
Management and epidemiology of pre- and postharvest diseases of sweet cherry

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Managing of pre- and postharvest diseases of sweet cherry

“One of the best ways to manage foliar and fruit diseases of tree crops is to apply effective materials that inhibit the growth of the fungal or bacterial pathogens.”

“This process of screening and developing new active ingredients and working with registrants and IR-4 is the most direct way of obtaining registered materials for growers of the commodity.”

Sum= 36

Table 1: Fungicides and bactericides used in 2024 studies*

Category	FRAC Code	Trade name	Active ingredient
Single active ingredients	M01	CS2005	Cu-sulfate pentahydrate
	3	Cevya	mefentrifluconazole
	3	Mentor	propiconazole
	3	Alto	cyproconazole
	4	Ridomil Gold	mefenoxam
	12	Scholar	fludioxonil
	13	Talendo	proquinazid
	19/BM 01	Oso	polyoxin-D
	22	Elumin	ethaboxam
	40	Revus	mandipropamid
	43	Presidio	fluopicolide
	48	BioSpectra, CX-10490	natamycin
	49	Orondis	oxathiapiprolin
	52	Axios	ipflufenquin
U12	Syllit	dodine	
P07 (33)	ProPhyt	potassium phosphite	
Numbered experimentals		V6M-5-14	not disclosed
Antibiotics	24	Kasumin	kasugamycin
	41	NUP	oxytetracycline
Biologicals	BM 01	Cinerate	cinnamon oil
	BM 01	Seican	cinnamaldehyde
	BM 01	Guarda, Thyme Guard	thyme oil
	BM 01	BTS	Quillaja saponaria extract
	BM 01	QAM 8921	Acacia sp. bark extract
	BM 01	PureCrop	soybean and com oils
	BM 02	YSY	Papiliotrema terrestris
	Food additive	Nisin	nisin
	Food additive	EPL	ε-poly-L-lysine
	Fertilizer	ManniPlex Zn	nitrate and urea nitrogen, zinc
Premixtures	3 + BM 01	Regev	difenoconazole + tea tree oil
	3 + 7	Elysis (Mibelya)	mefentrifluconazole + fluxapyroxad
	3 + 11	Absolute Maxx	tebuconazole + trifloxystrobin
	7 + 3	Miravis Duo	pydiflumetofen + difenoconazole
	7 + 3	Luna Experience	fluopyram + tebuconazole
	7 + 11	Luna Sensation	fluopyram + trifloxystrobin
	7 + 11	Merivon	fluxapyroxad + pyraclostrobin
	7 + 12	Miravis Prime	pydiflumetofen + fludioxonil

* - Chemicals are sorted by Fungicide Resistance Action Committee (FRAC) code or mode of action. Some treatments were used with adjuvants such as DyneAmic.

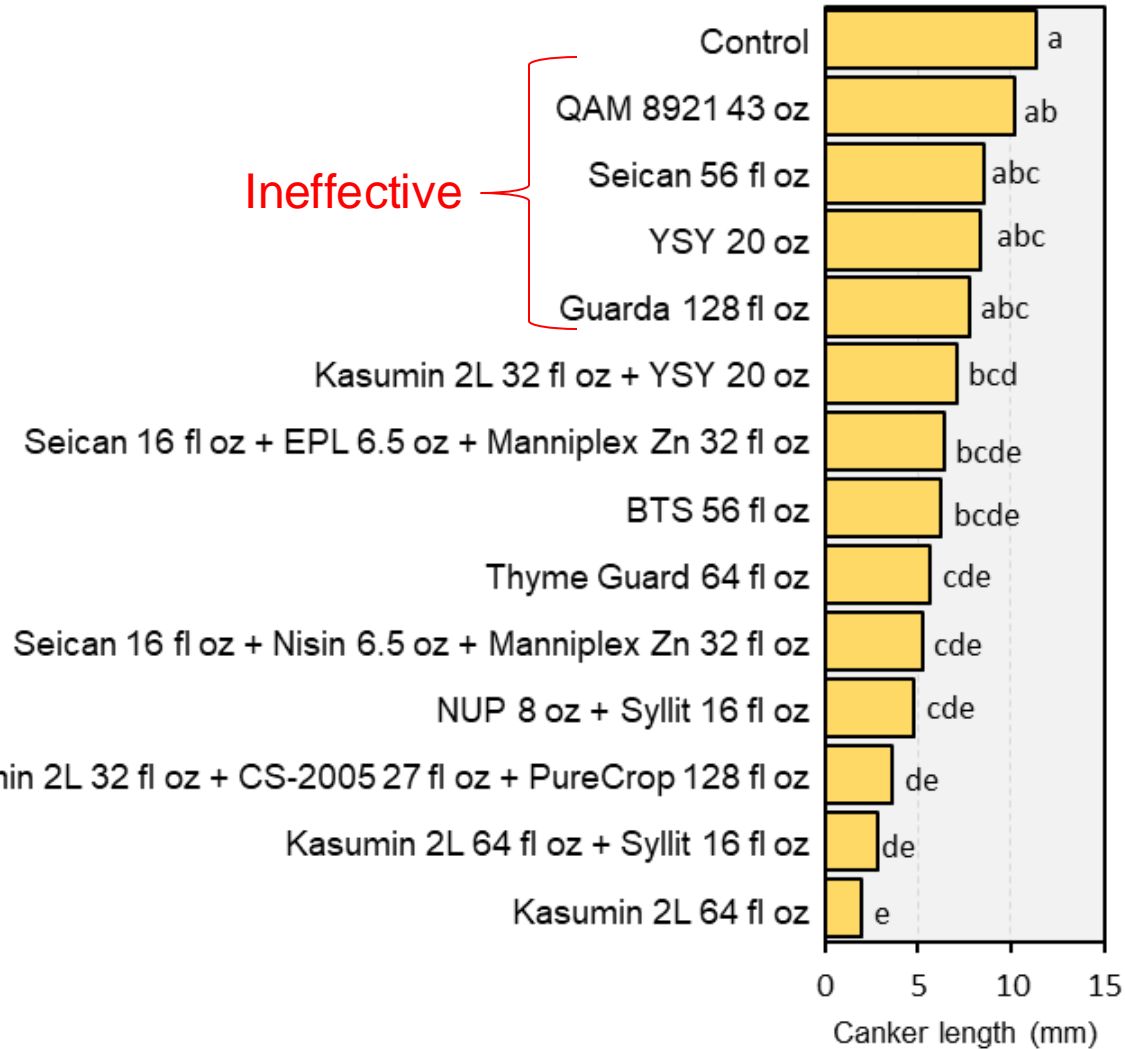
Bacterial blast and canker of sweet cherry



- Associated with any injury (cold or mechanical) or stress during cool, wet conditions
- Symptoms: Cankers with progressive dieback

Highly effective

Evaluation of antibacterial treatments for protection of cv. Coral branches from bacterial canker - 2024



Ineffective

On 12-19-23, 1- to 2-year-old branches were wounded (3 wounds/branch; 2 mm deep, 2 mm in diameter) on the tree, sprayed with selected treatments using a hand sprayer, and spray-inoculated with *Pseudomonas syringae* (4×10^7 cfu/ml) after air-drying. Disease was evaluated in June 2024, and canker length was measured after removing the bark.

