein synthesis (ribosome, termination step) # 24: fungicides (pyridazines)  
 D3: protein synthesis (ribosome, initiation step) # 44: fungicides (pyridazines)  
 D4: protein synthesis (ribosome, initiation step) # 25: phenylamides  
 D5: protein synthesis (ribosome, elongation step) # 41: bicyclic antibiotics

**E: Signal Transduction**

E1: signal transduction (mechanism unknown) # 3: fungicides (pyridazines)  
 E2: osmotic signal transduction # MAP / histidine kinase (os-1, Dnf1) # 1: fungicides (pyridazines)  
 E3: osmotic signal transduction # MAP / histidine kinase (os-1, Dnf1) # 1: fungicides (pyridazines)  
 E4: osmotic signal transduction # MAP / histidine kinase (os-1, Dnf1) # 1: fungicides (pyridazines)

**F: Lipid Synthesis or Transport / Membrane Integrity or Function**

F1: phospholipid biosynthesis # methylglucosyltransferase # 4: fungicides (pyridazines)  
 F2: phospholipid biosynthesis # methylglucosyltransferase # 4: fungicides (pyridazines)  
 F3: cell peroxidation (prop.) # 14: fungicides (pyridazines)  
 F4: cell membrane permeability, fatty acids (prop.) # 15: fungicides (pyridazines)  
 F5: ergosterol binding # 43: fungicides (pyridazines)

**G: Sterol Biosynthesis in Membranes**

G1: C14-demethylase in sterol biosynthesis (erg11/erg25) # 3: fungicides (morpholines)  
 G2:  $\Delta^2,^4$ -reductase and  $\Delta^7,^8$ -isomerase in sterol biosynthesis (erg3, erg24) # 4: fungicides (morpholines)  
 G3: 3-keto reductase in C4-de-methylation (erg27) # 17: fungicides (morpholines)  
 G4: squalene epoxidase in sterol biosynthesis (erg3) # 18: fungicides (morpholines)

**H: Cell Wall Biosynthesis**

H1: chitin synthase # 19: fungicides (morpholines)  
 H2: cellulose synthase # 4: fungicides (morpholines)  
 H3: cellulose synthase # 4: fungicides (morpholines)

**I: Melanin Synthesis in Cell Wall**

I1: reduction in melanin biosynthesis # 14: fungicides (pyridazines)  
 I2: dehydrogenase in melanin biosynthesis # 15: fungicides (pyridazines)  
 I3: polyketide synthase in melanin biosynthesis # 16: fungicides (pyridazines)

**J: Polyketide Synthase in Cell Wall**

J1: polyketide synthase in melanin biosynthesis # 16: fungicides (pyridazines)

**K: Polyketide Synthase in Cell Wall**

K1: polyketide synthase in melanin biosynthesis # 16: fungicides (pyridazines)

**L: Polyketide Synthase in Cell Wall**

L1: polyketide synthase in melanin biosynthesis # 16: fungicides (pyridazines)

**M: Chemicals with Multi-Site Activity**

M1: fungicides (pyridazines)  
 M2: fungicides (pyridazines)  
 M3: fungicides (pyridazines)  
 M4: fungicides (pyridazines)  
 M5: fungicides (pyridazines)  
 M6: fungicides (pyridazines)  
 M7: fungicides (pyridazines)  
 M8: fungicides (pyridazines)  
 M9: fungicides (pyridazines)  
 M10: fungicides (pyridazines)  
 M11: fungicides (pyridazines)  
 M12: fungicides (pyridazines)  
 M13: fungicides (pyridazines)  
 M14: fungicides (pyridazines)  
 M15: fungicides (pyridazines)  
 M16: fungicides (pyridazines)  
 M17: fungicides (pyridazines)  
 M18: fungicides (pyridazines)  
 M19: fungicides (pyridazines)  
 M20: fungicides (pyridazines)

**N: Not Specified**

N1: fungicides (pyridazines)

