

Review of Fungicides for Peach Disease Control

David F. Ritchie, Plant Pathologist – NC State University

NOTE: Fungicides listed in this presentation are selected for educational purposes and do not include all registered for peaches

TOPSIN M WSB
FUNGICIDE

70% Wettable Powder

CAUTION

KEEP OUT OF REACH OF CHILDREN

1 quart
Net Contents

rovrál brand
4 Flowable Fungicide

CAUTION

KEEP OUT OF REACH OF CHILDREN

1 quart
Net Contents

Orbit
Fungicide

For control of indicated diseases in tree nuts, nonbearing citrus, stone fruits, and berries

Active ingredient: Propiconazole 31.8%
Other ingredients 68.2%
Total 100.0%

Contains 2.6 lbs. propiconazole e.i. per gallon
*CAS No. 68307-90-1 **Contains petroleum distillates

KEEP OUT OF REACH OF CHILDREN. WARNING/AVISO

1 quart
Net Contents

Abound
Flowable Fungicide

syngenta.

Broad spectrum fungicide for control of plant diseases

Active ingredients:
Azoxystrobin (2-(2,4-D-chlorophenyl)-1,3,4-dihydro-6-methyl-5H-pyridin-3-one) 22.0%
Other ingredients 77.9%
Total 99.9%

Contains 2.0 lb of active ingredient per gallon

KEEP OUT OF REACH OF CHILDREN. CAUTION

1 gallon
Net Contents

Pristine
Fungicide

specIMEN

For use in disease control and plant health in the following crops: alfalfa; avocado; Belgium endive; berries; bulb vegetables; carrot; celery; citrus fruit; cucumber vegetables; globe artichoke; grape; hops; stone fruit; radishes; root vegetables (except sugar beets); stone fruit; strawberry; and tree nut

Active ingredients:
Boscalid (2-(2,4-dichlorophenyl)-1H-imidazo[4,5-b]pyridin-3-ylidene)-2-methyl-2-butanol 12.8%
Fluxapyroxad (2-(2,4-dichlorophenyl)-2-methyl-2-butanol) 27.2%
Other ingredients 59.9%
Total 100.0%

Contains 0.20 pounds of active ingredient per gallon

EPA Reg. No. 7508-08 EPA Est. No.

Merivon
Xemium Brand Fungicide

specIMEN

For disease control and plant health in the following crops: bulb vegetables, cucurbit vegetables, grapes, leafy vegetables, pome fruits, pomogranate, root vegetables, stone fruits, strawberries, and tree nuts

Active ingredients:
Pydiflumetopam (1-(2-(2,4-dichlorophenyl)-2-methyl-2-but-1-en-1-ylidene)-2-methyl-2-butanol) 21.30%
Pydiflumetopam (2-(2,4-dichlorophenyl)-2-methyl-2-but-1-en-1-ylidene)-2-methyl-2-butanol 27.40%
Other ingredients 51.30%
Total 100.00%

Contains 0.20 pounds of active ingredient per gallon

EPA Reg. No. 7509-01 EPA Est. No.

Thiophanate Methyl 85 WDG

Contains thiophanate methyl, the active ingredient used in Topstin and Chemix 200E

Thiophanate Methyl 85 WDG is not manufactured or distributed by Chemix

KEEP OUT OF REACH OF CHILDREN. CAUTION

1 gallon
Net Contents

Tilt
Fungicide

syngenta.

Broad spectrum fungicide for control of plant diseases

Active ingredients:
Azoxystrobin (2-(2,4-D-chlorophenyl)-1,3,4-dihydro-6-methyl-5H-pyridin-3-one) 22.0%
Other ingredients 77.9%
Total 99.9%

Contains 2.0 lb of active ingredient per gallon

KEEP OUT OF REACH OF CHILDREN. WARNING/AVISO

1 gallon
Net Contents

Drexel
Azoxystrobin SC

Fungicide

Broad spectrum fungicide for control of plant diseases

Active ingredients:
Azoxystrobin (2-(2,4-D-chlorophenyl)-1,3,4-dihydro-6-methyl-5H-pyridin-3-one) 22.0%
Other ingredients 77.9%
Total 99.9%

Contains 2.0 lb of active ingredient per gallon

KEEP OUT OF REACH OF CHILDREN. CAUTION

1 gallon
Net Contents

Quilt Xcel
Fungicide

syngenta.