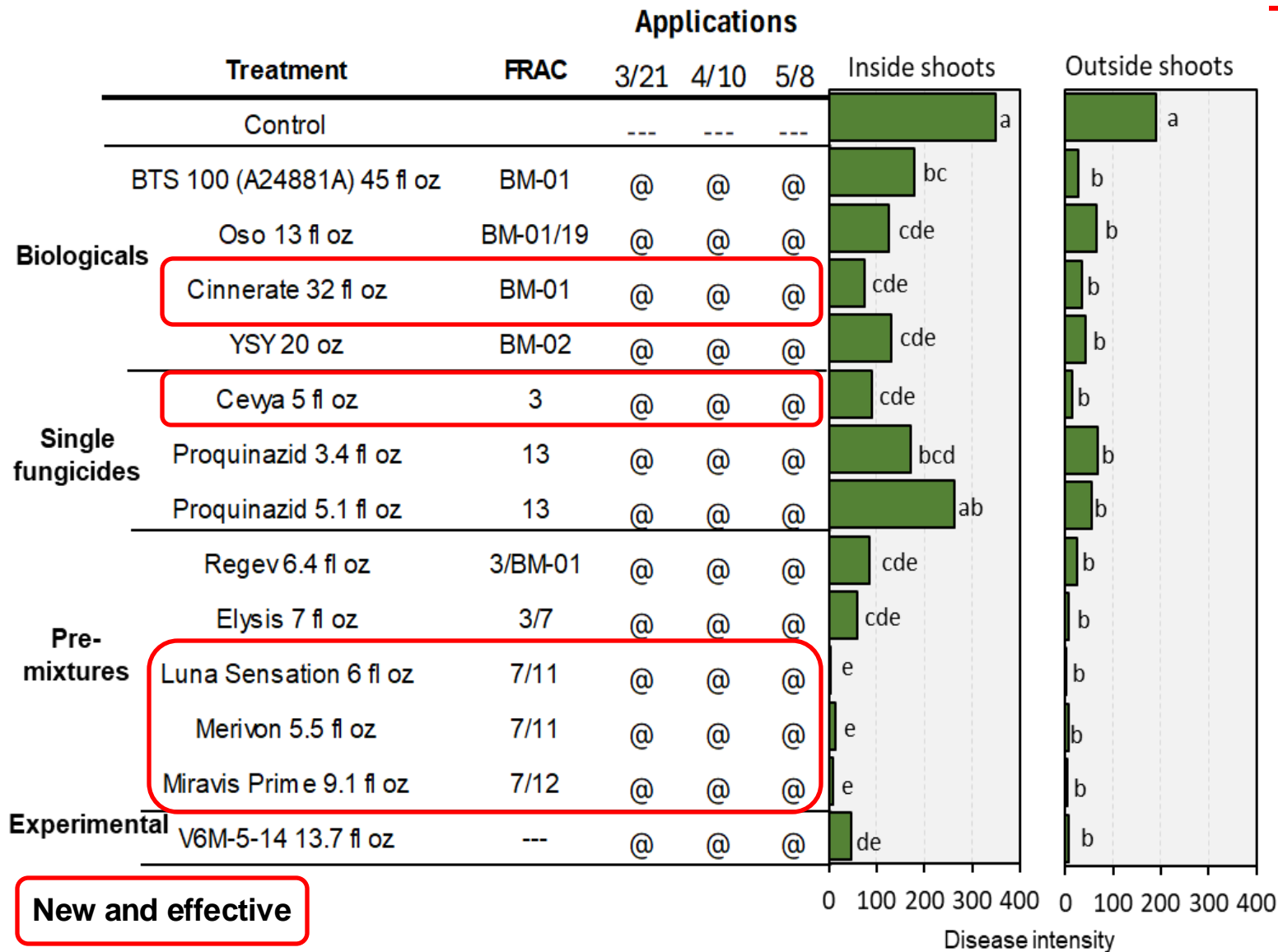
Management of bacterial canker and blast

- **Copper:** inconsistently suppressive – resistance widespread
 - **Kasumin:** highly and consistently effective. Registered in 2018
 - **Mycoshield/FireLine:** Pending registration at EPA since 2018 (2025?)
 - **Biocontrols** (Actinovate, Botector)/**PAA** (non-persistent): inconsistent.
 - **New products identified** (nisin, ϵ -poly-L-lysine, cinnamaldehyde)
 - **Timing:**
 - *Canker* – Cold wet (windy) conditions favoring disease and immediately after frost injury (1-day).
 - *Blast* - A bloom treatment with Kasumin or Mycoshield (pending) in combination with fungicides for blossom blight for trees treated with rest-breaking compounds
-

Evaluate, under field conditions, bloom and preharvest applications of new compounds, premixtures, and biologicals

- Brown rot and Botrytis blossom blight
 - Powdery mildew
 - Brown rot fruit rot
 - Gray mold decay

Preharvest fungicide treatments for management of powdery mildew of Bing cherries 2024



