

Northeastern Fungicide Resistance Management Guidelines for Vegetable Crops Grown in the mid-Atlantic region -2015



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Photo cover: Pepper anthracnose caused by *Colletotrichum acutatum* (L) and corn smut caused by *Ustilago maydis* (R).

Cover photos by Andy Wyenandt

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### **Mission of the Center**

The Northeastern Integrated Pest Management Center fosters the development and adoption of IPM, a science-based approach to managing pests in ways that generate economic, environmental, and human health benefits. The Center works in partnership with stakeholders from agricultural, urban, and rural settings to identify and address regional priorities for research, education, and outreach.

### Introduction

We are happy to distribute the 9<sup>th</sup> Edition of this guide. Since 2007, over 25,000 FRAC guides have been distributed in the mid-Atlantic and surrounding region representing over 100,000 A of vegetable production.

In the mid-Atlantic region (NJ, MD, VA, DE, PA) of the United States approximately 221, 000 A of fresh-market and processing vegetable crops are grown each year. Over the past decade, a number of new fungicide chemistries for use in vegetable production have been released in the United States. Many of these fungicides have specific modes-of-action (MOA) that target pathogen development at a single site. Fungicides with a single-site MOA are often considered at- or high-risk fungicides because the chances for fungal resistance to develop are much higher than fungicides with multiple MOA's. In recent years, fungicide resistance has developed in important diseases such as powdery mildew in cucurbits and phytophthora in pepper.

### About FRAC

In 2002, the NA-FRAC (North American Fungicide Resistance Action Committee) was established to i) coordinate and identify resources for contact between government, universities, and the public on fungicide resistance management issues, ii) assist in the creation of new working groups in North America for other areas of chemistry, as they are needed and iii) serve as a spokesman for the industry view on fungicide resistance management issues by providing an outlet for comments and position papers from members. Each year the FRAC group publishes a list of FRAC codes for most fungicides and fungicide chemistries. FRAC codes group fungicide chemistries according to class, mode-of-action and resistance-risk. To date, there are more than 60 FRAC groups within the FRAC code system. Accordingly, fungicides listed within a given FRAC code share a similar mode-ofaction, therefore, may have i) similar risks for resistance development, ii) similar use patterns on multiple crops and iii) exhibit the potential for cross-resistance development.

The purpose of this guide is to i) promote the importance and understanding of FRAC codes in fungicide resistance management ii) prevent the misuse of specific fungicides with a high-risk for resistance development and iii) provide the tools and knowledge to allow growers to develop vegetable disease control programs with an emphasis towards fungicide resistance management.

This guide should be used as a supplement to the 2015 Commercial Vegetable Productions Recommendations Guide for the mid-Atlantic region to help make decisions on vegetable disease control and fungicide resistance management. All fungicide application rates for chemicals listed in this guide are found in the 2015 Commercial Vegetable Productions Recommendations Guide for your state.

DISCLAIMER: The fungicide label is a legal-binding contract between the user and the manufacturer. The user must follow all rates and restrictions as per label directions.

#### Trade or Brand Names Disclaimer:

The trade or brand names given herein are supplied with the understanding that no discrimination is intended and no endorsement by the Rutgers Cooperative Extension is implied. Furthermore, in some instances the same compound may be sold under different names, which may vary as to label clearances.

# How to use this fungicide resistance management guide

This guide contains FRAC tables for the crop groups listed in the 2015 Commercial Vegetable Productions Recommendations Guide for the mid-Atlantic region. Each FRAC table lists all fungicides currently recommended for a particular crop (or crop group) in the 2015 recommendations guides for NJ, DE, MD, VA and PA along with FRAC and risk management codes, diseases for that particular crop or crop group and fungicide resistance management guidelines for each particular FRAC code. For example, in guidelines for pumpkin and winter squash crops grown in the mid-Atlantic region, 28 labeled fungicides that include 20 different FRAC codes are listed with risk management (L = low risk, M = medium risk, H = high risk for resistance development) for eight common pumpkin and winter squash diseases in the region. Also included in each table is the inherent-risk of each particular pathogen (i.e., disease) to develop resistance. Like fungicides, the risk for pathogens to develop resistance are listed as L = low, M = medium or H = high. For each fungicide or pathogen where there has been a reported case of resistance development, a superscript R is next to the risk assessment (e.g.,  $H^{R}$ ) Most importantly, when the pathogen and the respective FRAC group used to control the pathogen have known resistance development, the x in the box is red in color.

# Resistance risk assessments (H<sup>R</sup>) for pathogens and fungicides.

In order to make the guide more useful and easier to determine which fungicide/pathogen combinations were at most risk for resistance development we included the inherent resistance risks for both the fungicides and pathogens according to FRAC and other reported cases. Thus fungicides and/or pathogens with a superscript <sup>R</sup> have shown a demonstrated potential for resistance development. Importantly, we have taken the most conservative approach and included those which have demonstrated or reported to have resistance in the US and elsewhere, as well as, demonstrated resistance in the field and/or under artificial conditions.

In some cases where there is a superscript R and no red x, even though the pathogen or fungicide has shown resistance development, it has not demonstrated resistance development to that particular fungicide or pathogen and the x remains black.

Fungicide, chemical names, FRAC codes and risk management guidelines are color-coordinated to help distinguish differences based on FRAC code. The far right-hand column of each table includes fungicide resistance management guidelines for each particular FRAC code with specific instructions on risk assessment and/or application instructions.

In the back of the guide are tables which can be used by the grower during the production season to keep track of application dates and fungicide schedules.

## Finding FRAC codes on fungicide labels.

FRAC codes can normally be found on the front of the fungicides' label right under the Tradename. FRAC codes are often distinguished by the inverse black and white box with their FRAC code found in the center (Figure 1). If a fungicide contains more than one active ingredient both FRAC codes will be listed in the FRAC code box (Figure 2). For example, Quadris<sup>TM</sup>, belongs to FRAC code 11, the class of fungicides known as the strobilurins. All fungicides with strobilurin chemistry will belong to FRAC code 11. Other FRAC group 11 fungicides include Flint<sup>TM</sup> (trifloxystrobin) and Cabrio<sup>TM</sup> (pyraclostrobin).



Figure 1. Front of Quadris<sup>™</sup> label with FRAC code listed below tradename.

# GROUP 7 11 FUNGICIDE

Figure 2. FRAC codes for Pristine<sup>™</sup> containing the two active ingredients: boscalid (FRAC code 7) + pyraclostrobin (FRAC code 11)

If FRAC codes are not found on the front of the label, they can be found within the resistance management section of the label (Figure 3).

# RESISTANCE MANAGEMENT

Repeated use of products for control of specific plant pathogens may lead to selection of resistant strains of fungi and result in a reduction of disease control. Famoxadone, one of the active ingredients in TANOS<sup>TM</sup>, is one of EPA's Target Site of Action Group 11 fungicides, which also includes all strobilurins and fenamidone. A disease management program that includes rotation between TANOS<sup>TM</sup> and other non-Group 11 fungicides is essential to reduce the risk of fungicide resistance development. Tank-mixing TANOS<sup>TM</sup> with a protectant (contact) fungicide that has a different mode of action is required. This ensures optimum performance ard further reduces the potential for resistance development. For guidance on the particular crop and disease control situation, consult your state extension specialist or official state reconmendations.

Figure 3. Resistance management guidelines for Tanos<sup>™</sup>

Eungicido	Active	RAC CODE	Risk Management	Phytophthora (Crown/Spear rot)	Purple spot	<ul> <li>Asparagus Rust</li> </ul>	Fungicide Resistance				
Fungicide	ingredient(s)	Ë		M	H"	L	Management Guidelines				
mancozeb	mancozeb	М3	L			x	Multi-site MOA, low risk protectants. Use alone or				
chlorothalonil	chlorothalonil	M5	L		x	x	other FRAC codes				
Folicur	tebuconazole	3	Μ			x	High risk of reduced sensitivity, alw ays tank mix				
Rally	myclobutanil	3	М			x	and rotate with other FRAC codes				
MetaStar	metalaxyl	4	H <sup>R</sup>	x							
Ridom il Gold	mefenoxam	4	H <sup>R</sup>	x			High risk, resistance know n in other crops				
Ultra Flourish	mefenoxam	4	H <sup>R</sup>	x							
azoxystrobin	azoxystrobinazoxystrobin11HRHerHigh risk, tank mix and rotate with other FRAC codes, no consecutive applications										
Fur	ngicide resistance management	guideline	es for as	paragus	grown i	n mid-At	lantic region - 2015				
FRAC code: Risk management: L = lo	FRAC code: M = multi-site MOA, numbered codes = chemistries with similar mode-of-action, specific site (MOA) Risk management: L = low risk, M = moderate risk or H = high risk for fungicide resistance to develop, $M^R$ , $H^R$ = Known resistance reported										

High-risk fungicides with similar MOA (i.e. same FRAC code number) should not be sprayed consecutively