**Unknown Mode of Action**

U1: fungicides (pyridazines)  
 U2: fungicides (pyridazines)  
 U3: fungicides (pyridazines)  
 U4: fungicides (pyridazines)  
 U5: fungicides (pyridazines)  
 U6: fungicides (pyridazines)  
 U7: fungicides (pyridazines)  
 U8: fungicides (pyridazines)  
 U9: fungicides (pyridazines)  
 U10: fungicides (pyridazines)

**BM: Biologicals with Multiple Modes of Action**

BM 01: plant extract  
 BM 02: microbial (strains of living microbes or extract, metabolites)

**Legend:**

C: Respiration  
 C1: inhibition of complex I  
 C2: inhibition of complex II  
 C3: inhibition of complex II  
 C4: inhibition of complex II  
 C5: uncouplers of oxidative phosphorylation  
 C6: inhibitors of oxidative phosphorylation, ATP synthase  
 C7: ATP transport  
 C8: inhibition of complex II  
 C9: inhibition of complex II  
 C10: inhibition of complex II  
 C11: inhibition of complex II  
 C12: inhibition of complex II  
 C13: inhibition of complex II  
 C14: inhibition of complex II  
 C15: inhibition of complex II  
 C16: inhibition of complex II  
 C17: inhibition of complex II  
 C18: inhibition of complex II  
 C19: inhibition of complex II  
 C20: inhibition of complex II  
 C21: inhibition of complex II  
 C22: inhibition of complex II  
 C23: inhibition of complex II  
 C24: inhibition of complex II  
 C25: inhibition of complex II  
 C26: inhibition of complex II  
 C27: inhibition of complex II  
 C28: inhibition of complex II  
 C29: inhibition of complex II  
 C30: inhibition of complex II  
 C31: inhibition of complex II  
 C32: inhibition of complex II  
 C33: inhibition of complex II  
 C34: inhibition of complex II  
 C35: inhibition of complex II  
 C36: inhibition of complex II  
 C37: inhibition of complex II  
 C38: inhibition of complex II  
 C39: inhibition of complex II  
 C40: inhibition of complex II  
 C41: inhibition of complex II  
 C42: inhibition of complex II  
 C43: inhibition of complex II  
 C44: inhibition of complex II  
 C45: inhibition of complex II  
 C46: inhibition of complex II  
 C47: inhibition of complex II  
 C48: inhibition of complex II  
 C49: inhibition of complex II  
 C50: inhibition of complex II

FRAC – Fungicide Mode of Action:  
<https://www.frac.info/>

# PATHOGEN RISK LIST (Sept 2019)

Plant pathogens accepted as showing a high risk of development of resistance to fungicides:

- Botrytis cinerea      various, especially grapevine      grey mold
- Plasmopara viticola      grapevine      downy mildew

Plant pathogens accepted as showing a medium risk of development of resistance to fungicides:

- Erysiphe necator      grapevine      powdery mildew

Risk list - <https://www.frac.info/docs/default-source/publications/pathogen-risk/frac-pathogen-list-2019.pdf>

When the pathogen risk is plotted against the inherent resistance risk of the fungicide class, the combined resistance risk for each pathogen/fungicide combination can be estimated (Figure 1).