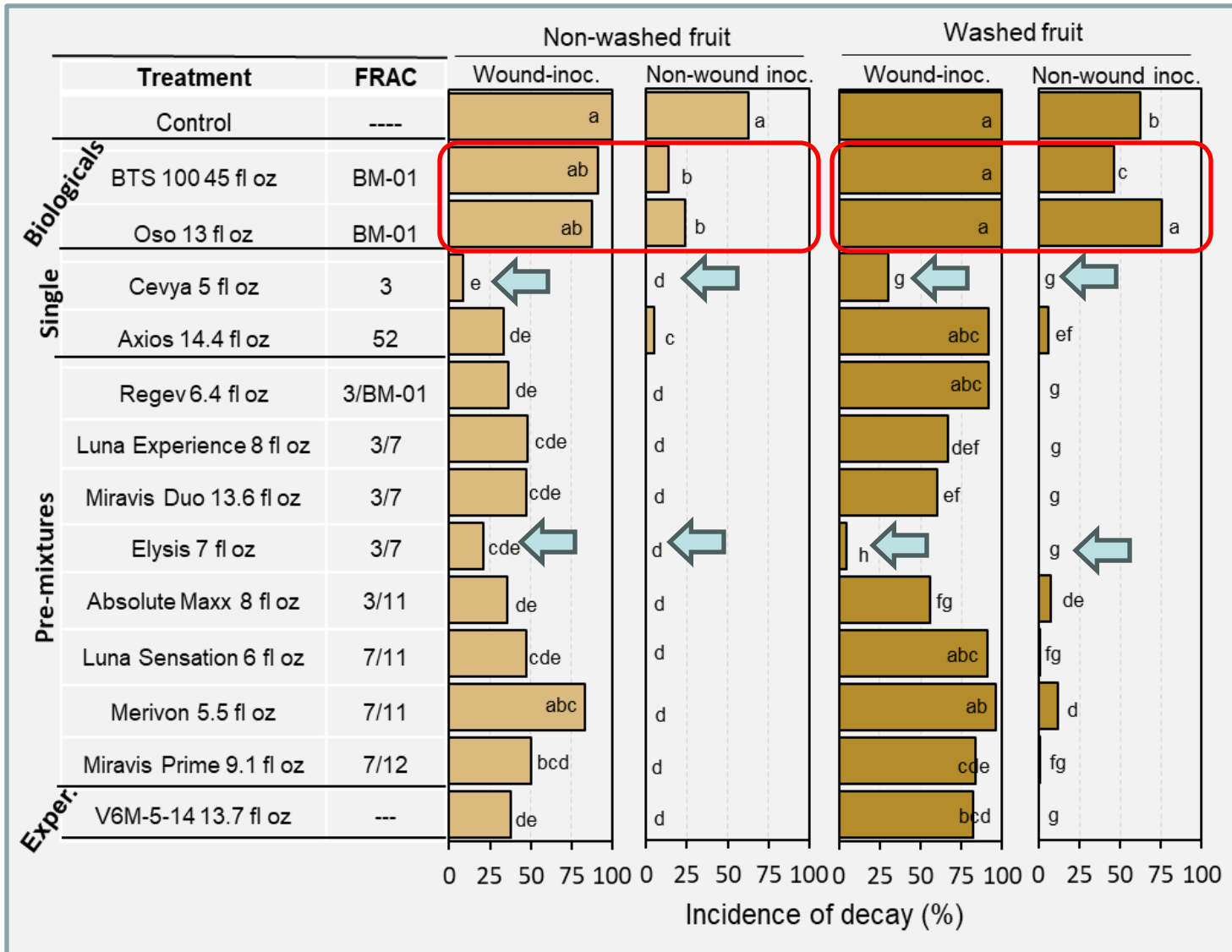
New and effective

New: Talendo (proquinazid) is in the IR-4 program.



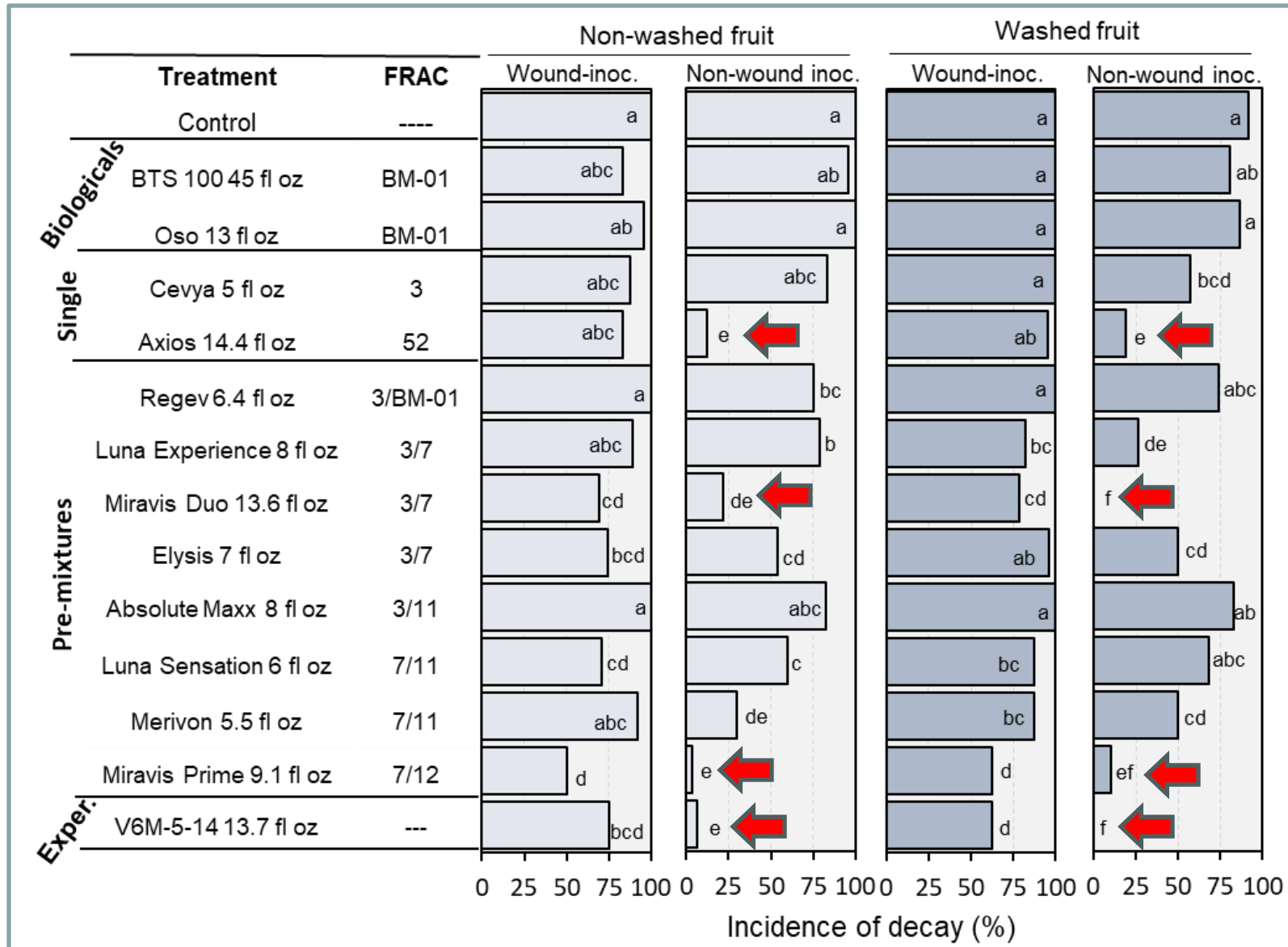
Applications starting at 50% bloom. Evaluation on 6-1-23. Terminal shoots from inside or outside of the tree were rated for the severity of disease: 0=healthy to 4=>50% of leaf area diseased.