Funciaida	Active	RAC CODE	Risk Management	- Anthracnose	Web blight ( <i>Rhizoctonia</i> )	<ul> <li>Cottony leak (Pythium blight)</li> </ul>	<ul> <li>Bacterial blight</li> </ul>	<ul> <li>Bacterial brown spot</li> </ul>	- Common bean rust	- Root rots	Z Lima bean downy mildew	<ul> <li>Lima bean pod blight</li> </ul>	Gray mold	White mold (Sclerotinia)	<ul> <li>Southern blight</li> </ul>	Fungicide Resistance Management
Fungicide	Ingreatent(S)	LL.		<b>L</b>	п	-	-	-	-	-	IVI	-	п	IVI	•	Guidelines
fixed copper	copper	IVI1					X	X			X					Multi-site protectant MOA, use alone or in tank mix with
	copper octanoate	IVIT					X	X								nigh risk fungicides and in rotations with other FRAC
chlorothalonii	chlorothalonii	CIVI							XD							codes
thiophanate-methyl	thiophanate-methyl	1	H										Xa	Xa		High risk, always tank mix with other FRAC codes, apply
iprodione	iprodione	2	M-H										Xp	Xp		no more than 4 lbs per crop season
Folicur	tebuconazole	3	M						X							High risk, always tank mix and rotate with other FRAC
Rally	myclobutanil	3	Μ						Xp							codes.
Ridomil Gold	mefenoxam	4	Н							x						High risk for resistance
Ridomil Gold Copper	mefenoxam + copper	<mark>4 +</mark> M1	Μ			x					х	x				Rotate with other FRAC codes
Uniform	mefenoxam + azoxystrobin	<mark>4</mark> + 11	Н							x						For use at planting; will help control Pythium and Rhizoctonia
Endura	boscalid	7	м									x	Xa	Xa		No more than 2 applications per season, rotate with other FRAC codes
Fontelis	penthiopyrad	7	М						x				x	x		No more than 2 sequential applications, rotate with other FRAC codes
Priaxor	fluxapyroxad + pyraclostrobin	7 + 11	н	x	x											No more than 2 applications per season, rotate with other FRAC codes
Switch	cyprodinil + fludioxonil	9 + 12	М										х	х		Tank mix and rotate with other FRAC codes
azoxystrobin	azoxystrobin	11	Н	X	X				X	X					X	High risk, no consecutive applications, no more than 4
Headline	pyraclostrobin	11	н	х	x				X		x					applications a season
Quilt Xcel	azoxystrobin + propiconazole	e 11 + 3	М-Н	x	x				x							Tank mix with FRAC code M fungicide and rotate with other FRAC codes. Check labels for days between applications and days to harvest restrictions. Please check labels and rates. Amounts of active ingredients vary between the different combinations.
Ranman	cyazofamid	21	Μ			X					X	X				Rotate with other FRAC codes
Omega	fluazinam	29	L								x		х	X		Low risk, rotate with other FRAC codes
Prophyt, K-Phite, Rampart, Phostrol	phosphorous acids	33	L			x					x					Low risk for resistance, see labels
Forum	dimethomorph	40	L-M								X	X				Tank mix and rotate with other FRAC codes
Contans	Coniothyrium minitans	bio	L											x		Low risk biological control, consult label

Fungicide resistance management guidelines for beans grown in the mid-Atlantic region - 2015

FRAC code: M = multi-site MOA, numbered codes = chemistries with similar mode-of-action, specific site (MOA) Risk management: L = low risk, M = moderate risk or H = high risk for fungicide resistance to develop,  $H^R$  = Known resistance reported High-risk fungicides with similar MOA (i.e. same FRAC code number) should not be sprayed consecutively



Fungicide	Active Ingredient(s)	FRAC CODE	Risk Management	□ Damping-off ( <i>Pythium</i> )	Cercospora leaf spot and other foliar diseases	<ul> <li>Pocket rot</li> <li>(Rhizoctonia)</li> </ul>	Fungicide Resistance Management Guidelines
fixed copper	copper	M1	L		x		Multi-site MOA, low risk protectant, see label
tebuconazole	tebuconazole	3	М		x		High risk, always tank mix and rotate with
Tilt	propiconazole	3	Н		x		other FRAC codes.
MetaStar	metalaxyl	4	Н	x			
Ridomil Gold	mefenoxam	4	Н	x			High risk, for control of damping-off caused
Ultra Flourish	mefenoxam	4	Н	x			
Uniform	mefenoxam + azoxystrobin	4 + 11	Н	x		x	For use at planting; will help control Pythium and Rhizoctonia
Fontelis	penthiopyrad	7	М		x		Moderate risk, tank mix.
Reason	fenamidone	11	H <sup>R</sup>		x		High-risk for resistance, tank-mix with a
Gem	trifloxystrobin	11	H <sup>R</sup>		x		code 11 fungicides consecutively. Reduced sensitivity has been reported in Early blight control
azoxystrobin	azoxystrobin	11	н		x	x	High risk, Rotate with other FRAC codes, No
Cabrio	pyraclostrobin	11	н		x		applications per season

Fungicide resistance management guidelines for beets grown in the mid-Atlantic region - 2015

FRAC code: M = multi-site MOA, numbered codes = chemistries with similar mode-of-action, specific site (MOA)

Risk management: L = low risk, M = moderate risk or H = high risk for fungicide resistance to develop

High-risk fungicides with similar MOA (i.e. same FRAC code number) should not be sprayed consecutively



Fungicide	Active	FRAC CODE	Risk Management	📕 Damping-off	r Bacterial Blight	L Alternaria leaf blight	Cercospora leaf blight	Powdery mildew	SWhite mold (Sclerotinia)	T Storage rots	Fungicide Resistance Management Guidelines
i ungiolae	ingreaterit(3)	ш		•••	_	••					Multi-site MOA, use alone, or in tank mix with high risk FRAC
copper, fixed	copper	M1	L		x						codes and in rotations with other FRAC codes
chlorothalonil	chlorothalonil	М5	L			x	x	x			Multi-site MOA, use alone, or in tank mix with high risk FRAC codes and in rotations with other FRAC codes
Mertect	thiobendazole	1	Н							x	High risk, for control of gray mold and sclerotinia in storage
iprodione	iprodione	2	M-H			х					Tank mix and rotate with other FRAC codes
Ridom il Gold	mefenoxam	4	HR	X							Hick rick for resistance development
Ultra Flourish	mefenoxam	4	HR	X							
Fontelis	penthiopyrad	7	М			x	x	x	x	x	Moderate risk, tank mix
Endura	boscalid	7	М			х					Moderate risk, tank mix and rotate
Switch	cyprodinil + fludioxonil	9 + 12	М			x					Moderate risk, tank mix and rotate
azoxystrobin	azoxystrobin	11	н			x	x				High risk, Tank mix with FRAC code M protectants and rotate
Cabrio	pyraclostrobin	11	Н			x	x	x			with other FRAC codes. Do not apply FRAC code 11
Pristine	pyraclostrobin + boscalid	11 + 7	Н			x	x	x		fungicides in consecutive applications	
Contans	Coniothyrium minitans	bio	L						x		Low risk biological control, consult label
							,				

Fungicide resistance management guidelines for carrots grown in mid-Atlantic region - 2015

FRAC code: M = multi-site MOA, numbered codes = chemistries with similar mode-of-action, specific site (MOA) Risk management: L = low risk, M = moderate risk or H = high risk for fungicide resistance to develop, H<sup>R</sup> = Known resistance reported High risk fungicides with similar MOA (i.e. same FRAC code number) should not be sprayed consecutively



	Active	AC CODE	Risk Management	Damping-off ( <i>Pythium</i> )	Black rot	Blackleg	Clubroot	Downy mildew	White mold (Sclerotinia)	Alternaria leaf blight	Fungicide Resistance
Fungicide	Ingredient(s)	FR		L	L	L	L	М	М	L	Management Guidelines
Actigard	acibenzolar-S-methyl	P1	L					x			Low-risk, No more than 4 applications
fixed copper	copper	M1	L		v						Multi-site MOA, use in tank mix with high
					×						risk FRAC codes and in rotations with
chlorothalonil	chlorothalonil	M5	L					x		x	rates and crops.
iprodione	iprodione	2	м-н			Xa					Moderate to high-risk, No more than 2 application per crop
MetaStar	metalaxyl	4	Н	x							High risk, rotate with other FRAC codes
Ridomil Gold	mefenoxam	4	Н	x							High risk, rotate with other FRAC codes
Ridomil Gold Bravo	mefenoxam + chlorothalonil	4 + M5	н							x	High risk, rotate with other FRAC codes
Uniform	mefenoxam + azoxystrobin	4 + 11	н	x							For use at planting; will help control Pythium and Rhizoctonia
Endura	boscalid	7	М						x	x	Moderate risk, tank mix and rotate
Fontelis	penthiopyrad	7	м						x	x	No more than 2 sequential applications, rotate with other FRAC codes
Switch	cyprodinil + fludioxonil	9 + 12	М							x	Moderate risk, tank mix and rotate
azoxystrobin	azoxystrobin	11	н	x				x		x	High risk, tank mix with FRAC code M
Cabrio	pyraclostrobin	11	н					v		v	fungicides. Rotate with other FRAC
Terraclor	pentachloronitrobenzene	14	L-M				x			~	Low to moderate
Ranman	cyazofamid	21	М				X				Moderate risk, tank mix
Aliette	aluminum tris	33	L					x			Low risk, do not tank mix with copper
Revus	mandipropamid	40	М					x			Tank mix with protectant fungicide,
Presidio	fluonicolide	43	н			+		×			Rotate with other FRAC codes
Zampro	ametoctradin + dimethomorph	45 + 40	M			+		x			Moderate risk, tank mix
Contans	Coniothyrium minitans	bio	L						x		Low risk biological control, consult label

Fungicide resistance management guidelines for selected cole crops grown in mid-Atlantic region - 2015

FRAC code: M = multi-site MOA, numbered codes = chemistries with similar mode-of-action, specific site (MOA) Risk management: L = low risk, M = moderate risk or H = high risk for fungicide resistance to develop High-risk fungicides with similar MOA (i.e. same FRAC code number) should not be sprayed consecutively