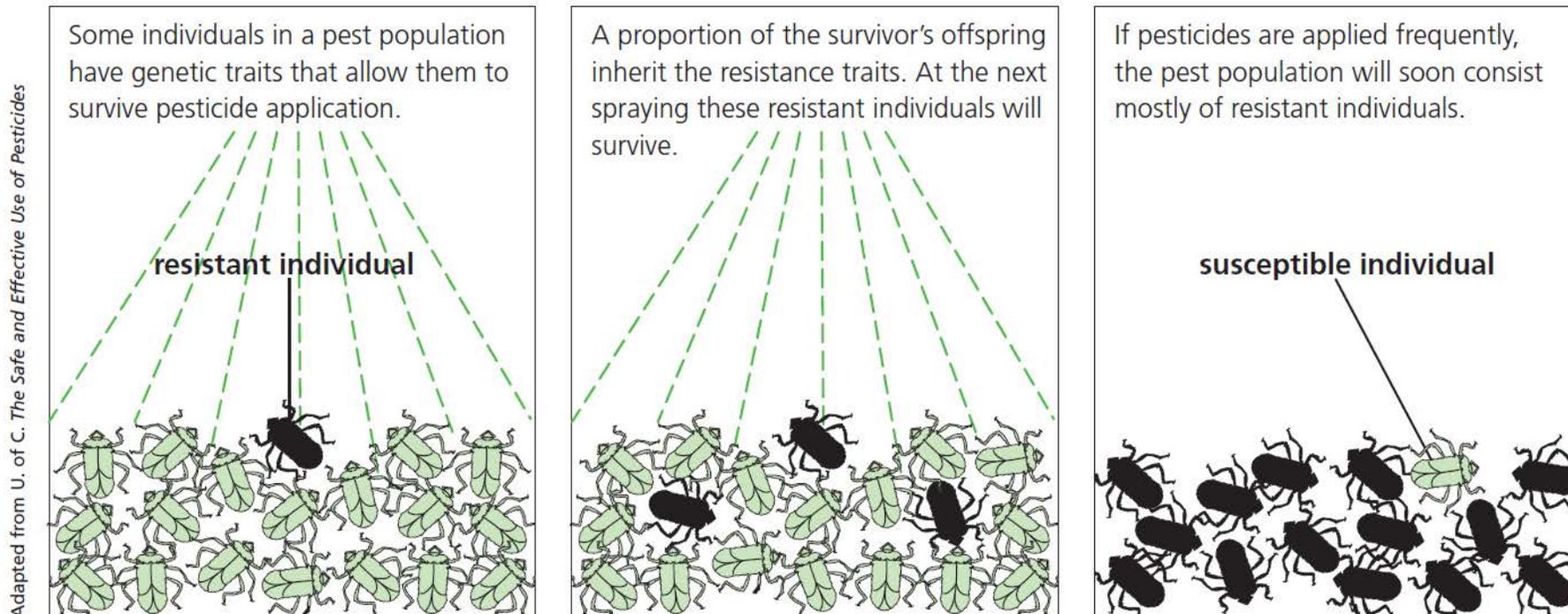


Figure 1: Combined resistance risk diagram based on inherent fungicide risk and inherent pathogen risk (\* only most important classes and groups mentioned) (according to FRAC Monograph No. 2, by K.J. Brent and D.W. Hollomon, 2007, \*\* SDHI fungicides have been moved from medium to medium to high risk)

↓ Fungicide Classes *	↓ Fungicide Risk	Combined Risk		
benzimidazoles dicarboximides phenylamides QoI fungicides SDHI fungicides**	high = 3	3	6	9
SBI fungicides anilinopyrimidines phenylpyrroles phosphorothiolates	medium = 2	2	4	6
multi site fungicides (e.g. dithiocarbamates Copper, Sulphur) MBI-R inhibitors SAR inducers	low = 1	1	2	3
Pathogen risk →		low = 1	medium = 2	high = 3
Pathogen groups * →		seed borne pathogens (e.g. <i>Pyrenophora</i> spp., <i>Ustilago</i> spp.) soil-borne pathogens (e.g. <i>Phytophthora</i> spp.) rust fungi <i>Rhizoctonia</i> spp.	<i>Rhynchosporium commune</i> <i>Zymoseptoria tritici</i> <i>Oculimacula</i> spp.	<i>Blumeria graminis</i> <i>Botrytis cinerea</i> ← <i>Penicillium</i> spp. <i>Pyricularia oryzae</i> <i>Venturia inaequalis</i> <i>Pseudocercospora fijiensis</i>

# How Pests Develop Resistance

Figure 1.4 Pesticide resistance



# Midwest Fruit Pest Management Guide 2021 - 2022

<https://ag.purdue.edu/hla/hort/documents/id-465.pdf>



## ***Grape Bud Break to Pre-bloom – Diseases***

### **Notes on disease management**

- Begin fungicide applications at 1-3 inch new shoot growth; repeat at 7-10 day intervals or according to label instructions and environmental conditions.
- **Powdery mildew:** Primary infections of powdery mildew can occur during this period. Adding a FRAC 3 fungicides (Cevya, Mettle, Procure, Rally, Tebuzol) in the third or fourth spray during this time period improves control of powdery mildew and black rot.