Efficacy of 6-day preharvest fungicide treatments for management of postharvest brown rot of Bing cherries - San Joaquin Co. - 2024



Treatments were applied on 5-23-24 using an air-blast sprayer at a rate of 100 gal/A, and all except Regev and Miravis Prime were done in combination with DynAmic at 8 fl oz/A. Treatments were also applied on 3-31, 4-10, and 5-8-24 as part of a powdery mildew program. Harvested fruit were washed by gently agitating in water for 2 min. Fruit were wound-inoculated (30,000 spores/ml) or non-wound drop-inoculated (500,000 spores/ml) with *M. fructicola*. Fruit were then incubated for 5-10 days at 24C.



Evaluation of new fungicides for managing postharvest decays of Bing cherry in laboratory studies 2024



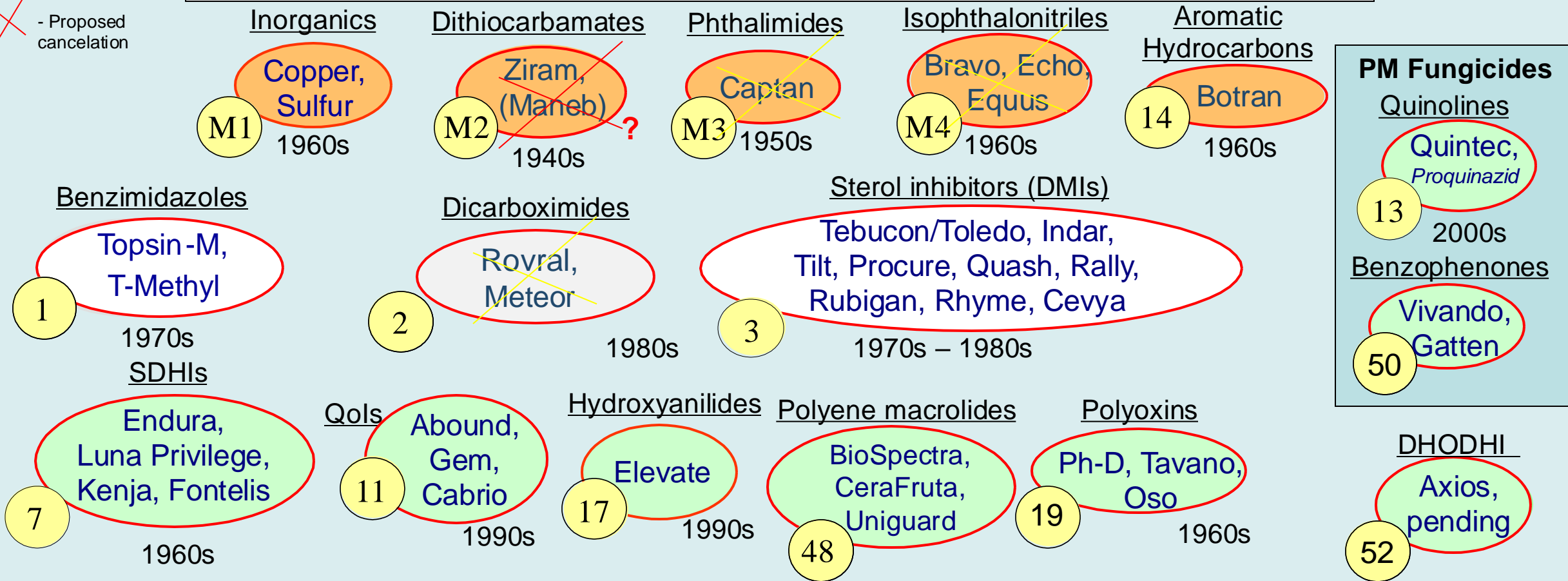
Treatments were applied on 5-23-24 using an air-blast sprayer at a rate of 100 gal/A, and all except Regev and Miravis Prime were done in combination with DynAmic at 8 fl oz/A.

Harvested fruit were washed by gently agitating in water for 2 min. Fruit were wound-inoculated (30,000 spores/ml) or non-wound drop-inoculated (300,000 spores/ml 25% cherry juice) with *B. cinerea*. Fruit were then incubated for 5-10 days at 24C.

Fungicides for Sweet Cherry

-  - Proposed restrictions
-  - Proposed cancellation

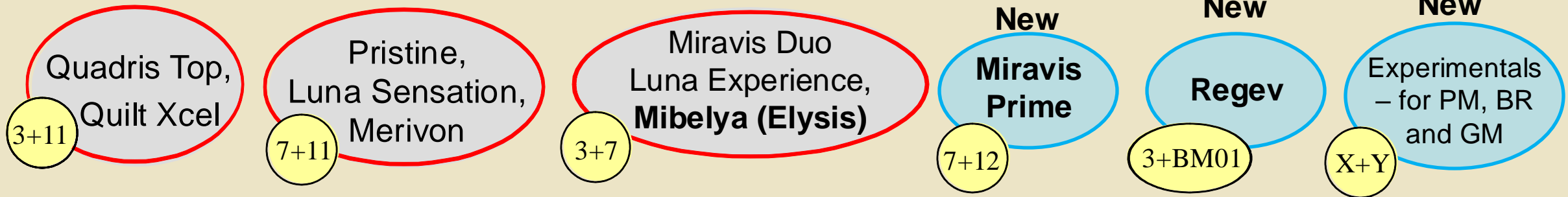
Single-fungicides - Inorganics and Conventional Synthetics