<sup>a</sup> For use on broccoli only

<sup>b</sup> Also for Alternaria leaf blight



	Active	AC CODE	Risk Management	Damping-off	Angular leaf spot	Belly rot	Cottony leak	Scab	Phytophthora fruit rot	Anthracnose	Gummy stem blight	Powdery mildew	Downy mildew	Fungicide Resistance Management
Fungicide	Ingredient(s)	FR/		L	L	L	L	HR	HR	L	HR	HR	HR	Guidelines
fixed copper	copper	M1	L		x				x					Multi-site MOA, use in tank mix
mancozeb	mancozeb	M3	L		x			x		x	x		x	with high risk fungicides and in
Gavel	zoxamide + mancozeb	M3 + 22	L-M						x				x	rotations with other FRAC
chlorothalonil	chlorothalonil	M5	L					x		x	x	x	x	codes
thiophanate-methyl	thiophanate-methyl	1	н							x				High risk, tank mix, rotate
tebuconazole	tebuconazole	3	MR								x	X		
Rally	myclobutanil	3	MR									X		High risk, always tank mix, and
Procure	triflumizole	3	MR									x		Totate with other FRAC codes
Inspire Super	difenconazole + cyprodinil	3 + 9	н								x	x		High risk, rotate with other FRAC codes
MetaStar	metalaxyl	4	HR	x										Hisk risk, resistance known.
Ridomil Gold	mefenoxam	4	HR	x			x							Only apply if Phytophthora
Ultra Flourish	mefenoxam	4	HR	x			x							sensitive
Uniform	mefenoxam + azoxystrobin	4 + 11	н	x										For use at planting; will help control Pythium and Rhizoctonia
Fontelis	penthiopyrad	7	М								x	x		Moderate risk, tank mix
Switch	cyprodinil + fludioxonil	9 + 12	м								x			Moderate risk, tank mix and rotate
azoxystrobin	azoxystrobin	11	Hĸ			x				x	X			High Risk, PM and DM
Cabrio	pyraclostrobin	11	HR							x	x			resistance known in mid-
Quadris Top	azoxystrobin + difenconazole	11 + 3	н							х				code M fungicides and rotate
Pristine	pyraclostrobin + boscalid	11 + 7	HR							x	x	¥		with as many different FRAC
Tanos	fomoxadone + cymoxanil	11 + 27	м						x	x	~	~	x	codes as possible. No consecutive applications.
Ranman	cyazofamid	21	M						x				x	Moderate risk, tank mix
Curzate	cymoxanil	27	L-M										x	Moderate risk, tank mix
Previcur Flex	propomocarb HCL	28	L-M	x									x	Low risk, tank mix
Forum	dimethomorph	40	Μ						x				x	Tank mix with a FRAC code M
Revus	mandipropamid	40	Μ						X					fungicide and rotate with as
Presidio	fluopicolide	43	н						x				x	possible
Zampro	ametoctradin + dimethomorph	45 + 40	Μ						x				x	Moderate risk, tank mix
Torino	cyflufenamid	U6	M									x		Moderate risk, tank mix

Fungicide resistance management guidelines for cucumber grown in the mid-Atlantic region - 2015

FRAC code: M = multi-site MOA, numbered codes = chemistries with similar mode-of-action, specific site (MOA)

Risk management: L = low risk, M = moderate risk or H = high risk for fungicide resistance to develop, H<sup>R</sup> = Known resistance reported High-risk fungicides with similar MOA (i.e. same FRAC code number) should not be sprayed consecutively



	Active	AC CODE	Risk Management	Phytophthora blight - crown rot phase	Phytophthora blight - fruit rot and foliar phase	Leaf spots and fruit rots	Fungicide Resistance
Fungicide	Ingredient(s)	FR/		H <sup>R</sup>	H <sup>R</sup>	H <sup>R</sup>	Management Guidelines
fixed copper	copper	M1	L		x	x	Multi-site MOA, use alone or in tank mix with
chlorothalonil	chlorothalonil	M5	L			x	FRAC codes and in rotation with other
Ridomil Gold	mefenoxam	4	H <sup>R</sup>	x			High risk, mefenoxam-resistance known in mid-
Ultra Flourish	mefenoxam	4	H <sup>R</sup>	x			Atlantic region. Tank mix with other FRAC codes
Fontelis	penthiopyrad	7	м			x	Tank mix and rotate with other FRAC codes
Priaxor	boscalid + pyraclostrobin	7 + 11	н			x	Tank mix and rotate with other FRAC codes
azoxystrobin	azoxystrobin	11	н			x	High-risk, rotate and tank mix with other FRAC
Cabrio	pyraclostrobin	11	н			x	consecutive applications.
Quadris Top	azoxystrobin + difenconazole	11 + 3	н			x	High risk, rotate with other FRAC codes
Ranman	cyazofamid	21	м		x		Rotate with other FRAC codes
Forum	dimethomorph	40	м		x		Tank mix and rotate with other FRAC codes
Presidio	fluopicolide	43	н	x	x		Tank mix and rotate with other FRAC codes

Fungicide resistance management guidelines for eggplant grown in mid-Atlantic region - 2015

FRAC code: M = multi-site MOA, numbered codes = chemistries with similar mode-of-action, specific site (MOA)

Risk management: L = low risk, M = moderate risk or H = high risk for fungicide resistance to develop, H<sup>R</sup> = Known resistance reported

High-risk fungicides with similar MOA (i.e. same FRAC code number) should not be sprayed consecutively



	Active	AC CODE	Risk Management	Damping-off	White rot	Botrytis leaf blight (Blast)	Purple blotch	Downy mildew	- Fungicide Resistance Management
Fungicide	Ingredient(s)	FR		L	L	HR	L	м	Guidelines
chlorothalonil	chlorothalonil	M5	L			x	x	x	Low risk, multi-site MOA, use alone, or in tank mix with high risk FRAC codes and in rotations with other FRAC codes
iprodione	iprodione	2	М-Н		x				Moderate to high-risk, No more than 2 application per crop
tebuconazole	tebuconazole	3	м		x		x		Medium risk, tank mix, rotate with other FRAC codes
Inspire Super	difenconazole + cyprodinil	3 + 9	н			x	x		High-risk, rotate with other FRAC codes
Ridomil Gold	mefenoxam	4	н	Xa					
Ultra Flourish	mefenoxam	4	Н	Xa					High risk for resistance
MetaStar	metalaxyl	4	Н	Xa					
Uniform	mefenoxam + azoxystrobin	<mark>4</mark> + 11	н	x <sup>ab</sup>					For use at planting; will help control Pythium and Rhizoctonia
Endura	boscalid	7	М			x	x		Moderate risk, tank mix and rotate with other FRAC codes
Reason	fenamidone	11	н					x	High-risk, rotate with other FRAC codes
Quilt	azoxystrobin + propiconazole	11 + 3	М-Н				x		Tank mix with FRAC code M fungicide and rotate with other FRAC codes. Check labels for days between
Quilt Xcel	azoxystrobin + propiconazole	11 + 3	М-Н			x	x	x	labels and rates. Amounts of active ingredients vary between the different combinations.
azoxystrobin	azoxystrobin	11	н	xb			x	x	High-risk, rotate and tank mix with other FRAC codes. Do
Cabrio	pyraclostrobin	11	н				X	x	not apply any FRAC code 11 fungicide in consecutive
Pristine	pyraclostrobin + boscalid	11 + 7	н			X			applications.
Cannonball	fludioxonil	12	М		x				For use at planting
Forum	dimethomorph	40	Μ					x	Tank mix and rotate with other FRAC codes
Zampro	ametoctradin + dimethomorph	45 + <mark>40</mark>	М					X	Rotate with other FRAC codes

Fungicide resistance management guidelines for garlic grown in mid-Atlantic region - 2015

FRAC code: M = multi-site MOA, numbered codes = chemistries with similar mode-of-action, specific site (MOA)

Risk management: L = low risk, M = moderate risk or H = high risk for fungicide resistance to develop, H<sup>R</sup> = Known resistance reported High-risk fungicides with similar MOA (i.e. same FRAC code number) should not be sprayed consecutively

<sup>a</sup> for *Pythium* <sup>b</sup> for *Rhizoctonia* 

Garlic

	Active	AC CODE	Risk Management	Damping-off	Downy mildew	Leaf spots	Fungicide Resistance			
Fungicide	Ingredient(s)	FR		L	М	М	Management Guidelines			
fixed copper	copper	M1	L		x	x	Multi-site MOA, use alone, or tank mix with high risk FRAC codes			
Folicur	tebuconazole	3	М			x	Tank mix and rotate with other FRAC codes			
Ridom il Gold	mefenoxam	4	Н	xa			High risk			
Uniform	mefenoxam + azoxystrobin	<mark>4</mark> + 11	Н	x			For use at planting; w ill help control Pythium and Rhizoctonia			
Fontelis	penthiopyrad	7	Μ			x	No more than 2 sequential applications, rotate with other FRAC codes			
Sw itch	cyprodinil + fludioxonil	9 + 12	М			x	Rotate with other FRAC codes			
azoxystrobin	azoxystrobin	11	н	х	х	x	High risk, tank mix and/or rotate w ith a FRAC code M			
Cabrio	pyracolstrobin	11	н		x	х	fungicide.			
Aliette	aluminum tris	33	L		xb		Low risk, do not tank mix with copper			
Forum	For um         dimethomorph         40         M         x         Tank mix and rotate with other FRAC codes									
Fungicide resistance management guidelines for greens grown in mid-Atlantic region - 2015										
FRAC code: M = multi-site MOA, numbered codes = chemistries with similar mode-of-action, specific site (MOA) Risk management: L = low risk, M = moderate risk or H = high risk for fungicide resistance to develop High-risk fungicides with similar MOA (i.e. same FRAC code number) should not be sprayed consecutively										