Broad spectrum fungicide for control of plant diseases

Active ingredients:
Azoxystrobin (2-(2,4-D-chlorophenyl)-1,3,4-dihydro-6-methyl-5H-pyridin-3-one) 22.0%
Other ingredients 77.9%
Total 99.9%

Contains 2.0 lb of active ingredient per gallon

KEEP OUT OF REACH OF CHILDREN. WARNING/AVISO

2.5 gallons
Net Contents

Luna SENSATION
Fungicide

BAYER

Broad spectrum fungicide for control of plant diseases

Active ingredients:
Pydiflumetopam (1-(2-(2,4-dichlorophenyl)-2-methyl-2-but-1-en-1-ylidene)-2-methyl-2-butanol) 21.30%
Pydiflumetopam (2-(2,4-dichlorophenyl)-2-methyl-2-but-1-en-1-ylidene)-2-methyl-2-butanol 27.40%
Other ingredients 51.30%
Total 100.00%

Contains 0.20 pounds of active ingredient per gallon

KEEP OUT OF REACH OF CHILDREN. CAUTION

1 Gallon

Miravis
Fungicide

syngenta.

Active ingredients:
Pydiflumetopam 18.3%
Other ingredients 81.7%
Total 100.0%

Technology denotes the active ingredient Pydiflumetopam

*CAS No. 1228584-64-7
Miravis is formulated as a suspension concentrate (SC) and contains 1.67 lb of pydiflumetopam per gallon.

Sulfur 90W
Fungicide

CAUTION

KEEP OUT OF REACH OF CHILDREN

1 gallon
Net Contents

Bumper 41.8 EC
FUNGICIDE

ADAMA ESSENTIALS

Active ingredients:
Propiconazole 41.8%
Other ingredients 58.2%
Total 100.0%

Contains 0.418 pounds of active ingredient per gallon

KEEP OUT OF REACH OF CHILDREN. WARNING-AVISO

1 gallon
Net Contents

PropiMax
EC

FUNGICIDE

Active ingredients:
Propiconazole 41.8%
Other ingredients 58.2%
Total 100.0%

Contains 0.418 pounds of active ingredient per gallon

KEEP OUT OF REACH OF CHILDREN. WARNING-AVISO

1 gallon
Net Contents

Captan 4L
Fungicide

CAUTION

KEEP OUT OF REACH OF CHILDREN

DANGER / PELIGRO

1 gallon
Net Contents

Miravis Duo
Fungicide

syngenta.

Active ingredients:
Pydiflumetopam 6.9%
Difenoconazole 11.5%
Other ingredients 81.6%
Total 100.0%

Technology denotes the active ingredient Pydiflumetopam

*CAS No. 1228584-64-7
*CAS No. 19446-65-3
Miravis Duo is formulated as a suspension concentrate and contains 0.53 lb of pydiflumetopam and 1.04 lb of difenoconazole per gallon.

Three Common Major Diseases of Peaches



Blossom Blight
Monilinia fructicola



Brown Rot
Monilinia fructicola



Peach Scab
Cladosporium (Venturia) carpophilum

Some Fungicides Prior to 1980s for Use on Peaches Mostly for Brown Rot and Scab Control



Benlate (SS MOA) 1971
Captan (MS MOA)
Ferbam (MS MOA)
Sulfur (MS MOA)
Topsin-M (SS MOA)
Ziram (MS MOA)



History of fungicides for control of brown rot and scab on peaches --

Fungicides have Multiple Sites of Action (toxicity)

Pre - 1940s sulfur and sulfur-based fungicides (**in organics**); dusts, liquid-lime sulfur

1940s Ethylene bisdithiocarbamates (**EBDC**); zineb, thiram

1950s & 60s captan, chlorothalonil (**Bravo**)

Beginning of the fungicides having a Single Mode of Action (toxicity)

1970s Methyl Benzimidazole Carbamates (**MBC**); benomyl - **BENLATE**,
thiophanate-methyl - **TOPSIN-M**

1980s Sterole Biosynthesis Inhibitors (**SBI**)
C-14 Demethylation Inhibitors (**DMI**) **ORBIT, INDAR, ELITE**

1980s Dicarboximides **Ronilan** and **Rovral**

1990s Strobilurins (**Quinone outside Inhibitors, QoI**) **ABOUND, GEM (Flint)**



(con't) History of fungicides for control of brown rot and scab on peaches --

2000 – Package Pre-mix fungicide – two prepackaged fungicides having different modes of action.