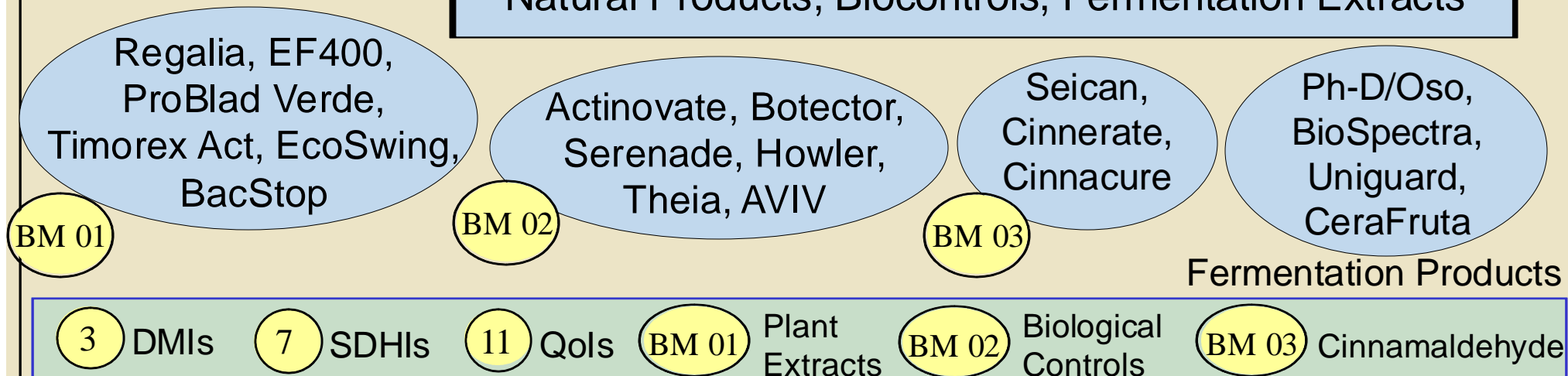
New 2023: Cevya, Miravis Duo, BioSpectra/Cerafruta (postharvest). Pending: Parade, Miravis Prime, Mibelya (Elysis), Regev, Axios

Premixture Fungicides and Natural Alternatives for Managing Cherry Diseases

Conventional Synthetic Fungicides – Pre-mixtures



Natural Products, Biocontrols, Fermentation Extracts



Natural products and biocontrols that already are or potentially will be OMRI approved are being continuously evaluated for organic farming of stone fruits.

Crown rot with associated cankers and gumming followed by tree death are the most common symptoms of *Phytophthora* sp. infection on sweet cherry



Infected trees decline and may die.

Five species of *Phytophthora* (*P. cactorum*, *P. cambivora*, *P. cryptogea*, *P. syringae*, and an unidentified species) and *Phytophthium vexans* were recovered.

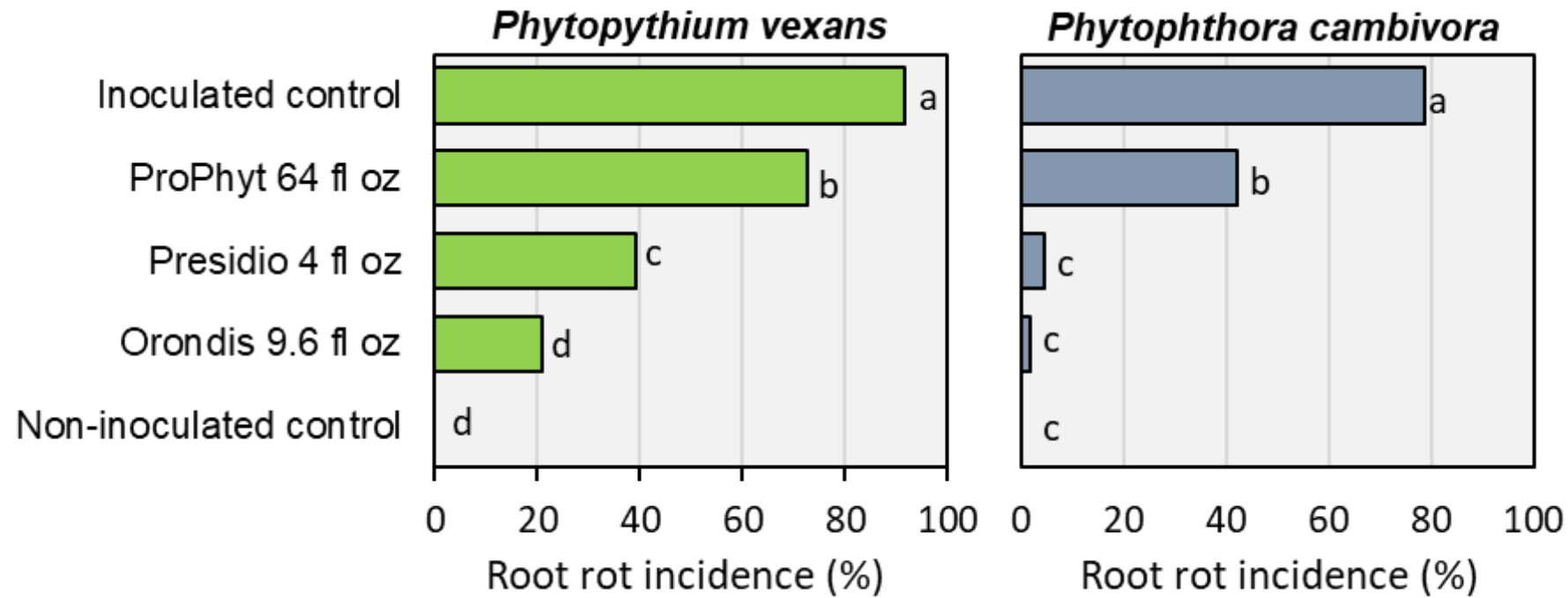
Laboratory and field studies on new *Phytophthora* root rot fungicides

Fungicides for managing *Phytophthora* root and crown rot diseases

	Common Name	Trade Name	Class	FRAC
Currently registered	metalaxyl, mefenoxam	Ridomil Gold	phenylamides	4
	fosetyl-AI, phosphorous acid	Various	phosphonates	P07 (33)
In development for cherry	mandipropamid	Revus	CAAs	40
	fluopicolide	Presidio	benzamides	43
	ethaboxam	Intego	thiazole carboxamide	22
	oxathiapiprolin	Orondis	piperidinyl thiazole isoxazolines	49

The new fungicides were shown to have high in vitro activity against all *Phytophthora* species from cherry with EC_{50} values mostly of less than 0.1 ppm. Oxathiapiprolin was most toxic at extremely low concentrations (EC_{50} values ≤ 0.001 ppm or ≤ 1 ppb).

Efficacy of soil-applied fungicide treatments for management of *Phytophthora* crown and trunk cankers in greenhouse studies - 2024



8- to 12-week-old Mahaleb seedlings were planted into infested soil, and the soil was treated with selected fungicides. Fungicide rates were based on field rates that were proportionally reduced based on pot surface area. After 4 weeks, roots were plated onto a selective medium, and the incidence of root rot was calculated based on the number of colonized root pieces of the total number of pieces plated. Data are the average of two experiments.