<sup>a</sup> for Turnip Greens Only <sup>b</sup> for Mustard Greens Only



Fungicide	Active Ingredient(s)	FRAC CODE	Risk Management	Damping-off caused by Pythium, Rhizoctonia, Phytophthora	<b>⊥</b> Bacterial spot	Fungal leaf molds and spots (Early blight)	Late blight	Grey mold (Botrytis)	Powdery mildew	<b>H</b> Downy mildew	<ul> <li>White mold</li> <li>(Sclerotinia)</li> </ul>	Fungicide Resistance Management Guidelines
Champ, Champion*, Cuprofix Disperss, Kocide, Camelot	copper hydroxide, copper sulfate, copper salts	M1	H <sup>R</sup>		x	x		x	x	x		Protectant, low risk, see labels for details
sulfur*	sulfur	M2	L						x			Protectant, use low rate
Mancozeb, Dithane	EBDC	M3	L	x		x						Protectant, low risk
Fontelis	penthiopyrad	7	М			x			x		x	Madium riak
Pageant	pyraclastrobin + boscalid	7 + 11	M - H					x				Medium fisk
Scala	pyrimethanil	9	М -Н			x		x				Rotate with other FRAC codes
Terraclor	PCNB	14	L-M	x								For certain container grown vegetables
Botran	dicloran	14	L-M			x		x			x	For Botrytis stem canker; low to medium risk
Decree	fenhexamid	17	L					x				Low risk
Ranman	cyazofamid	21	М	x						x		Low to medium risk
Agri-mycin 17	streptomycin sulfate	25	Н		x							Low risk
Previcur Flex	propamocarb HCL	28	L-M	x								Low to medium risk
Micora	mandipropamid	40	L-M	x			x			x		Low to medium risk
Contans*	Coniothyrium minitans	Bio	L								x	
Companion	Bacillus subtillus	Bio	L	x	x	x						
Sonata*	Bacillus pumilus	Bio	L			x	х		x	x		Biological control agents,
Plantshield HC*, SoilGard*, RootShield*	Trichoderma sp.	Bio	L	x				x	x			application specificities
Actinovate	Streptomyces lydicus	Bio	L	x		x		x	x	x		
Mycostop*, Mycostop Mix*	Streptomyces griseoviridis	Bio	L	x		x		x				
Surround	kaolin clay	NC	NC						x			Forms a white clay film
Zerotol*, Oxidate*	hydrogen dioxide	NC	NC	x					x	x		
M-Pede	potassium salts	NC	NC						x			Contact disinfestant, no residual activity
Armicarb, Kaligreen, Milstop*	potassium bicarbonate	NC	NC						x			,
Ultra fine oils*	horticultural oils	NC	NC						x			Use low rates, see labels

Fungicide resistance management guidelines for selected vegetable crops grown in high tunnels and greenhouses in mid-Atlantic region - 2015

FRAC code: M = multi-site MOA, numbered codes = chemistries with similar mode-of-action (MOA); \* = OMRI approved; NC = not classified Risk management: L = low risk, M = moderate risk or H = high risk for fungicide resistance to develop Fungicides with similar MOA (i.e. same FRAC code number) should not be sprayed consecutively.

High Tunnel and Greenhouse

	Active	c code	Risk Management	Damping off	Purple blotch	Downy mildew	White rot	Funcicido Decistones
Fungicide	Ingredient(s)	FRA		L	L	м	м	Management Guidelines
chlorothalonil	chlorothalonil	M5	L		x	x		Multi-site MOA, low risk protectant fungicide, use alone, or tank mix with high-risk FRAC codes
Folicur	tebuconazole	3	м		x	x	x	Tank mix and rotate with other FRAC codes
Inspire Super	difenconazole + cyprodinil	3 + 9	н		x			High-risk, rotate with other FRAC codes
MetaStar	metalaxyl	4	H <sup>R</sup>	x				High-risk, rotate with other FRAC codes
Ridomil Gold	mefenoxam	4	H <sup>R</sup>	x				High-risk, rotate with other FRAC codes
Uniform	mefenoxam + azoxystrobin	4 + 11	н	x				For use at planting; will help control Pythium and Rhizoctonia
Endura	boscalid	7	М		x			Moderate risk, tank mix and rotate
Fontelis	penthiopyrad	7	М		x	x		Moderate risk, tank mix and rotate
Merivon	fluxapyroxad + pyraclostrobin	7 + 11	н		x	x		Moderate risk, tank mix and rotate
azoxystrobin	azoxystrobin	11	н	x	x	x		
Cabrio	pyraclostrobin	11	н		x	x		High risk, tank mix or rotate with a FRAC code M protectant fungicide
Pristine	pyraclostrobin + boscalid	11 + 7	н		x	x		
Forum	dimethomorph	40	м			x		Tank mix and rotate with other FRAC codes

Fungicide resistance management guidelines for leeks grown in mid-Atlantic region - 2015

FRAC code: M = multi-site MOA, numbered codes = chemistries with similar mode-of-action, specific site (MOA)

Risk management: L = low risk, M = moderate risk or H = high risk for fungicide resistance to develop

High-risk fungicides with similar MOA (i.e. same FRAC code number) should not be sprayed consecutively



Funcicido	Active	RAC CODE	Risk Management	□ Damping-off	Downy mildew	☐ Leaf spots	<ul> <li>Bottom rot (Rhizoctonia)</li> </ul>	E Lettuce drop (Sclerotinia)	<b>Gray mold (</b> <i>Botrytis</i> )	- Fungicide Resistance
iprodione	ingreatent(S)	2	M-H <sup>R</sup>				×	Y		Moderate to high risk
MetaStar	metalaxy	4	HR	v	v		~	^		High risk for resistance development.
Ridomil Gold	metenovam	4	HR.	×	×					Application for damping-off control will also
Ultra Flourish	metenoxam	4	HR	x	x					help suppress early-season downy mildew
Uniform	mefenoxam + azoxystrobin	4 + 11	н	x	~		x			For use at planting; will help control Pythium and Rhizoctonia
Fontelis	penthiopyrad	7	м			x				Moderate risk, tank mix
Endura	boscalid	7	м				x	x	x	Moderate risk, tank mix and rotate
Merivon	fluxapyroxad + pyraclostrobin	7 + 11	н			x			x	High risk, tank mix and rotate
azoxystrobin	azoxystrobin	11	н			x		x		High risk, tank mix with FRAC code M
Reason	fenamidone	11	н		x					No consecutive applications
Cannonball	fludioxonil	12	н					x	x	Tank mix and rotate
Botran	dichloran	14	L-M <sup>R</sup>						x	Low to medium risk
Previcur Flex	propomocarb HCL	28	L-M		x					Tank mix with FRAC code M fungicide, rotate with other FRAC codes
Forum	dimethomorph	40	L-M		X					Tank mix and rotate, do not apply consecutive
Revus	mandipropamid	40	H		X					applications
Zampro	ametoctradin + dimethomorph	45 + <mark>40</mark>	M		X					Moderate risk, tank mix
Contans	Coniothyrium minitans	bio	L					x		Low risk biological control, consult label

Fungicide resistance management guidelines for lettuce grown in mid-Atlantic region - 2015

FRAC code: M = multi-site MOA, numbered codes = chemistries with similar mode-of-action, specific site (MOA)

Risk management: L = low risk, M = moderate risk or H = high risk for fungicide resistance to develop, H<sup>R</sup> = Known resistance reported

High-risk fungicides with similar MOA (i.e. same FRAC code number) should not be sprayed consecutively



	Active	AC CODE	Risk Management	Damping-off ( <i>Pythium</i> )	Alternaria leaf blight	Scab	Phytophthora blight	Gummy stem blight	Powdery mildew	Downy mildew	Fungicide Resistance Management	
Funaicide	Ingredient(s)	R/		L	L	HR	HR	HR	HR	HR	Guidelines	
fixed copper	copper	M1	L				x				Multi-site MOA, use alone or in tank mix with high	
mancozeb	mancozeb	M3	L		x					x	risk fungcides and in rotations with other FRAC	
chlorothalonil	chlorothalonil	M5	L		X	x		x	x	x	codes	
Proline	prothioconazole	3	M					x			1. Park whether Construction and the second Official structure of the large base of the second structure of the second stru	
Rally	myclobutanil	3	MR						X		High risk of reduced sensitivity, always tank mix with	
tebuconazole	tebuconazole	3	М					x			FRAC code in fungicides, and rotate with other	
Procure	triflumizole	3	MR						X		FRAC codes	
Inspire Super	difenconazole + cyprodinil	3+9	н		x			x			High risk, rotate with other FRAC codes	
MetaStar	metalaxyl	4	Н	x							High risk, mefenoxam-insensitivity in Phytophthora	
Ridomil Gold	mefenoxam	4	Н	x							known in region. Only apply if strains are	
Ultra Flourish	mefenoxam	4	Н	x							mefenoxam-sensitive	
Uniform	mefenoxam + azoxystrobin	<mark>4</mark> + 11	Н	x							For use at planting; will help control Pythium and Rhizoctonia	
Fontelis	penthiopyrad	7	М						X		Moderate risk, tank mix	
Switch	cyprodinil + fludioxonil	9 + 12	M					X			Moderate risk, tank mix and rotate	
azoxystrobin	azoxystrobin	11	HR		x							
Cabrio	pyraclostrobin	11	HR		X						High Rick, DM and DM registeries known in mid	
Reason	fenamidone	11	Н		X						Atlantia ragion Tank mix with EBAC and M	
Pristine	pyraclostrobin + boscalid	11 + 7	HR		X			x	X		function and rotate with other ERAC code M	
Tanos	fomoxadone + cymoxanil	11 + 27	М				X			X		
Quadris Top	azoxystrobin + difenconazole	11 + 3	н		X							
Quintec	quinoxyfen	13	Н						x		High risk for resistance, tank mix with FRAC code M and rotate	
Ranman	cyazofamid	21	М				x			x	Tank mix with FRAC code M fungicides and rotate with other FRAC codes	
Gavel	zoxamide + mancozeb	22 + M3	L-M				X			X	Low to moderate risk, rotate with other FRAC codes	
Curzate	cymoxanil	27	L-M							X		
Previcur Flex	propomocarb HCL	28	L-M	x						X	Tank mix with FRAC code M fundicides: rotate with	
Forum	dimethomorph	40	L-M				x			x	other ERAC codes	
Revus	mandipropamid	40	L-M				X					
Presidio	fluopicolide	43	н				X			X	X	
Zampro	ametoctradin + dimethomorph	45 + <mark>40</mark>	Μ				X			x	Moderate risk, tank mix	
Torino	cyflufenamid	U6	M						X		Moderate risk, tank mix	

Fungicide resistance management guidelines for muskmelon grown in mid-Atlantic region - 2015

FRAC code: M = multi-site MOA, numbered codes = chemistries with similar mode-of-action, specific site (MOA)

Risk management: L = low risk, M = moderate risk or H = high risk for fungicide resistance to develop,  $H^R$  = Known resistance reported High-risk fungicides with similar MOA (i.e. same FRAC code number) should not be sprayed consecutively