### **Fungicide Resistance Alert**

- The downy and powdery mildew pathogens are especially prone to fungicide resistance. Avoid back-to-back applications of any one systemic fungicide class. See Fungicide Resistance Management, page 140, for information about fungicide resistance development in powdery and downy mildews. See generic fungicides table for product with the same active ingredient, page 218.
- Avoid using fungicides in FRAC group 7 or 11 during this period.

### **Phytotoxicity Alert**

- Inspire Super, Quadris Top, and Revus Top all contain the active ingredient difenoconazole. All fungicides with difenoconazole labeled for grapes have the following precaution: "On *V. labrusca*, *V. labrusca* hybrids, and other non-vinifera hybrids where sensitivity is not known, the use of Inspire Super, Quadris Top, or Revus Top by itself or in tank mixes with materials that may increase uptake (adjuvants, foliar fertilizers) may result in leaf burning or other phytotoxic effects."
- Revus Top cannot be used on Concord, Concord Seedless, and Thomcord grapes.
- Flint 50WG should not be applied to Concord or other American type grapes, as injury may occur.
- Luna Experience is labeled for wine grapes only and should not be used on Concord grapes.
- Pristine should not be applied to Concord or other American-type grapes, as injury may occur.

**Foundation program:** This program contains products that are at a lower risk of resistance and serves as foundation for a grape disease management program.

## Foundation Fungicide Program for Early Season Control of Grape Diseases<sup>1</sup>

Product and formulation	Active ingredient	FRAC <sup>2</sup>	Black rot	Downy mildew	Phomopsis	Powdery mildew	REI <sup>4</sup> PHI <sup>3</sup>	Max amt <sup>5</sup> Max app <sup>6</sup>
Captan 80 WDG		M3	1.2-2.5 lb.	1.2-2.5 lb.	1.2-2.5 lb.	1.2-2.5 lb.	48h	12 lb.
	captan		F	G	E	i	0d	NA
Microthiol Disperss		M	x	x	3-10 lb.	3-10 lb.	12h	NA
	sulfur		x	x	F	E	0d	NA
Ridomil Gold Copper		4+M	x	2 lb.	x	x	48h	8 lb.
	mefanoxam + Copper Hydroxide		x	E	x	x	42d	4
Ridomil Gold MZ		4 + M	x	2.5 lb.	x	x	48h	10 lb.
	mefenoxam + mancozeb		x	E	x	x	66d	4
Roper DF Rainshield		M	1.5-4 lb.	1.5-4 lb.	1.5-4 lb.	x	24h	24 lb.
	mancozeb		E	E	E	x	66d	6

**E** = excellent control    **G** = good control    **F** = fair control    **[r]** = fungicide/insecticide resistance possible    **s** = suppression only    **i** = ineffective    **u** = unknown efficacy  
**x** = pest not on the label

### Effectiveness of Pesticides for Control of Grape Diseases – Bud Break to Pre-Bloom<sup>1</sup> (continued)

Product and formulation Active ingredient	FRAC <sup>2</sup>	Black rot	Downy mildew	Phomopsis	Powdery mildew	REI <sup>4</sup> PHI <sup>3</sup>	Max amt <sup>5</sup> Max app <sup>6</sup>
Topsin-M WSB	1	0.7-1.5 lb.	x	0.7-1.5 lb.	0.7-1.5 lb.	48h	6 lb.
thiophanate methyl		F	x	G	E	7d	NA
Torino (SC)	U6	x	x	x	3.4 oz.	4h	6.8 oz.
cyflufenamid		x	x	x	E	3d	1 or 2
Vanguard WG (75WG)	9	x	x	x	See label	12h	30 oz.
cyprodinil		x	x	x	s	7d	See label
Vivando (2.5F)	U8	x	x	x	10.3-15.4 fl. oz.	12h	42.6 fl. oz.
metrafenone		x	x	x	E	14d	3
Zampro	45 + 40	x	11-14 fl. oz.	x	x	12h	56 fl. oz.
ametoctradin + dimethomorph		x	E	x	x	14d	NA
Ziram 76DF	M	3-4 lb.	3-4 lb.	3-4 lb.	x	48h	28 lb.
ziram		E	G	G	x	21d	NA