Qol (strobilurin) + SDHI (carboxamide)

pyraclostrobin + boscalid = PRISTINE 38WDG

2009 another DMI – Quash 50WDG (metconazole)

2009 – Package Pre-mix fungicide – two prepackaged fungicides having different modes of action.

Qol (strobilurin) + DMI (triazole)

trifloxystrobin + tebuconazole = ADAMENT 50WG

2011 -- Package Pre-mix fungicide – two prepackaged fungicides having different modes of action

Qol (strobilurin) + DMI triazole

azoxystrobin + propiconazole = QUILT Xcel

(Qol (strobilurin) + SDHI (carboxamide)

**trifloxystrobin + fluopyram (pyridinyl ethylbenzamide) =
Luna Sensation**



(con't) History of fungicides for control of brown rot and scab on peaches --

2014 Package Pre-mix fungicide – two prepackaged fungicides having different modes of action

QoI (strobilurin) + SDHI (carboximide)

pyraclostrobin + fluxapyroxad = Merivon

2020 Package Pre-mix fungicide – two prepackaged fungicides having different modes of action

SDHI (pyrazole-carboximide) + DMI (triazole)

pydiflumetofen + difenoconazole = Miravis Duo

Also available as **pydiflumetofen = Miravis**



“Generic” Fungicides – 1990s & 2000s

Captan -- many

Sulfur – many formulations

MBC: TOPSIN M 70WDG, WSB, 4.5F

Thiophanate Methyl 85WDG

DMI (triazoles):

propiconazole **ORBIT 3.6EC**

PropiMax EC
BUMPER 41.8EC

tebuconazole **ELITE 45DF**

Orius 45DF
Tebuzol 45DF

Fungicide Resistance Action Committee (FRAC)

<https://www.frac.info/>

The FRAC Mode of Action (MoA) classification provides growers, advisors, extension staff, consultants and crop protection professionals with a guide to the selection of fungicides for use in an effective and sustainable fungicide resistance management strategy.

Labelling	Links to Recommendations for FRAC Mode of Action Groups	Synonyms, examples
GROUP 1	MBC fungicides	B1, Methyl Benzimidazole Carbamates, Benzimidazoles, BA, BCM
GROUP 2	Dicarboximide fungicides	E3, DI
GROUP 3	SBI Class I: DMI fungicides	G1, DeMethylation Inhibitors, Azoles, Triazoles, erg11, cyp51
GROUP 4	PA fungicides	A1, PhenylAmides, Acylalanines,
GROUP 5	SBI Class II: Amines	G2, Morpholines, erg2-, erg24-gene
GROUP 7	SDHI fungicides	C2, Succinate dehydrogenase inhibitors, Carboxamides, sdh-gene
GROUP 9	AP fungicides	D1, Anilino-Pyrimidine
GROUP 10	NPC fungicides	B2, N-Phenyl Carbamates
GROUP 11	QoI-fungicides	C3, Quinone outside Inhibitors, Strobilurines, cyt-b-gene
GROUP 13	AZN fungicides	E1, Azanaphthalenes
GROUP 17	SBI Class III: KRI fungicide	G3, KetoReductase Inhibitors, erg27-gene
GROUP 18	SBI Class IV	G4, Squalene-epoxidase in sterol biosynthesis
GROUP 40	CAA fungicides	H5, Carboxylic Acid Amides
GROUP 49	OSBPI fungicides	F9, OxySterol Binding Protein Inhibitors