	Active	AC CODE	Risk Management	Bacterial disease	Damping-off ( <i>Pythium</i> )	Neck rot	Downy mildew	Purple blotch (Alternaria)	Botrytis leaf blight	Stemphylium leaf blight	White rot	_ Fungicide Resistance
Fungicide	Ingredient(s)	L H		L	L	н	HR	L	HR	HR	L	Management Guidelines
fixed copper	copper	M1	L	x								Low risk, multi-site MOA, use alone, or tank
mancozeb	mancozeb	M3	L	x			x					mix with high-risk FRAC codes and rotate with
chlorothalonil	chlorothalonil	M5	L					x	X			other FRAC codes
iprodione	iprodione	2	H <sup>R</sup>			x		x	X	X		High risk
tebuconazole	tebuconazole	3	н								x	Rotate with other FRAC codes
Inspire Super	difenconazole + cyprodinil	<mark>3</mark> + 9	н					x	x	x		High risk, rotate with other FRAC codes
Ridomil Gold	mefenoxam	4	Н		x							High risk
Ultra Flourish	mefenoxam	4	Н		x							High risk
Uniform	mefenoxam + azoxystrobin	4 + 11	н		x							For use at planting; will help control Pythium and Rhizoctonia
Endura	boscalid	7	М					x	x	x		Moderate risk, tank mix and rotate
Fontelis	penthiopyrad	7	М			x		x	x	x		Rotate with other FRAC codes
Merivon	fluxapyroxad + pyraclostrobin	7 + 11	Н			x			x			Tank mix and rotate
Scala	pyrimethanil	9	М			x		x	x	x		Tank mix and rotate
Switch	cyprodinil + fludioxonil	9 + 12	м						x	x		Moderate risk, tank mix with FRAC code M fungicide and rotate with other FRAC codes
azoxystrobin	azoxystrobin	11	н				x	x	x	x		
Cabrio	pyraclostrobin	11	н				x			x		High risk. Tank mix with FRAC code M
Reason	fenamidone	11	н				x	x		x		
Quilt	azoxystrobin + propiconazole	11 + 3	М-Н					x		x		Tank mix with FRAC code M fungicide and rotate with other FRAC codes. Check labels for days between applications and days to
Quilt Xcel	azoxystrobin + propiconazole	11 + 3	М-Н				x	x	x	x		harvest restrictions. Please check labels and rates. Amounts of active ingredients vary between the different combinations.
Quadris Opti	azoxystrobin + chorothalonil	11 + M5	М				x	x	x	x		Rotate with other non-FRAC code 11
Pristine	pyraclostrobin + boscalid	11 + 7	н					x	x	x		fungicides
Omega	fluazinam	29	L			x	x	x	x	x		Low-risk for resistance development
Zampro	ametoctradin + dimethomorph	45 + <mark>40</mark>	Μ				X					Rotate with other FRAC codes

Fungicide resistance management guidelines for onions grown in mid-Atlantic region - 2015

FRAC code: M = multi-site MOA, numbered codes = chemistries with similar mode-of-action, specific site (MOA), NC = not classified Risk management: L = low risk, M = moderate risk or H = high risk for fungicide resistance to develop, H<sup>R</sup> = Known resistance reported High-risk fungicides with similar MOA (i.e. same FRAC code number) should not be sprayed consecutively



	Active	IC CODE	Risk Management	Damping-off ( <i>Pythium</i> )	Bacterial leaf blight	Septoria leaf spot	Fungicide Resistance Management
Fungicide	Ingredient(s)	FRA		L	L	L	Guidelines
fixed copper	copper	<b>M</b> 1	L		x	x	Low risk, protectant fungicide, use alone or rotate with a fungicide with high-risk FRAC code
Ridomil Gold	mefenoxam	4	Н	x			High righ for registering development
MetaStar	metalaxyl	4	Н	x			- High tisk for resistance development
Uniform	mefenoxam + azoxystrobin	4 + 11	н	x			For use at seeding; will help control Pythium and Rhizoctonia
Fontelis	penthiopyrad	7	Μ			x	Moderate risk, tank mix
Merivon	fluxapyroxad + pyraclostrobin	7 + 11	н			x	
azoxystrobin	azoxystrobin	11	н	x		x	High risk, tank mix with a protectant fungicide, and rotate with fungicides from other FRAC codes
Cabrio	pyraclostrobin	11	н			x	

Fungicide resistance management guidelines for parsley grown in mid-Atlantic region - 2015

FRAC code: M = multi-site MOA, numbered codes = chemistries with similar mode-of-action, specific site (MOA)

Risk management: L = low risk, M = moderate risk or H = high risk for fungicide resistance to develop, H<sup>R</sup> = Known resistance reported High-risk fungicides with similar MOA (i.e. same FRAC code number) should not be sprayed consecutively

Parsley

	Active	AC CODE	Risk Management	Damping-off ( <i>Pythium</i> ) and Root rot	Powdery mildew	White mold (Sclerotinia)	Ascochyta blight	Fungicide Resistance						
Fungicide	Ingredient(s)	FR		L	L	М	H <sup>R</sup>	Management Guidelines						
sulfur	sulfur	M2	L		x			Low risk, protectant fungicide, use alone or rotate with a fungicide with high-risk FRAC code						
MetaStar	metalaxyl	4	H <sup>R</sup>	xp										
Ridom il Gold	mefenoxam	4	H <sup>R</sup>	xp				High risk for resistance development						
Ultra Flourish	mefenoxam	4	H <sup>R</sup>	xp										
Uniform	mefenoxam + azoxystrobin	<mark>4</mark> + 11	Н	<b>x</b> <sup>ab</sup>				For use at planting; will help control Pythium and Rhizoctonia						
Endura	boscalid	7	М			x	x	Moderate risk, tank mix and rotate with other FRAC codes						
azoxystrobin	azoxystrobin	11	н	xª			x	High risk for resistance development, tank mix and rotate with						
Headline	pyraclostrobin	11	н				x							
Contans       Coniothyrium minitans       bio       L       x       Low risk biological control, consult label														
Fungicide resistance management guidelines for peas grown in mid-Atlantic region - 2015														
FRAC code: M = multi-site MOA, numbered codes = chemistries with similar mode-of-action, specific site (MOA) Risk management: L = low risk, M = moderate risk or H = high risk for fungicide resistance to develop, H <sup>R</sup> = Known resistance reported														

High-risk fungicides with similar MOA (i.e. same FRAC code number) should not be sprayed consecutively

<sup>a</sup> Rhizoctonia only
 <sup>b</sup> Pythium only



Fungicide	Active Ingredient(s)	FRAC CODE	Risk Management	□ Damping-off ( <i>Pythium</i> )	<mark>⊥</mark> Bacterial leaf spot	☐ Anthracnose fruit rot	Hytophthora blight - <sup>™</sup> crown rot phase	➡ Phytophthora blight - <sup>∞</sup> fruit rot/foliar phase	Couthern blight     Southern blight	Fungicide Resistance Management Guidelines
Actigard	acibenzolar-S-methyl	P1	L		x					Plant defense activate
fixed Copper	copper	M1	L		x			x		Low rick protoctant
Manzate Pro-Stick	mancozeb	М3	L			x				fungicides, use alone or tank
chlorothalonil	chlorothalonil	M5	L			x				mix with high-risk fungicides
Ridomil Gold Copper	mefenoxam + copper	4 + M1	H - M <sup>R</sup>					x		Rotate with other FRAC codes
MetaStar	metalaxyl	4	H <sup>R</sup>				x			Hisk risk, resistance known.
Ridomil Gold	mefenoxam	4	H <sup>R</sup>				x			Only apply if Phytophthora
Ultra Flourish	mefenoxam	4	H <sup>R</sup>				x			sensitive
Priaxor	boscalid + pyraclostrobin	7 + 11	н			x				Rotate with other FRAC codes
azoxystrobin	azoxystrobin	11	н	x		x			x	
Cabrio	pyraclostrobin	11	н			x				FRAC codes. No consecutive
Quadris Top	azoxystrobin + difenconazole	11 + 3	н			x				applications.
Quintec	quinoxyfen	13	н		x					Section 2ee, see label
Terraclor	PCNB	14	L-M						x	Use in transplant water
Ranman	cyazofamid	21	м				x	x		Rotate with other FRAC codes
Agri-Mycin, Agri-strep	streptomycin	25	H <sup>R</sup>		x					Greenhouse use only
Previcur Flex	propomocarb HCL	28	L-M	x						Low risk, tank mix
Revus	mandipropomid	40	L-M					x		Table and and address in the
Forum	dimethomorph	40	L-M					x		other FRAC codes
Presidio	fluopicolide	43	н				x	x		

Fungicide resistance management guidelines for peppers grown in mid-Atlantic region - 2015

FRAC code: M = multi-site MOA, numbered codes = chemistries with similar mode-of-action, specific site (MOA)

Risk management: L = low risk, M = moderate risk or H = high risk for fungicide resistance to develop, H<sup>R</sup> = Known resistance reported High-risk fungicides with similar MOA (i.e. same FRAC code number) should not be sprayed consecutively