- New Oomycota fungicides significantly improved tree health.
- *P. cactorum* and *P. cambivora* were recovered from trunk cankers.
- Fluopicolide (Presidio) showed some phytotoxic in sandy soils



Fungicide mobility after soil application in greenhouse and field studies

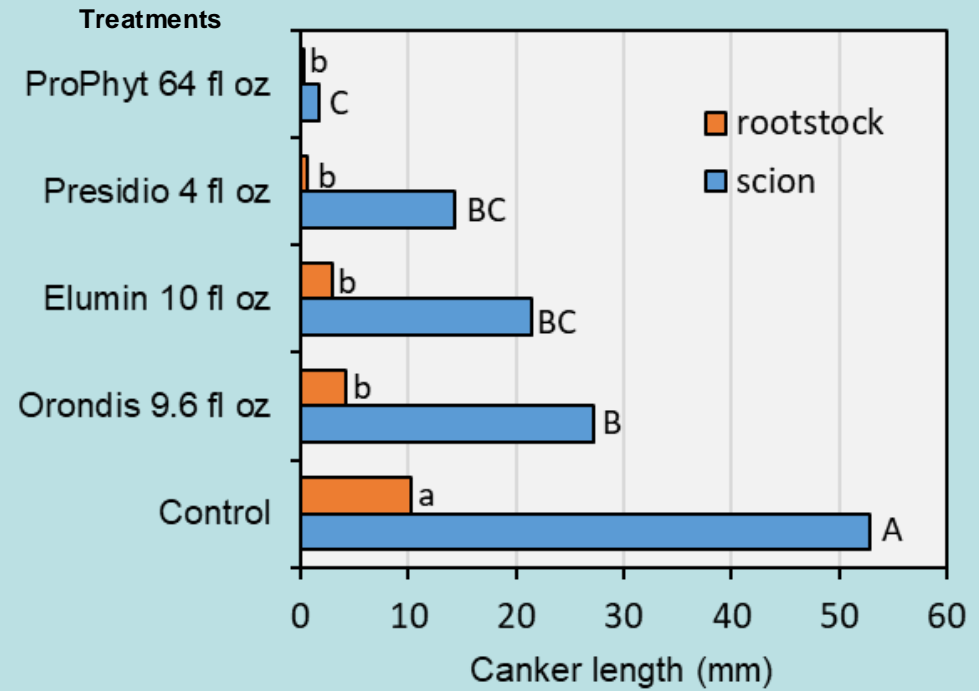


Control



Fluopicolide

Rootstocks (cvs. Mazzard and Mahaleb) and scions (cvs. Coral and Rainier) inoculated with *P. citricola* after soil treatment in field studies in 2024



Fungicide treatments were applied in the field to first-leaf Coral on Mahaleb rootstock cherry trees. Tree trunks were inoculated with *P. citricola* after two weeks by placing agar plugs containing mycelium onto wounds 8 cm above the soil-line for the rootstock and 16 cm above the graft union for the scion. Cankers were measured 3 weeks later. Lower- and uppercase letters next to the bars indicate statistical significances for rootstocks and scions, respectively. (This is a repeat of last year's study)