MOA Groups Containing Fungicides Used on Peaches

Labelling	Links to Recommendations for FRAC Mode of Action Groups	Synonyms, examples
GROUP 1	MBC fungicides	B1, Methyl Benzimidazole Carbamates, Benzimidazoles, BA, BCM
GROUP 2	Dicarboximide fungicides	E3, DI
GROUP 3	SBI Class I: DMI fungicides	G1, DeMethylation Inhibitors, Azoles, Triazoles, erg11, cyp51
GROUP 7	SDHI fungicides	C2, Succinate dehydrogenase inhibitors, Carboxamides, sdh-gene
GROUP 9	AP fungicides	D1, Anilino-Pyrimidine
GROUP 11	QoI-fungicides	C3, Quinone outside Inhibitors, Strobilurines, cyt-b-gene

Currently fungicides in groups 7, 9, and 11 are almost all in pre-mixtures

Labelling	Links to Recommendations for FRAC Mode of Action Groups	Synonyms, examples
GROUP 1	MBC fungicides	Topsin-M, Thiophanate methyl
GROUP 3	SBI Class I: DMI fungicides	G1, DeMethylation Inhibitors, Azoles, Triazoles, erg11, cyp51
GROUP 7	SDHI fungicides	C2, Succinate dehydrogenase inhibitors, Carboxamides, sdh-gene
GROUP 9	AP fungicides	D1, Anilino-Pyrimidine
GROUP 11	QoI-fungicides	C3, Quinone outside Inhibitors, Strobilurines, cyt-b-gene

Currently fungicides in groups 7, 9, and 11 are almost all in pre-mixtures

Some Current Demethylation inhibitor (DMI) fungicides: Disrupt the fungal cell membrane (MOA GROUP 3)

Orius 20 AQ(%) (tebuconazole) ADAMA, 1.67 lb ai/gal REI = 12 h, PHI = 0 day, 8.6 fl oz/a MOA GROUP 3

Indar 2F (fenbuconazole) CORTEVA, 2.0 lb ai/gal, REI = 12 h, PHI = 1 day, 6.0 fl oz/acre MOA GROUP 3

Tilt (propiconazole) SYNGENTA 3.6 lb ai/gal, REI = 24 h , PHI = 0 days 4.0 fl oz/acre MOA GROUP 3

PropiMax EC (propiconazole) CORTEVA (Dow) 3.6 lb ai/gal, REI = 12 h, **PHI = 10 days** 4.0 fl oz/acre MOA GROUP 3

Bumper 41.8EC (propiconazole) ADAMA 3.6 lb ai/gal, REI = 12 h, PHI = 0 day 4.0 fl oz/acre MOA GROUP 3

Quash SC (metconazole) VALENT 4.0 lb ai/gal, REI = 12 h, **PHI = 14 days**, 2.5 – 3.6 fl oz/acre MOA GROUP 3

Rally 40WSP (myclobutanil) CORTEVA REI = 24 h, PHI = 1 day, 2.5 – 6.0 oz/acre MOA GROUP 3

Cevya (mefentrifluconazole) BASF 3.34 lb ai/gal REI = 12 h, PHI = 0, 3-5 fl oz/acre MOA GROUP 3

Topguard (flutriafol) FMC 1.04 lb ai/gal REI = 12 h **PHI = 7 days**, 14 fl z/acre MOA GROUP 3

QoI fungicides block the cells ability to produce energy by blocking “quinone outside site” (MOA GROUP 11):

Abound (azoxystrobin) SYNGENTA 2.08 lb ai/gal REI = 4 h, PHI = 0 days 12-15 fl oz/acre MOA GROUP 11

Gem 500 SC (trifloxystrobin) BAYER 4.05 lb ai/gal REI = 12 h, PHI = Blossom Blight 1.9-3.8 fl oz/acre MOA GROUP 11

SDHI (succinate dehydrogenase inhibitor) fungicides (MOA GROUP 7):

Fontelis (penthioopyrad) CORTEVA 1.67 lb ai/gal REI = 12 h, PHI = 0 day 14-20 fl oz/acre MOA GROUP 7

Miravis (pydiflumetofen) SYNGENTA 1.67 lb ai/gal REI = 12 h, PHI = 0 day 5.1 fl oz/acre MOA GROUP 7