	Active	RAC CODE	Risk Management	Early blight	Late blight	. Rhizoctonia stem canker	Black scurf (Rhizoctonia)	White mold	- Leak ( <i>Pythium</i> )	Pink rot (Phytophthora)	Verticillium wilt	Fungicide Resistance Management
Fungicide	Ingredient(s)	Ē		L	H	L	L	IVI	L	H	L	Guidelines
mancozeb	mancozeb	M3	L	X	X							Protectants, low-risk, use alone or tank mix with high-risk
Polyram	metiram	M3	L	X	X							FRAC codes alternate with other FRAC codes
chlorothalonil	chlorothalonil	M5	L	X	X							
thiophanate-methyl	thiophanate-methyl	1	н					X				High risk, rotate with other FRAC codes
iprodione	iprodione	2	M-H					X				Moderate to High risk
Quash	metconazole	3	M	X								Tank mix, rotate with other FRAC codes
Ridomil Gold Copper	mefenoxam + copper	4 + M1	M						X	X		Rotate with other ERAC codes and with other Ridomil /
Ridomil Gold MZ	mefenoxam + mancozeb	4 + M3	Μ						X	х		notace with other intrac codes and with other indomin/
Ridomil Gold Bravo	mefenoxam + chlorothalonil	4 + M5	Μ						X	X		protectant rangicide combinations
Ridomil Gold	mefenoxam	4	HR						X	X		High rick, resistance known in Late blight and Bink ret
Ultra Flourish	mefenoxam	4	HR						X	X		High-lisk, resistance known in Late blight and Plitk for
Platinum Ridomil Gold	mefenoxam + thiamethoxam	4 + 4A	HR						X	X		High-risk, includes an insecticide
Moncut	flutolanil	7	L-M			Х	X					Low to Moderate risk
Endura	boscalid	7	M-H	X				X				Rotate with other FRAC codes
Luna Tranquility	fluopyram + pyrimethanil	7 + 9	M-H	X								Medium to high-risk, tank mix and rotate
Priaxor	fluxapyroxad + pyraclostrobin	7 + 11	н	X								
azoxystrobin	azoxystrobin	11	HR	X		x	x					
Gem	trifloxystrobin	11	HR	X								High-risk for resistance, tank-mix with a protectant (M)
Headline	pyraclostrobin	11	HR	X								fungicide, Do not apply FRAC code 11 fungicides
Reason	fenamidone	11	HR	X								consecutively. Reduced sensitivity has been reported in
Quadris Top	azoxystrobin + difenconazole	11 + 3	н	x								Early blight control
Quadris Opti	azoxystrobin + chlorothalonil	11 + M5	M	x								
Tanos	famoxadone + cymoxanil	11 + 27	M-H	x	x							
Ranman	cyanofamid	21	н		x				x	X		Always tank mix with a protectant, rotate
Gavel	zoxamide + mancozeb	22 + M3	L-M		x							Rotate with other FRAC codes
Curzate	cymoxanil	27	L-M		x							Tank mix with protectant fungicide, rotate with other FRAC
Previcur Flex	propamocarb HCL	28	L-M		x							codes
Omega	fluazinam	29	L		x			x				Low-risk for resistance development
Super Tin	triphenyltin hydroxide	30	L-M	x	x	1						Table with most of and free dation matches with the FDAO
Forum	dimethomorph	40	L-M		x		1			1		I ank mix with protectant fungicide, rotate with other FRAC
Revus	mandipropamid	40	L-M		x	1						COORES
Revus Top	mandipropamid + difenconazole	40 + 3	L-M	x	x							Rotate with other FRAC codes
Presidio	fluopicolide	43	Н		x		1			x		Rotate with other FRAC codes
K-Pam HL, Vapam HL	Na-,K-methyldithiocarbamate	NC				1	1			1	x	soil fumigants, see labels

Fungicide resistance management guidelines for potatoes grown in mid-Atlantic region - 2015

FRAC code: M = multi-site MOA, numbered codes = chemistries with similar mode-of-action, specific site (MOA)

Potatoes

Risk management: L = low risk, M = moderate risk or H = high risk for fungicide resistance to develop, H<sup>R</sup> = Known resistance reported High-risk fungicides with similar MOA (i.e. same FRAC code number) should not be sprayed consecutively

Funcicido	Active	RAC CODE	Risk Management	<ul> <li>Damping-off</li> </ul>	<ul> <li>Angular leaf spot</li> </ul>	<ul> <li>Plectosporium blight</li> </ul>	R Scab	Phytophthora blight	<b>Gummy stem blight</b>	- Anthracnose	Powdery mildew	Downy mildew	Fungicide Resistance
fixed copper	copper	M1		-	- v	-		v		-			Wanagement Guidennes
sulfur	sulfur	M2	-		<b>^</b>			<b>^</b>			v		Multi-site MOA, use alone, or in tank mix with
mancozeh	mancozeh	M3			×						^		high risk fungicides and in rotations with other
chlorothalonil	chlorothalonil	M5			<b>^</b>	v	v		v	v	Y	v	FRAC codes
Proline	prothioconazole	3	M			<b>^</b>	<b>^</b>		×	<b>^</b>	×		
Rally	myclobutanil	3	MR						<b>^</b>		×		High risk of reduced sensitivity, always tank
tebuconazole	tebuconazole	3	M						x	x	x		mix, and alternate with other codes
Procure	triflumizole	3	MR								X		-
Inspire Super	difenconazole + cyprodinil	3+9	Н						x	x	X		High risk, rotate with other FRAC codes
Ridomil Gold	mefenoxam	4	HR	x				x					
Ultra Flourish	mefenoxam	4	HR	x				x					Hisk risk, resistance known. Only apply if
MetaStar	metalaxyl	4	HR	x									Phytophinora strains are merenoxam-sensitive
Uniform	mefenoxam + azoxystrobin	4 + 11	н	x									For use at planting; will help control Pythium and Rhizoctonia
Fontelis	penthiopyrad	7	М								x		Moderate risk, tank mix
Switch	cyprodinil + fludioxonil	9 + 12	м						x	x			Tank mix and rotate with other FRAC codes
Quadris Top	azoxystrobin + difenconazole	11 + 3	Н			X							High Risk, PM and DM resistance detected in
Pristine	pyraclostrobin + boscalid	11 + 7	HR						X	X	X		mid-Atlantic region. Tank mix with FRAC code
Tanos	famoxadone + cymoxanil	11 + 27	M					X				X	IN fungicides and rotate with other FRAC codes
Quintec	quinoxyfen	13	н								x		Tank mix and rotate with other FRAC codes
Ranman	cyazofamid	21	М					x				x	Tank mix with FRAC code M fungicide and rotate, do not tank mix with copper
Gavel	zoxamide + mancozeb	22 + M3	L-M									x	Low to moderate risk, rotate with other FRAC codes
Curzate	cymoxanil	27	L-M									X	
Previcur Flex	propamocarb HCL	28	L-M	x								X	Tank mix with a FRAC code M fungicide, rotate
Forum	dimethomorph	40	L-M					X				X	with as many different FRAC codes as possible
Revus	mandipropamid	40	L-M					X				X	to avoid resistance issues
Presidio	fluopicolide	43	H					X				X	
Zampro	ametoctradin + dimethomorph	45 + 40	M	L								X	Moderate risk, tank mix
Torino	cyflufenamid	U6	M								X		Moderate risk, tank mix

Fungicide resistance management guidelines for pumpkin and winter squash crops grown in mid-Atlantic region - 2015

FRAC code: M = multi-site MOA, numbered codes = chemistries with similar mode-of-action, specific site (MOA)

Risk management: L = low risk, M = moderate risk or H = high risk for fungicide resistance to develop, H<sup>R</sup> = Known resistance reported High-risk fungicides with similar MOA (i.e. same FRAC code number) should not be sprayed consecutively

**Pumpkin & Winter Squash** 

	Active	AC CODE	Risk Management	Damping-off	Downy mildew	Leaf spots	White rust	Eungicide Resistance
Fungicide	Ingredient(s)	FR/		L	м	L	L	Management Guidelines
fixed copper	copper	M1	L		x	x		Use alone, or tank mix and/or rotate with high- risk fungicides
Ridomil Gold	mefenoxam	4	н	x	x			
Ultra Flourish	mefenoxam	4	н		x			High risk for resistance development
MetaStar	metalaxyl	4	н	x				-
Ridomil Gold Copper	mefenoxam + copper	4 + M1	м				x	High risk, rotate with other FRAC codes
Uniform	mefenoxam + azoxystrobin	4 + 11	н	x	x			For use at planting; will help control Pythium, Rhizoctonia and early season Downy mildew
Merivon	fluxapyroxad + pyraclostrobin	7 + 11	н			x		
azoxystrobin	azoxystrobin	11	н	x		x	x	High risk, tank mix and rotate with other FRAC codes
Cabrio	pyraclostrobin	11	н			x	x	-
Ranman	cyazofamid	21	м		x			Tank mix and rotate with other FRAC codes
Presidio	fluopicolide	43	н	xa	x		x	Tank mix and rotate with other FRAC codes

Fungicide resistance management guidelines for radishes, rutabagas and turnips grown in mid-Atlantic region - 2015

FRAC code: M = multi-site MOA, numbered codes = chemistries with similar mode-of-action, specific site (MOA)

Risk management: L = low risk, M = moderate risk or H = high risk for fungicide resistance to develop, H<sup>R</sup> = Known resistance reported

High-risk fungicides with similar MOA (i.e. same FRAC code number) should not be sprayed consecutively

<sup>A</sup> For Pythium Only

Radish, Rutabaga, and Turnip

	Active	AC CODE	Risk Management	Damping-off	Downy mildew (Blue mold)	White rust	Leaf Spots and Anthracnose	Fungicide Resistance Management			
Fungicide	Ingredient(s)	FR,		L.	М	L	L-M	Guidelines			
Actigard	acibenzolar-S-methyl	P1	L		x	x		Low -risk, rotate with other FRAC codes			
fixed copper	copper	<b>M</b> 1	L		x	x		Use alone and rotate			
Ridom il Gold	mefenoxam	4	HR	x	x	x		High risk for resistance. At-planting			
Ultra Flourish	mefenoxam	4	HR	x	x	x		applications for root rot control will also help			
MetaStar	metalaxyl	4	HR	х	х	х		w ith early-season dow ny mildew control			
Ridom il Gold Copper	mefenoxam + copper	<mark>4 +</mark> M1	L		x	x		Rotate with other FRAC codes			
Uniform	mefenoxam + azoxystrobin	4 + 11	н	x				For use at planting; w ill help control Pythium and Rhizoctonia			
Fontelis	penthiopyrad	7	М				х	Moderate risk, tank mix			
Merivon	fluxapyroxad + pyraclostrobin	7 + 11	н				x				
Cabrio	pyraclostrobin	11	н		x	x	x	High risk, tank mix with FRAC code M fundicides and rotate with fundicides from			
Reason	fenamidone	11	н		x	x		other FRAC codes. FRAC code 11 fungicides			
Pristine	pyraclostrobin + boscalid	11 + 7	н				x	ahould not be applied more than teice before			
Tanos	famoxadone + cymoxanil	11 + 27	М		х	х		Totaling to another Trive code.			
Ranman	cyazofamid	21	М		x	x					
Aliette	fosetyl-Al	33	L		x	x		Low risk, do not tank mix with copper			
Presidio	fluopicolide	43	н		x	x		Tank mix and rotate with other FRAC codes			
Fungicide resistance management guidelines for spinach grown in mid-Atlantic region - 2015											
FRAC code: M = multi-site MOA, numbered codes = chemistries with similar mode-of-action, specific site (MOA) Risk management: L = low risk, M = moderate risk or H = high risk for fungicide resistance to develop, H <sup>R</sup> = Known resistance reported High-risk fungicides with similar MOA (i.e. same FRAC code number) should not be spraved consecutively											