**E** = excellent control   **G** = good control   **F** = fair control   **[r]** = fungicide/insecticide resistance possible   **s** = suppression only   **i** = ineffective   **u** = unknown efficacy  
**x** = pest not on the label



## Fungicide

For the control of certain diseases of cucumbers, melons, summer squash, grapes, onions, potatoes, sugar beets, and tomatoes

**KEEP OUT OF REACH OF CHILDREN.**

## CAUTION

See additional precautionary statements and directions for use inside booklet.

**5 pounds**

Net Weight



MEFENOXAM	GROUP	4	FUNGICIDE
MANCOZEB	GROUP	M03	FUNGICIDE

*Active Ingredients:*

Mefenoxam*	4.0%
Mancozeb: A coordination product of zinc ion and Manganese ethylene bisdithiocarbamate**	64.0%
in which the ingredients are:	
Manganese <sup>++</sup>	12.8%
Zinc	1.6%
Ethylene bisdithiocarbamate ion (C <sub>4</sub> H <sub>6</sub> N <sub>2</sub> S <sub>4</sub> )	49.6%

*Other Ingredients:* 32.0%

*Total:* 100.0%

\*CAS Nos. 70630-17-0 and 69516-34-3

\*\*Same as the active ingredient found in Dithane<sup>®</sup> M-45 and Manzate<sup>®</sup> 200.

Ridomil Gold MZ WG is a dry flowable containing 0.04 lb of mefenoxam and 0.64 lb of mancozeb per pound of product.

**EPA Reg. No. 100-1269 EPA Est. 054675-MEX-001**

**Product of France**

**SCP 1269A-L1F 1119 4115038**

To delay fungicide resistance, take one or more of the following steps:

- Rotate the use of Ridomil Gold MZ WG or other Group 4 fungicides and Group M03 fungicide within a growing season sequence with different groups that control the same pathogens.
  - Use tank mixtures with fungicide from a different group that are equally effective on the target pest when such use is permitted. Use at least the minimum application rate as labeled by the manufacturer.
  - Adopt an integrated disease management program for fungicide use that includes scouting, uses historical information related to pesticide use, and crop rotation, and which considers host plant resistance, impact of environmental conditions on disease development, disease thresholds, as well as cultural, biological and other chemical control practices.
  - Where possible, make use of predictive disease models to effectively time fungicide applications. Note that using predictive models alone is not sufficient to manage resistance.
- 
- Monitor treated fungal populations for resistance development.
  - Contact your local extension specialist or certified crop advisor for any additional pesticide resistance-management and/or IPM recommendations for specific crops and pathogens.
  - For further information or to report suspected resistance contact Syngenta at 1-866-Syngent(a) (866-796-4368). You can also contact your pesticide distributor or university extension specialist to report resistance.

# Managing for Resistance

# Take Home Messages

Know your pest – Pest ID

What is the pest severity – do you need to treat?

What are the environmental conditions now and in the near future – will these reduce or increase the pest damage

Is the product labeled for the pest and labeled for the crop  
**READ the LABEL**

What is the Mode of Action (MoA)?

**Alternate products having different MoAs!**

# 2. All about Sprayers

Sprayer type

Nozzles

Calibration

Label Directions

Apply properly

# Sprayer type

- FABE-533: Sprayers for Effective Pesticide Application in Orchards and Vineyards <https://ohioline.osu.edu/factsheet/fabe-533>
- FABE-538: Advancements in Technology for Effective Spraying in Orchards and Vineyards <https://ohioline.osu.edu/factsheet/fabe-53>
- Airblast 101 Your Guide to Effective and Efficient Spraying  
<https://sprayers101.com/airblast101/>



- *Effective and efficient spraying in vineyards and orchards fact sheets - Erdal Ozkan, Ohio State University Extension*
- *Aiblast 101(Deveau, Ledebuhr, Manketelow)*