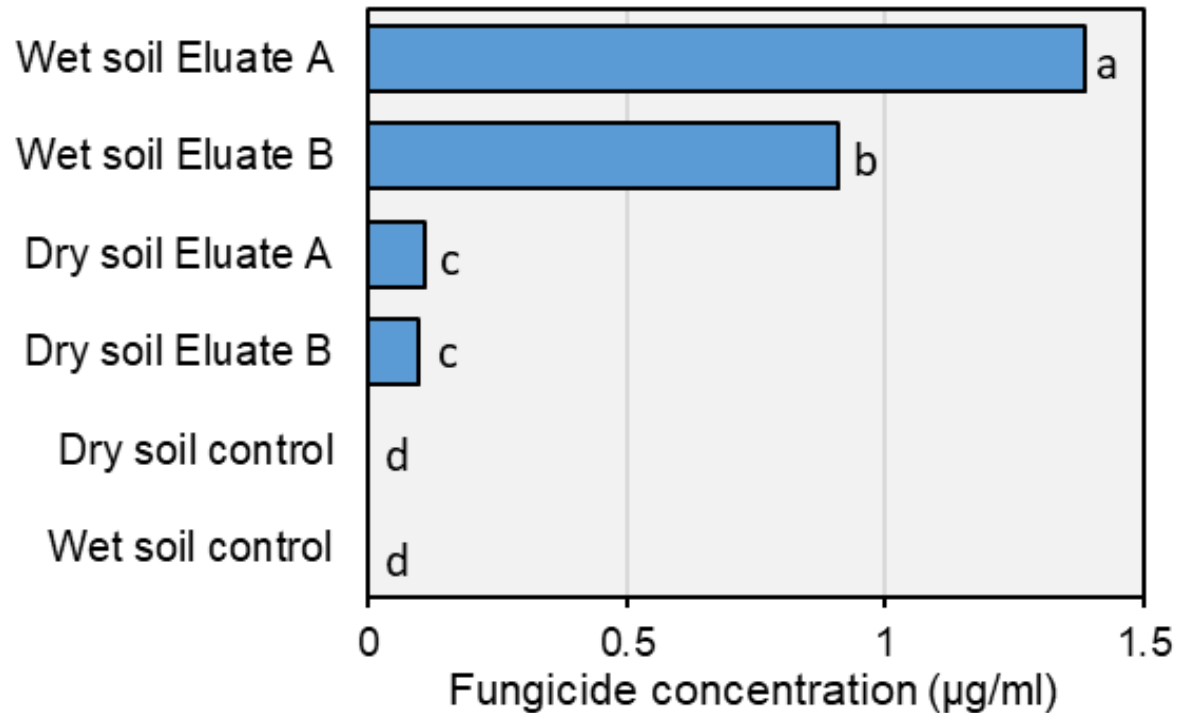
Control



Fluopicolide

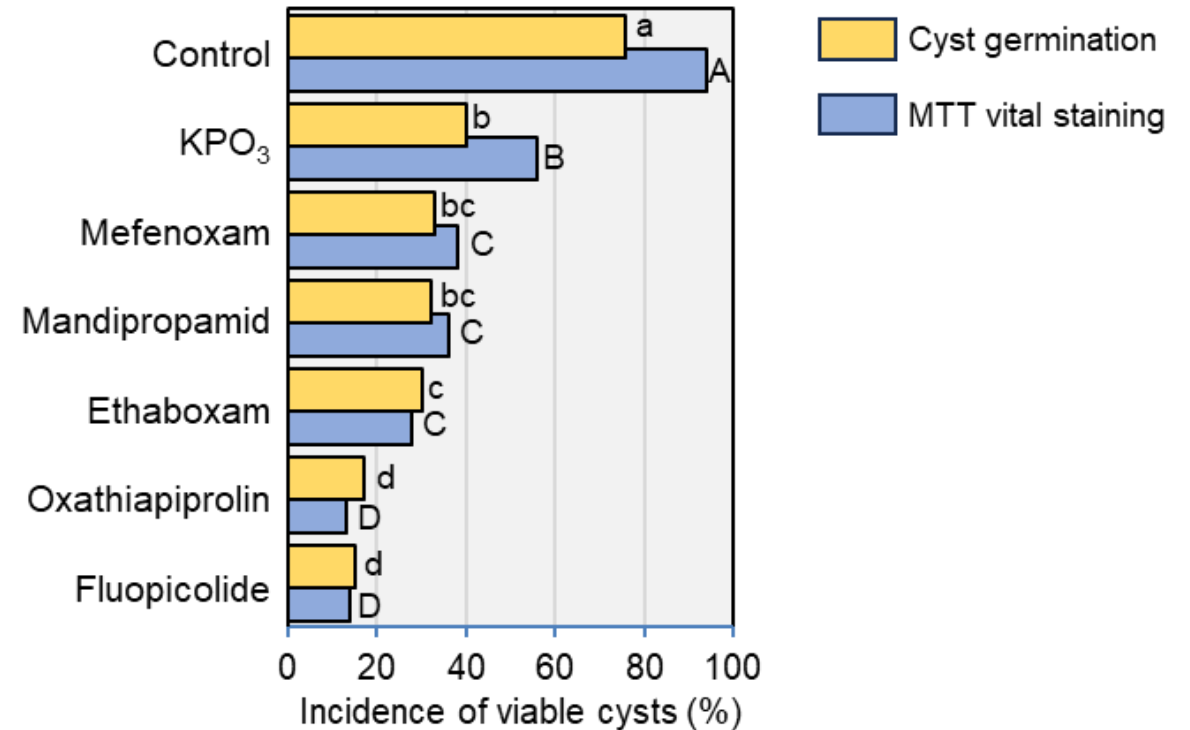
New Oomycota fungicides show systemic movement in cherry plants.

Evaluation of soil binding of Orondis in a laboratory study



Oxathiapiprolin was applied to 100 ml wet (12% water content) or dry (0.9% water content) Riverside field soil in a Buchner funnel. After 10 min, 10 ml or 25 ml of water was applied to the wet or dry soil, respectively. After 30 min, two 6-ml fractions of eluate were obtained by applying a vacuum. Eluates were applied to filter paper disks in bioassays, inhibition zones of *Phytophthora* growth were measured, and fungicide concentrations were calculated based on inhibition zones developing using fungicide standards in the bioassay.

Evaluation of the fungicidal and/or fungistatic action of Oomycota fungicides



Fungicides (1 ppm, except for KPO₃ where 100 ppm was used) were added to encysted zoospores of *P. citrophthora* on the bottom of empty petri dishes. After 2 h, cysts were washed four times with water for 30 min each. Cysts were then either treated with the MTT vital stain or allowed to germinate. Staining (viable cysts were stained blue) and germination were observed microscopically after 1 or 4 h, respectively.

Natamycin and Polyoxin-D are Organic Materials Review Institute (OMRI) listed for organic postharvest use in the U.S.

Organic Fruit Decay Control

BioSPECTRA^{100 SC} | ORGANIC

Now OMRI Certified



Natamycin Natural Organic Decay Control

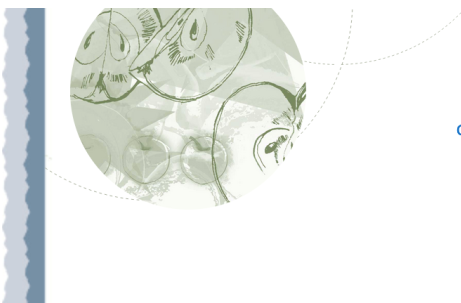
BioSpectra is the latest biorational fungicide to be organically certified for postharvest applications. It provides a broad-spectrum decay control against several major fungal postharvest diseases across various crops and has shown better disease control compared to other organic alternatives.

BioSpectra is a novel postharvest fungicide of natural origin with a unique mode of action against decay, including resistant strains to conventional fungicides, making it an ideal rotation or mixture partner.



CERADIS GRANTED OMRI LISTED STATUS FOR CERAFRUTA® BIOLOGICAL FUNGICIDE

Natamycin



OMRI Listed®

The following product is OMRI Listed. It may be used in certified organic production or food processing and handling according to the USDA National Organic Program regulations.