	Active	AC CODE	Resistance Risk	Angular leaf spot	Anthracnose fruit rot	, Gray mold	Fungal leaf blight, , leaf scorch and leaf spot	Red stele and Phytophthora crown rot	, Powdery mildew	Fungicide Resistance Management
Fungicide	Ingredient(s)	Ë		L	Hĸ	Hĸ	Hĸ	L	Hĸ	Guidelines
fixed copper	copper	M1	L	x						
Thiram	thiram	M3			X	X				Low risk protectants, multi-site MOA, use alone, or tank
Captec	captan	M4				~	X			mix and rotate with high-risk fungicides
Captan	Captan Conton y fank avamid	IVI4	<u> </u>		X	X	X			
	Captan + rennexamid	W14 + 17	L		X	X				Low risk, no more than 2 consecutive applications
	thiophanate-methyl	1	H"				X			High risk for resistance development
Rovral	iprodione	2	H				X			High risk for resistance development
Mettle	Tetraconazole	3	M						X	Moderate to high risk tank mix and rotate with other
Rally	myclobutanil	3	M				X		X	FRAC codes
Procure	triflumizole	3	М						x	
Inspire Super	difenconazole + cyprodinil	<mark>3</mark> + 9	Н						x	High risk, rotate with other FRAC codes
Ultra Flourish	mefenoxam	4	HR					X		High rick for registering development. Can be applied as
MetaStar	metalaxyl	4	HR					X		spray or through drip irrigation
Ridomil Gold	mefenoxam	4	HR					x		
Fontelis	penthiopyrad	7	Μ			х				Moderate risk, tank mix
azoxystrobin	azoxystrobin	11	HR							Ligh right tools mix with EDAC and a M fur sinidan and
Cabrio	pyraclostrobin	11	HR		X		x		x	rotate with other non-ERAC code 11 fundicides and
Pristine	pyraclostrobin + boscalid	11 + 7	н		x		x		x	
Quintec	quinoxyfen	13	Н						х	Tank mix and rotate with other FRAC codes
Switch	cyprodinil + fludioxonil	9 + 12	м		x	x				Moderate risk, tank mix and rotate with other FRAC codes
Elevate	fenhexamid	17	L		x	х				Low risk, rotate with other FRAC codes
K-Phite, Prophyt, Rampart, Phostrol	phosphorous acid	33	L					x		Low risk, see label
Aliette	fosetyl-al	33	L					x		Low risk, use as pre-plant dip or spray application, see label
Torino	cyflufenamid	U6	Μ						x	Moderate risk, tank mix

Fungicide resistance management guidelines for strawberries grown in mid-Atlantic region - 2015

FRAC code: M = multi-site MOA, numbered codes = chemistries with similar mode-of-action, specific site (MOA)

Risk management: L = low risk, M = moderate risk or H = high risk for fungicide resistance to develop, H<sup>R</sup> = Known resistance reported High-risk fungicides with similar MOA (i.e. same FRAC code number) should not be sprayed consecutively

Strawberry

	Active	AC CODE	Risk Management	Damping-off	Plectosporium blight	Scab	Phytophthora Crown and Fruit Rot	Powdery mildew	Downy mildew	Fungicide Resistance
Fungicide	Ingredient(s)	FR		L	L	HR	HR	HR	HR	Management Guidelines
fixed copper	copper	M1	L				x			Multi-site MOA use alone or in tank mix
mancozeb	mancozeb	M3	L		x					with high risk fungicides and in rotations
chlorothalonil	chlorothalonil	M5	L		x	x		х	x	with other FRAC codes
Proline	prothioconazole	3	М					х		
Rally	myclobutanil	3	MR					X		High risk, tank mix with a FRAC code M
tebuconazole	tebuconazole	3	М					х		codes
Procure	triflumizole	3	MR					x		
Inspire Super	difenconazole + cyprodinil	<mark>3 +</mark> 9	н					x		High risk, rotate with other FRAC codes
Ridomil Gold	mefenoxam	4	HR	х			X			Hisk risk, resistance known. Only apply if
MetaStar	metalaxyl	4	H <sup>R</sup>	х			X			Phytophthora strains are mefenoxam-
Ultra Flourish	mefenoxam	4	HR	х			X			sensitive
Uniform	mefenoxam + azoxystrobin	4 + 11	н	x						For use at planting; will help control Pythium and Rhizoctonia
Fontelis	penthiopyrad	7	М					x		Moderate risk, tank mix
Quadris Top	azoxystrobin + difenconazole	11 + 3	н		x					High Risk, PM and DM resistance detected
Pristine	pyraclostrobin + boscalid	11 + 7	н					х		in mid-Atlantic region. Tank mix with FRAC
Tanos	fomoxadone + cymoxanil	11 + 27	М				x		x	FRAC codes
Ranman	cyazofamid	21	м				x		x	Tank mix with FRAC code M fungicide and rotate, do not tank mix with Copper
Gavel	zoxamide + mancozeb	22 + M3	L-M				x		x	Low to moderate risk
Curzate	cymoxanil	27	L-M						x	
Previcur Flex	propomocarb HCL	28	L-M	х					x	Tank mix with a FRAC code M fundicide
Forum	dimethomorph	40	L-M				x		x	rotate with as many different FRAC codes
Revus	mandipropamid	40	L-M				x			as possible to avoid resistance issues
Presidio	fluopicolide	43	Н				x		X	
Zampro	ametoctradin + dimethomorph	45 + <mark>40</mark>	Μ						X	Moderate risk, tank mix
Torino	cyflufenamid	U6	М					x		Moderate risk, tank mix

Fungicide resistance management guidelines for summer squash crops grown in mid-Atlantic region - 2015

FRAC code: M = multi-site MOA, numbered codes = chemistries with similar mode-of-action, specific site (MOA)

Risk management: L = low risk, M = moderate risk or H = high risk for fungicide resistance to develop,  $H^R$  = Known resistance reported High-risk fungicides with similar MOA (i.e. same FRAC code number) should not be sprayed consecutively



Fungicide	Active Ingredient(s)	FRAC CODE	Risk Management	⊢ Leaf spots and blights	r Rust	Fungicide Resistance Management Guidelines
mancozeb	mancozeb	M3	L	x	x	Multi-site MOA, use alone, or in tank mix with high risk fungicides and in
chlorothalonil	chlorothalonil	M5	L	x	x	rotations with other FRAC codes
Prosaro	prothioconazole	3	м	x	x	
Tilt	propiconazole	3	м	x	x	Tank mix with FRAC code M fundicide and rotate with other FRAC codes
azoxystrobin	azoxystrobin	11	н	x	x	Check labels for days between applications and days to harvest
Aproach	picoxystrobin	11	н	x	x	restrictions.
Headline	pyraclostrobin	11	н	x	x	
Headline AMP	pyraclostrobin + metconazole	11 + 3	М-Н	x	x	
Quilt	azoxystrobin + propiconazole	11 + 3	М-Н	x	x	Tank mix with FRAC code M fungicide and rotate with other FRAC codes.
Quilt Xcel	azoxystrobin + propiconazole	11 + 3	М-Н	x	x	Check labels for days between applications and days to harvest restrictions. Please check labels and rates. Amounts of active ingredients.
Stratego	trifloxystrobin + propiconazole	11 + 3	М-Н	x	x	vary between the different combinations.
Stratego YLD	trifloxystrobin + prothioconazole	11 + 3	М-Н	x	x	
Priaxor	pyraclostrobin + fluxapyroxad	11 + 7	М-Н	x	x	No more than 2 applications per season, rotate with other FRAC codes
	Fungicide resistance manageme	nt guideli	nes fo	or swe	etcor	n grown in mid-Atlantic region - 2015
FRAC code: M = multi-	site MOA, numbered codes = che	emistries	with s	similar	mod	e-of-action, specific site (MOA)
Risk management: L = High-risk fungicides wit	low risk, M = moderate risk or H h similar MOA (i.e. same FRAC (	= high ris	sk for nber)	fungio shoulo	cide r d not	esistance to develop, H <sup>R</sup> = Known resistance reported be sprayed consecutively