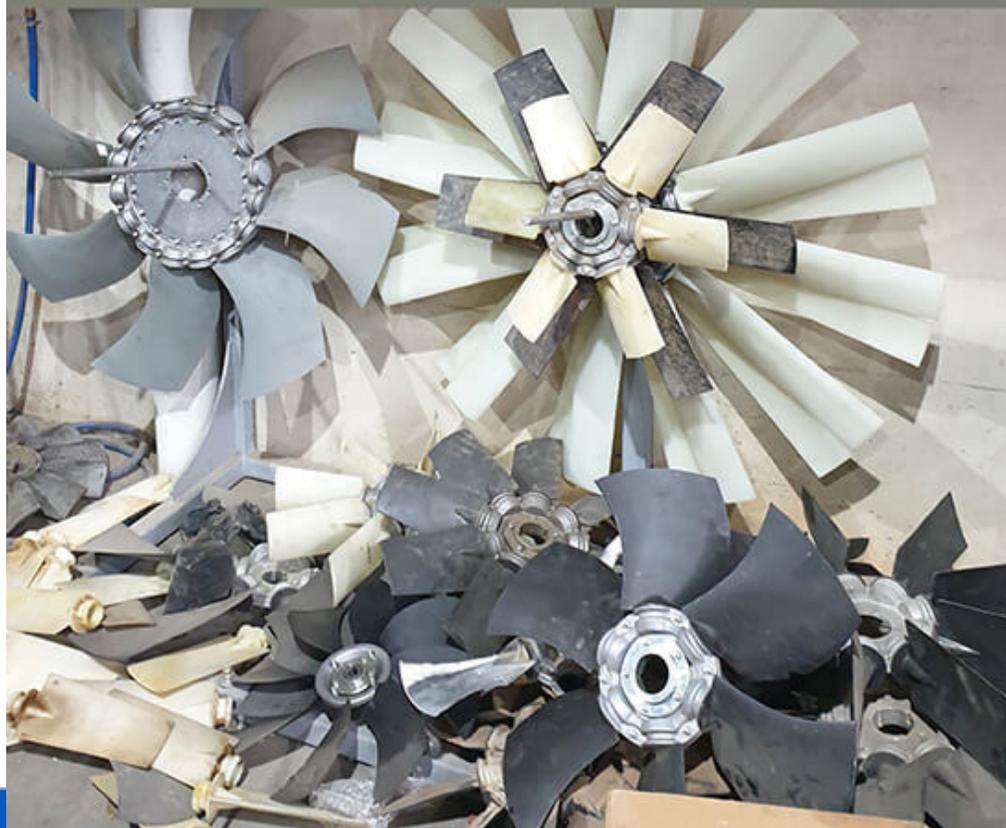
# Airblast 101



## *Airblast 101*

Your Guide to Effective and Efficient Spraying

SECOND EDITION



*Serving and Supporting Extension Pesticide Safety Education*

# Nozzles

- FABE-534: Selecting the Right Type and Size of Nozzles for Effective Spraying in Orchards and Vineyards <https://ohioline.osu.edu/factsheet/fabe-534>



*- Effective and efficient spraying in vineyards and orchards fact sheets - Erdal Ozkan, Ohio State University Extension*