Product

CeraFruta ORGANIC

Ceradis Granted OMRI Listed Status for CeraFruta® Biological Fungicide

GROUP 19 FUNGICIDE

Polyoxin D Zinc Salt 5SC Post-Harvest Fungicide

For post-harvest use on listed fruits

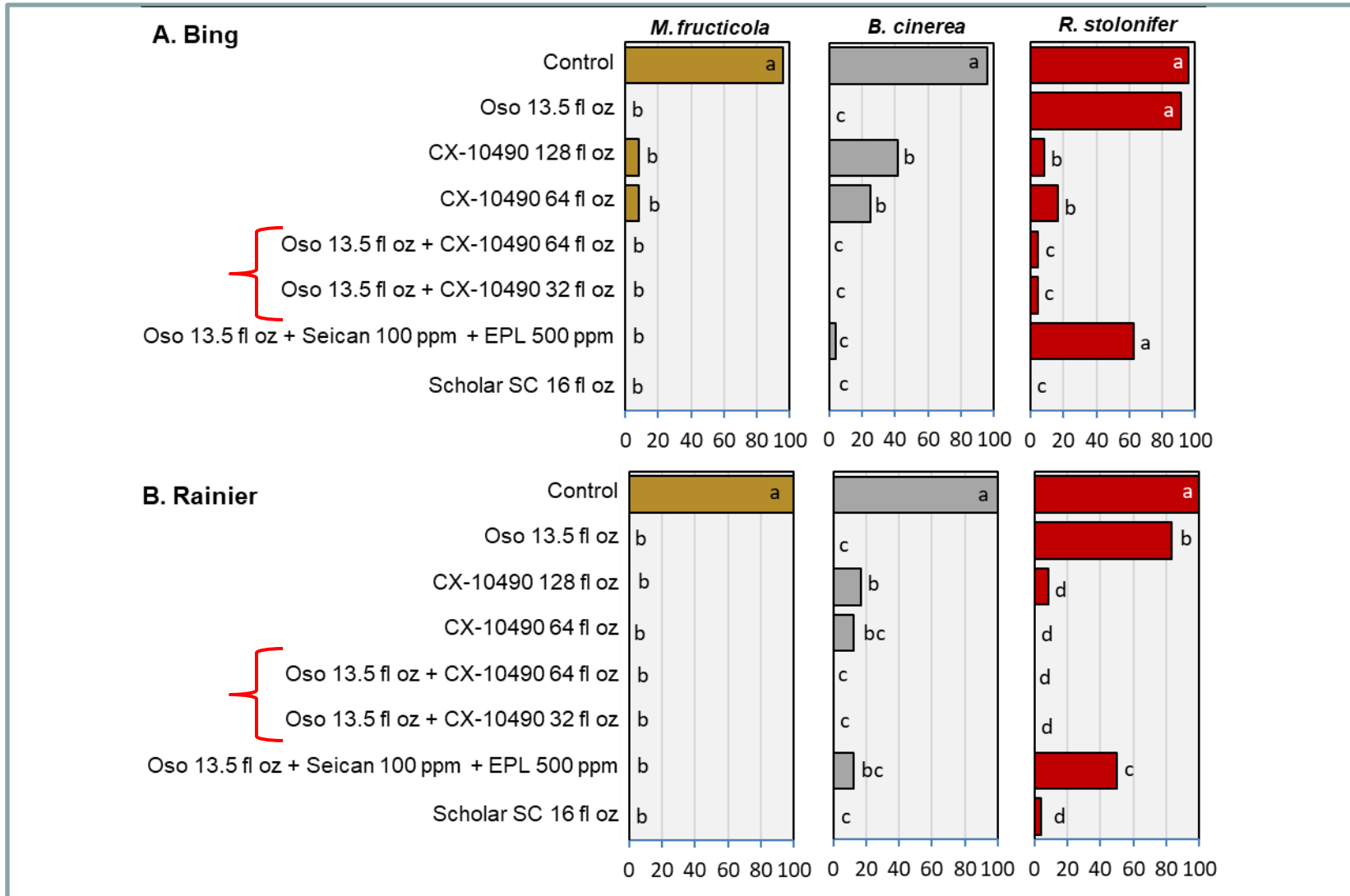
Polyoxin D Zinc Salt 5SC Post-Harvest Fungicide is a suspension concentrate fungicide of polyoxin D zinc salt for control of certain post-harvest diseases of fruits in storage

STONE FRUIT			
Application Method	Disease	Rate (fl. oz.)	Remarks
In-line Dip, Drench or aqueous Spray	Gray Mold (<i>Botrytis cinerea</i>) Brown Rot (<i>Monilinia fructicola</i>) Suppression of Rhizopus Rot (<i>Rhizopus stolonifer</i>) and Sour Rot (<i>Geotrichum candidum</i>)	3.5-16 fl. oz./100 gal	<ul style="list-style-type: none"> Mix 3.5-16 fl. oz. of product in 100 gallons of water carrier. Treat for approximately 15-30 seconds and allow fruit to drain. For Rhizopus Rot and/or Sour Rot use highest rate. Make no more than one application. Make an application either before storage or after storage prior to shipping.
<ul style="list-style-type: none"> Stone Fruit Includes - Apricot (<i>Prunus armeniaca</i>); Apricot, Japanese (<i>Prunus mume</i>); Capulin (<i>Prunus serotina</i>); Cherry, black (<i>Prunus serotina</i>); Cherry, Nanking (<i>Prunus tomentosa</i>); Cherry, sweet (<i>Prunus avium</i>); Cherry, tart (<i>Prunus cerasus</i>); Jujube, Chinese (<i>Ziziphus jujuba</i>); Nectarine (<i>Prunus persica</i>); Peach (<i>Prunus persica</i>); Plum (<i>Prunus domestica</i>); Plum, American (<i>Prunus americana</i>); Plum, beach (<i>Prunus maritima</i>); Plum, Canada (<i>Prunus nigra</i>); Plum, cherry (<i>Prunus cerasifera</i>); Plum, Chickasaw (<i>Prunus angustifolia</i>); Plum, Damson (<i>Prunus domestica</i>); Plum, Japanese (<i>Prunus salicina</i>); Plum, Klamath (<i>Prunus subcordata</i>); Plum, prune (<i>Prunus domestica</i>); Plumcot (<i>Prunus hybr.</i>); Sloe (<i>Prunus spinosa</i>); Cultivars, varieties, and/or hybrids of these. 			

Polyoxin D pending CA approval

Includes sweet cherry

Evaluation of new fungicides for managing postharvest decays of Bing cherry in laboratory studies 2024



Fruit were wound-inoculated with spores of *M. fructicola*, *B. cinerea*, or *R. stolonifer* (40,000 spores/ml) and incubated for 13-14 h at 20C. Aqueous treatments were applied using an air-nozzle sprayer. Fruit were incubated at 20C for 4-7 days.

Summary for 2024

1. New products against **bacterial blast and canker** - Biologicals/natural products, antibiotics
 - KSM, OTC, and EPL/Cinnamaldehyde mixture
2. New fungicides for control of **brown rot and Botrytis blossom blight, powdery mildew, and preharvest brown rot and gray mold fruit decay**: Cevya, new premixtures- Miravis Top, and biologicals (Cinnerate for PM). Pending - Axios, Parade, Talendo, Mibelya (Elysis)
3. New **postharvest treatments**: fungicides (Chairman), 'exempt from tolerance-OMRI approved biofungicides (natamycin and polyoxin-D) (BioSpectra+Oso) OMRI-approved
 - Support Scholar-natamycin mixtures for food additive tolerance (FAT) in Japan
 - Support IR-4 registration of Miravis Prime for preharvest use to remove postharvest labeling in Japan
4. New fungicides for managing **Phytophthora root and crown rot**
 - Completed in vitro baseline sensitivities to oxathiapiprolin, mandipropamid, fluopicolide, and ethaboxam
 - Completed studies in experimental orchards at UC Davis and UC Riverside, demonstrating efficacy that are needed for CA registration.
 - characterize fungicide mobility in greenhouse and field studies with selected cherry rootstocks and scions
 - Support registration of mandipropamid for use in container greenhouse trees during propagation.

Thank you!

- Questions?