		RAC CODE	Resistance Risk	Damping-off (Pythium)	Bacterial Canker	Bacterial spot and speck	Early blight	Septoria leaf spot	Leaf mold Fulvia/Cladosporium)	Anthracnose fruit rot	Alternaria ruit rot	Buckeye rot	Grey mold	Late blight	Powdery mildew	Timber rot White mold)	Fungicide Resistance
Fungicide	Active Ingredient(s)	L L		L	L	HR	HR	L	L	L	L	L	HR	HR	HR	M	Management Guidelines
Actigard	acibenzolar-s-methyl	P1	L		x	x											No more than 6 applications per season
fixed copper(s)	copper	M1	L		x	x											
chlorothalonil	chlorothalonil	M5	L				x	x		x	x		x	x			
mancozeb	mancozeb	M3	L			х	х	х		х	X			x			Low risk protectant fungicides. Use alone, or tank
Cuprofix MZ	copper + mancozeb	M1 + M3	L			x											mix with high risk fungicides and rotate
ManKocide	mancozeb + copper	M3 + M1	L			x											
Rally	myclobutanil	3	м												х		Rotate with other FRAC codes
Inspire Super	difenconazole + cyprodinil	<mark>3</mark> + 9	н				x	x		x	x				x		
MetaStar	metalaxyl	4	H <sup>R</sup>	x													
Ridomil Gold	mefenoxam	4	HR	x								x					High risk, resistance known
Ultra Flourish	mefenoxam	4	Hĸ	x								x					
Ridomil Gold Copper	mefenoxam + copper	4 + M1	М									x					
Ridomil Gold Bravo	mefenoxam + chlorothalonil	4 + M5	м									x					Moderate risk, rotate with other FRAC codes
Flouronil	mefenoxam + chlorothalonil	<mark>4 +</mark> M5	М									x					
Endura	boscalid	7	М				x	х		х	x		x				Rotate with other FRAC codes
Fontelis	penthiopyrad	7	М				х	x		x	x						Rotate with other FRAC codes
Priaxor	fluxapyroxad + pyraclostrobin	7 + 11	н				x	x		x	x						No more than 2 applications per season, rotate with other FRAC codes
Switch	cyprodinil + fludioxonil	9 + 12	M										x				Rotate with other FRAC codes
azoxystrobin	azoxystrobin	11	н				X	X		X	X						_
Cabrio	pyraciostrobin	11	H				X	X		X	X				X		
Reason	fenamidone	11	н				×	×		×				v			High risk, tank-mix with protectants; rotate with other
Quadris Top	azoxystrobin + difenconazole	11+3	н				x	x		x	x						non-FRAC code 11 fungicides
Tanos	famoxadone + cymoxanil	11 + 27	н				×	x		x	x	×		¥			
Torraclor	PCNB	14	L -M					^		^	^	~		~			Liso in transplant water
Ranman	cyazofamid	21	M - H											¥			Tank mix with a protectant rotate
Gavel	zoxamide + mancozeb	22 + M3	I -M				x	x		x	x	x		x			Rotate with other ERAC codes
Curzate	cymoxanil	27	L-M				<u> </u>	^ _		^ _	<u>^</u>	<u>^</u>		x			Tank mix with a protectant rotate
Previour Elex	Propamocarb HCI	28	L -M											x			Tank mix with a protectant, rotate
Aliette	fosetyl-al	33		- v										~			
Catamaran	potassium posphite + chlorothalonil	33 + M5	L						x								Low risk
Forum	dimethomorph	40	L-M											x			
Revus Top	mandipropamid + thiophanate methyl	40	L-H				x	x	x	x	x			x	x		Tank mix with a protectant, rotate
Presidio	fluopicolide	43	Н											x			Tank mix with a protectant, rotate
Contans	Coniothyrium minitans	bio	L													x	Biological control, see label

Fungicide resistance management guidelines for field-grown tomatoes in mid-Atlantic region - 2015

FRAC code: M = multi-site MOA, numbered codes = chemistries with similar mode-of-action, specific site (MOA)

 $\label{eq:rescaled} \mbox{Risk} \mbox{ management: } L = \mbox{low risk}, \mbox{M} = \mbox{moderate risk} \mbox{ or } H = \mbox{high high risk} \mbox{ for fungicide resistance to develop}, \mbox{H}^{R} = \mbox{Known resistance reported}$ 

High-risk fungicides with similar MOA (i.e. same FRAC code number) should not be sprayed consecutively

TOMATO

	Active	AC CODE	Risk Management	Damping-off (Pvthium)	Bacterial fruit blotch	Alternaria leaf blight	Phytophthora Crown and Fruit Rot	Anthracnose	Gummy stem blight	Powdery mildew	Downy mildew	Fungicide Resistance Management
Fungicide	Ingredient(s)	Ľ.		L	L	L	H <sup>ĸ</sup>	L	Hĸ	Hĸ	Hĸ	Guidelines
Actigard	acibenzolar-S-methyl	P1	L		X							Low-risk, rotate with other FRAC codes
fixed copper	copper	M1	L		X		X					Multi-site MOA use alone or in tank mix with high risk
mancozeb	mancozeb	M3	L			X		X				fundicides and in rotations with other FRAC codes
chlorothalonil	chlorothalonil	M5	L			X		X	x	X	X	·····g·····
Ariston	chlorothalonil + cymoxanil	M5 + 27	L-M								X	Rotate with other FRAC codes
thiophanate-methyl	thiophanate-methyl	1	н					X				High risk for resistance development
Proline	prothioconazole	3	M						x	X		
Rally	myclobutanil	3	MR							X		High risk tank mix and rotate with other ERAC codes
tebuconazole	tebuconazole	3	M						x	X		
Procure	triflumizole	3	MR							X		
Inspire Super	difenconazole + cyprodinil	<mark>3 + 9</mark>	н			x			x			High risk, rotate with other FRAC codes
Ridomil Gold	mefenoxam	4	HR	X								High risk Mefenovam resistance known in mid-Atlantic region
Ultra Flourish	mefenoxam	4	HR	X								
MetaStar	metalaxyl	4	HR	X								High risk for resistance development
Uniform	mefenoxam + azoxystrobin	4 + 11	н	x								For use at planting; will help control Pythium and Rhizoctonia
Fontelis	penthiopyrad	7	М					X	x	Х		Moderate risk, tank mix
Luna Experience	fluopyram + tebuconazole	7 + 3	М						x	х		High risk, rotate with other FRAC codes
Merivon	fluxapyroxad + pyraclostrobin	7 + 11	н						x			
Switch	cyprodinil + fludioxonil	9 + 12	М						x			Moderate risk, tank mix and rotate with other FRAC codes
azoxystrobin	azoxystrobin	11	н			X		X				
Cabrio	pyraclostrobin	11	н			x		X				
Reason	fenamidone	11	н			X						High Risk. PM and DM resistance detected in mid-Atlantic
Quadris Top	azoxystrobin + difenconazole	11 + 3	н			x		X				region. Tank mix with FRAC code M fungicides and rotate
Pristine	pyraclostrobin + boscalid	11 + 7	н			x		X	x			with other FRAC codes
Luna Sensation	trifloxystrobin + fluopyram	11 + 7	н			X				х		
Tanos	fomoxadone + cymoxanil	11 + 27	М				X	X			х	
Quintec	quinoxyfen	13	н							х		Medium to high risk for resistance, always tank mix with a
Ranman	cyazofamid	21	М				x				x	FRAC code M fungicide, rotate with other FRAC codes
Gavel	zoxamide + mancozeb	22 + M3	L-M				x				x	Protectant, low to moderate risk
Curzate	cymoxanil	27	L-M								x	· · · · · · · · · · · · · · · · · · ·
Previcur Flex	propomocarb HCL	28	L-M	x	1						x	
Forum	dimethomorph	40	L-M		1		X				X	I ANK MIX WITH A FRAC code M fungicide, rotate with as many
Revus	mandipropamid	40	L-M				x					unterent FRAC codes as possible to avoid resistance ISSUES
Presidio	fluopicolide	43	н				x				X	
Zampro	ametoctradin + dimethomorph	45 + <mark>40</mark>	М				x				X	Moderate risk, tank mix
Torino	cyflufenamid	U6	Μ							X		Moderate risk, tank mix

Fungicide resistance management guidelines for watermelon grown in mid-Atlantic region - 2015

FRAC code: M = multi-site MOA, numbered codes = chemistries with similar mode-of-action, specific site (MOA)

Risk management: L = low risk, M = moderate risk or H = high risk for fungicide resistance to develop, H<sup>R</sup> = Known resistance reported

High-risk fungicides with similar MOA (i.e. same FRAC code number) should not be sprayed consecutively

Watermelon

#### 2015 Fungicide Application Schedules

Crop:		Applications											
	1	2	3	4	5	6	7	8	9	10	Notes:		
Date													
Farm/Block													
FRAC code													
Chemical													
Rate(s)													
Sprayed for:													

Crop:		Applications											
	1	2	3	4	5	6	7	8	9	10	Notes:		
Date													
Farm/Block													
FRAC code													
Chemical(s)													
Rate(s)													
Sprayed for:													

Crop:		Applications											
	1	2	3	4	5	6	7	8	9	10	Notes:		
Date													
Farm/Block													
FRAC code													
Chemical(s)													
Rate(s)													
Sprayed for:													

Сгор:		Applications										
	1	2	3	4	5	6	7	8	9	10	Notes:	
Date												
Farm/Block												
FRAC code												
Chemical(s)												
Rate(s)												
Spraved for:												

#### 2015 Fungicide Application Schedules

Crop: Pumpkin	Example Cucurbit Fungicide Application Schedules													
	1	2	3	4	5	6	7	8	9	10	Notes:			
Date	7/15	7/22	7/31	8/7	8/14	8/23	9/1	9/8	9/18					
Farm/Block	RAREC	RAREC	RAREC	RAREC	RAREC	RAREC	RAREC	RAREC	RAREC					
FRAC code	M5 + M1	M5	M5+M3	M5+3	4+M5	11+7	M5+3	M5+M1	M5					
Chemical	Bravo+S	Bravo	Bravo+copper	Bravo+Rally	Bravo	Pristine	Bravo+Rally	Bravo+S	Bravo					
Rate(s)	2pt+2lb	3 pt	2pt ea	2 pt + 5 oz	2 lb	15 oz	2 pt + 5 oz	2pt+2 lb	3 pt					
Sprayed for:	PM	PM	PM,ALS	PM	PM	PM	PM	PM	PM					

Сгор:		Applications										
	1	2	3	4	5	6	7	8	9	10	Notes:	
Date												
Farm/Block												
FRAC code												
Chemical(s)												
Rate(s)												
Sprayed for:												

Сгор:		Applications											
	1	2	3	4	5	6	7	8	9	10	Notes:		
Date													
Farm/Block													
FRAC code													
Chemical(s)													
Rate(s)													
Sprayed for:													

Crop:	Applications													
	1	1 2 3 4 5 6 7 8 9 10												
Date														
Farm/Block														
FRAC code														
Chemical(s)														
Rate(s)														
Sprayed for:														