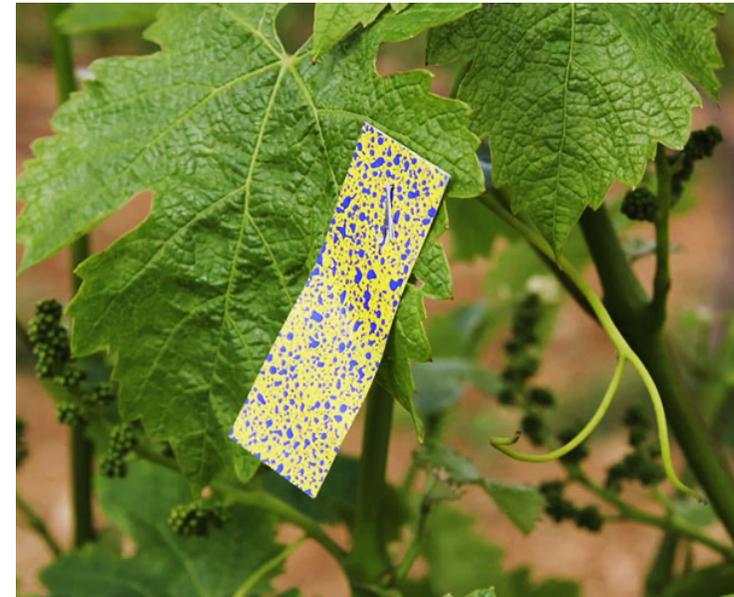
## SPRAY EQUIPMENT

### Nozzles

- Equip sprayers with nozzles that provide accurate and uniform application.
- Nozzles should be the same size and uniformly spaced across the boom.
- Calibrate sprayer before use.
- It is suggested that screens be used to protect the pump and to prevent nozzles from clogging.
- Screens placed on suction side of pump should be 16-mesh or coarser.
- Do not place a screen in the recirculation line.
- Use 50-mesh or coarser screens between the pump and boom, and where required, at the nozzles.
- Check nozzle manufacturer's recommendations.

# Calibration

- Air Blast Sprayer calibration - <https://youtu.be/NYbVtoP-C4M>
- FABE-537: Calibration of Orchard and Vineyard Sprayers <https://ohioline.osu.edu/factsheet/fabe-539>



- *George Hamilton – University of New Hampshire*

- *Effective and efficient spraying in vineyards and orchards fact sheets - Erdal Ozkan, Ohio State University Extension*

# Label Directions

## PRODUCT USE INSTRUCTIONS

**Application:** Thorough coverage is necessary to provide good disease control. Make up no more spray solution than is needed for application. Avoid spray overlap, as crop injury may occur.

**Efficacy:** Under certain conditions conducive to extended infection periods, use another registered fungicide for additional applications if maximum amount of Ridomil Gold MZ WG has been used. If resistant isolates to Group 4 fungicides are present, efficacy can be reduced.

**Crop Tolerance:** Plant tolerance has been found acceptable for all crops on the label, however, not all possible tank-mix combinations have been tested under all conditions. When possible, it is recommended to test the combinations on a small portion of the crop to ensure a phytotoxic response will not occur as a result of application.

**IPM:** Ridomil Gold MZ WG should be integrated into an overall disease and pest management strategy (IPM) whenever the use of a fungicide is required. Cultural practices known to reduce disease development should be followed. Consult your local agricultural authorities for additional IPM strategies established for your area.

# Apply properly

- FABE-536: Strategies to Maximize Pesticide Deposit and Coverage for Effective Spraying in Orchards and Vineyards <https://ohioline.osu.edu/factsheet/fabe-536>
- FABE-539: Best Practices for Effective Spraying in Orchards and Vineyards <https://ohioline.osu.edu/factsheet/fabe-539>
- Quick Tips For Using Your Sprayers - <https://npsec.us/sprayers>



*- Effective and efficient spraying in vineyards and orchards fact sheets - Erdal Ozkan, Ohio State University Extension*

*- George Hamilton – University of New Hampshire*

# All about Sprayers

# Take Home Messages

Select the Correct Sprayer

Select the correct nozzles

Calibrate the sprayer correctly

**READ the LABEL**

Use the right product  
Mix and load properly  
Apply properly

# 3. Worker Protection Standards (WPS)



## AGRICULTURAL USE REQUIREMENTS

Use this product only in accordance with its labeling and with the Worker Protection Standard, 40 CFR Part 170. This Standard contains requirements for the protection of agricultural workers on farms, forests, nurseries, and greenhouses, and handlers of agricultural pesticides. It contains requirements for training, decontamination, notification, and emergency assistance. It also contains specific instructions and exceptions pertaining to the statements on this label about personal protective equipment (PPE) and restricted-entry interval. The requirements in this box only apply to uses of this product that are covered by the Worker Protection Standard (WPS).