Fungicide Pre-Mixtures Having Different MOA:

Pristine (pyraclostrobin + boscalid) BASF 3.046 lb ai/gal REI = 12 h PHI = 0 day 10.5-14.5 fl oz/acre MOA GROUP **11 & 7**

Luna Sensation (trifloxystrobin + fluopyram) BAYER 4.20 lb ai/gal REI = 12 h PHI = 1 day 5.0-7.6 fl oz/acre MOA GROUP **11 & 7**

Merivon (pyraclostrobin + fluxaproxad) BASF 4.0 lb ai/gal REI 12 PHI 0 day 4-6.7 fl oz/acre MOA GROUP **11 & 7**

Quadris Top (azoxystrobin + difenoconazole) SYNGENTA 2.72 lb ai/ gal REI = 12 h PHI = 0 days 12-14 floz/acre MOA GROUP **3 & 11**

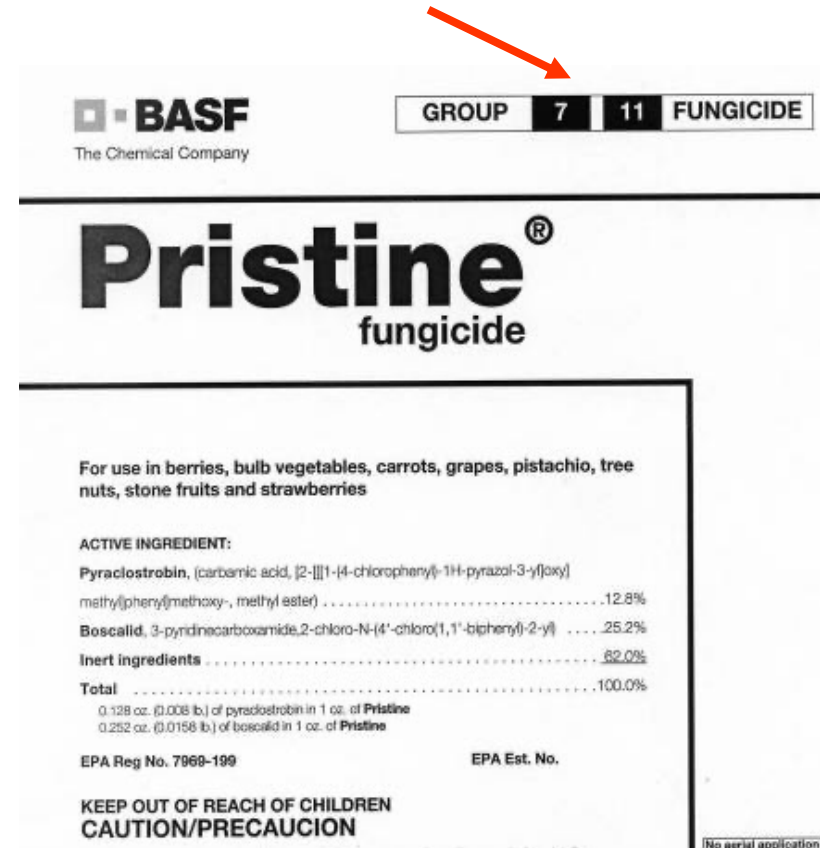
Topguard EQ (azoxystrobin + flutriafol) 4.33 lb ai/gal FMC REI = 12 h, PHI = 7 days MOA GROUPS **11 & 3**

Miravis Duo (difenoconazole + pydiflumetofen) SYNGENTA 1.67 lb ai/gal REI = 12 h PHI = 0 day 13.6 fl oz/acre MOA GROUP **3 & 7**

Inspire Super (difenoconazole + cyprodinil) SYNGENTA 2.82 lb ai/gal REI = 12 h PHI = 2 days 16-20 fl oz/acre MOA GROUP **3 & 9**

Two items of information on the fungicide label to help select the proper fungicide

1. Mode of Action (MOA) Group



Critical fruit growth stage (shuck split) for scab control



Fruit about 2-3 weeks before harvest – use a highly effective fungicide for brown rot