**Do not enter or allow worker entry into treated areas during the restricted-entry interval (REI) of 48 hours.**

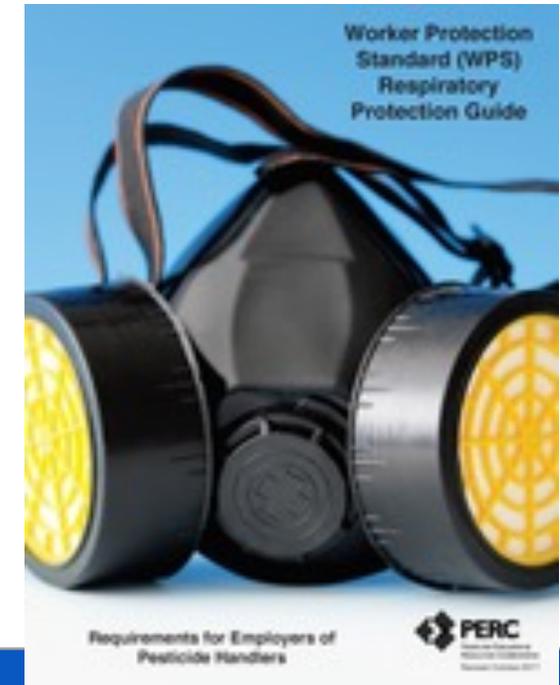
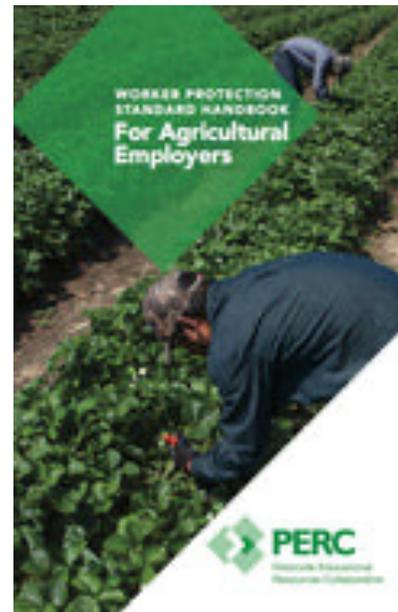
## **AGRICULTURAL USE REQUIREMENTS (continued)**

PPE required for early entry to treated areas that is permitted under the Worker Protection Standard and that involves contact with anything that has been treated, such as plants, soil, or water is:

- Coveralls
- Shoes and socks
- Chemical-resistant gloves made of barrier laminate, butyl rubber  $\geq$  14 mils, nitrile rubber  $\geq$  14 mils, neoprene rubber  $\geq$  14 mils, natural rubber  $\geq$  14 mils, polyethylene, polyvinyl chloride (PVC)  $\geq$  14 mils, or Viton®  $\geq$  14 mils

# WPS Resources

NPSEC WPS resources - <https://npsecstore.com/pages/perc-page>



ORDER YOUR PERC POSTERS HERE

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# Worker Protection Standards (WPS)

# Take Home Messages

WPS Label requirements

WPS Compliance – Training,  
Posting and Recordkeeping

# 4. Pesticide Certification & Training (C&T)

Private Applicators

Commercial Applicators

TN Department of Agriculture Online Pesticide System - <https://agriculture.tn.gov/default.asp>

Tennessee's PSEP website <http://psep.utk.edu>

# VESTA Resource Center



- Repository for the Grape and Wine Industry
- Integrates the resources of V&E alliance organizations
- Promotes the Grape and Wine Industry
- Collaborative Alliance:
  - Universities
  - Community Colleges
  - Grape and Wine Industry
  - Grape and Wine Associations
  - Viticulture and Enology Programs
- Partnership to advance Registered Apprenticeships to increase the GWI workforce

# Resources Available



- Nationwide V&E Programs
- Grape and Wine Industry Associations
- Webinars
- Publications
- Newsletters
- Workforce Development Tools
- VESTA educational courses
- Scholarships
- Grant funding sources
- Continuing Education for Faculty
- Mentoring for 2-year Colleges
- New Website Launch May 2022



Exhibit Booth 36

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Access this presentation at:

<https://npsec.us/picktn>

